SELECTED VALUES
of
PROPERTIES OF HYDROCARBONS

CIRCULAR OF THE NATIONAL BUREAU OF STANDARDS C461

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

SELECTED VALUES
of
PROPERTIES OF HYDROCARBONS

CIRCULAR OF THE NATIONAL BUREAU OF STANDARDS C461

Prepared as Part of the work of the
American Petroleum Institute Research Project 44

by

Frederick D. Rossini, Kenneth S. Pitzer
William J. Taylor, Joan P. Ebert, John E. Kilpatrick
Charles W. Beckett, Mary G. Williams, and Helene G. Werner

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PREFACE

One of the bulwarks of any technical or scientific research program is the collection and critical appraisal of the pertinent information already available. One type of such information that is required by all laboratories in industry and science comprises selected values of the fundamental physical constants and of the properties of the chemical substances. Many advantages result from having such fundamental work performed systematically and consistently in a cooperative program by a full-time staff of experts, rather than incidentally and sporadically by workers in different laboratories. In addition to the obvious advantage of producing a complete, accurate, and self-consistent set of values of constants and properties, such a cooperative program results in a considerable saving in over-all cost and manpower.

Since its founding in 1901, the National Bureau of Standards has been the principal agency of the Federal Government for fundamental research in physics, chemistry, and engineering. The Research Associate Plan of the National Bureau of Standards makes it possible for an industry to join with the National Bureau of Standards in the prosecution of a fundamental research program of mutual benefit and in the public interest. Research investigations in the petroleum, rubber, and chemical industries depend heavily upon fundamental data on the physical and thermodynamic properties of hydrocarbons. In 1941 the National Bureau of Standards, through Lyman J. Briggs, then Director, and G. E. F. Lundell, Chief of the Division of Chemistry, proposed to the American Petroleum Institute, through J. Bennett Hill, then Chairman of the Institute's Advisory Committee on Fundamental Research on the Composition and Properties of Petroleum, that the two organizations establish a cooperative program on the compilation of tables of selected values of properties of hydrocarbons. The proposal was approved, and the new undertaking was begun in 1942, as the American Petroleum Institute Research Project 44. In the several years of its operation, the Project has had the wholehearted support of the American Petroleum Institute, represented by David V. Stroop, Assistant to the President (and coordinator of the research programs), and William J. Sweeney, Chairman of the Institute's Advisory Committee on Fundamental Research on the Composition and Properties of Hydrocarbons.

To advise the Project in its policy and program of work, the Institute is represented by the following Advisory Committee:

WAYNE E. KUHN, The Texas Co., chairman.
OTTO BEECK, Shell Development Co.
GUSTAV EGLOFF, Universal Oil Products Co.
STEWART S. KURTZ, JR., Sun Oil Co.

From its beginning, the Project has had the benefit of the advice, guidance, and enthusiastic support of this Advisory Committee.

Direction of the project was placed under Frederick D. Rossini, Chief of the Section on Thermochemistry and Hydrocarbons at the National Bureau of Standards. Kenneth S. Pitzer, Professor of Chemistry at the University of California, joined the project, first as a consultant, and then as associate director. The research and clerical staff of the project has increased from two persons in 1942 to eight persons as of May 31, 1947. These include five research investigators, William J. Taylor, John E. Kilpatrick, Joan P. Ebert, Mary G. Williams, and Helene G. Werner, and two clerical assistants, at the National Bureau of Standards, and one research investigator, Charles W. Beckett, at the University of California. Provision has been made by the American Petroleum Institute for the addition of two more research investigators to the staff beginning July 1, 1947, one each at the National Bureau of Standards and the University of California.

The following investigators on the regular scientific staff of the National Bureau of Standards have collaborated in various investigations of the API Research Project 44 and are serving as consultants to the Project: Carl S. Cragoe, Edward J. Prosen, and Donald D. Wagman.

With regard to the physical and thermodynamic properties of hydrocarbons, and closely related compounds, the aims of the Project are as follows: (1) To examine all the pertinent original data in the literature and all available unpublished data and appraise them critically, (2) to correlate values of given properties with temperature, pressure, molecular structure, etc., as appropriate, (3) to make original calculations of thermodynamic and physical properties, as necessary, (4) to select and tabulate "best" values of the properties, (5) to prepare the selected values in a convenient, usable form for prompt distribution to the American Petroleum Institute, the National Bureau of Standards, and to United States Government, university, and industrial laboratories, (6) to prepare the original calculations, analyses, and correlations in a form suitable for publication, and (7) to keep the tables of selected values of the properties up to date by revision at appropriate intervals.

The properties being investigated or to be investigated, include the following: Boiling point, and pressure coefficient of the boiling point; refractive index; density and specific gravity; freezing point; molecular volume; molecular and specific refraction; specific dispersion; refractivity intercept; viscosity; critical constants; P-V-T relations; vapor pressures; heat and entropy of vaporization; heat of combustion; heat content; free energy function; entropy; heat capacity; heat of formation; free energy of formation; equilibrium

constant of formation; heat and entropy of fusion; cryoscopic constants; and heat of transition.

In addition to the compilation of critically selected values of the physical and thermodynamic properties, the American Petroleum Institute Research Project 44 has also performed the service of collecting (from cooperating laboratories in the industry, university and government laboratories) and distributing, on standard forms, infrared and ultraviolet spectograms of hydrocarbons and related compounds. Procedures for the collection and distribution of Raman and mass spectral data are in process of formulation. Information concerning these spectographic data may be obtained by writing the National Bureau of Standards.

The manner in which the work of the Project is performed is indicated in the chart at the end of this preface.

Since the beginning of the work, the tables of numerical constants and properties prepared by the Project have been, and will continue to be, issued in loose-leaf form, monthly as compiled. The distribution of the tables is in accordance with the following plan: (1) Copies of tables and spectograms are supplied to all United States Government laboratories having a proper need for them, at no cost, on application to the National Bureau of Standards, (2) one set of the tables and spectograms is supplied gratis to each department of chemistry, physics, and engineering, in universities and colleges, with the compliments of the American Petroleum Institute and the National Bureau of Standards, on application to the National Bureau of Standards, (3) up to 10 copies each of the tables and spectrograms are supplied gratis to each of the supporters of the research fund of the American Petroleum Institute, on application to the Institute, (4) additional sets of the existing tables and spectograms, as well as new tables and spectograms as issued, may be obtained by individual research workers, and by laboratories in industry, research institutions, and universities, from the American Petroleum Institute, attention of D. V. Stroop, 50 West Fiftieth Street, New York, N. Y., at a cost of 3 cents a sheet for the tables of properties and 5 cents a sheet for the spectral data.

The present volume is a complete collection of all the numerical tables issued by the American Petroleum Institute Research Project 44 as of May 31, 1947. The plan of issuing new tables in loose-leaf form, monthly as compiled, will in no way be affected by the preparation of this bound volume. It is planned to have a second volume of this work published at the end of the second 5-year period.

The staff of the Project will greatly appreciate receiving comments regarding any errors that have escaped attention, as well as suggestions for improving the work and its presentation.

These tables are being extended to cover additional properties and additional compounds as rapidly as the resources will permit.

EDWARD U. CONDON, *Director.*

AMERICAN PETROLEUM INSTITUTE RESEARCH PROJECT 44

TABLES OF SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

LOCATION OF DATA

- CHEMICAL ABSTRACTS AND OTHER ABSTRACT JOURNALS
- PRIOR COMPILATIONS, REFERENCE WORKS, AND REVIEWS
- PRIVATE COMMUNICATIONS

COLLECTION OF THE ORIGINAL DATA FROM

- PUBLISHED SCIENTIFIC LITERATURE
- UNPUBLISHED REPORTS

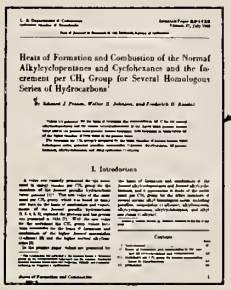
SYSTEMATIC FILING OF DATA ON

- PHYSICAL PROPERTIES
- THERMODYNAMIC PROPERTIES
- SPECTROSCOPIC AND OTHER MOLECULAR PROPERTIES

ANALYSIS, CORRELATION, AND CALCULATION

- DIRECT ANALYSIS AND EVALUATION OF DATA
- GRAPHICAL AND ANALYTICAL CORRELATION OF DATA
- CORRELATION OF DATA WITH MOLECULAR STRUCTURE
- STATISTICAL CALCULATION OF THERMODYNAMIC PROPERTIES FROM SPECTROSCOPIC AND OTHER MOLECULAR DATA

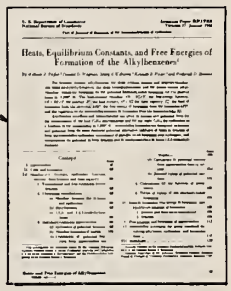
EXTENSION OF THE AVAILABLE EXPERIMENTAL DATA BY THEORETICAL CALCULATIONS INVOLVING THE APPLICATION OF CHEMICAL THERMODYNAMICS, STATISTICAL MECHANICS, AND QUANTUM MECHANICS TO THEORIES OF THE GASEOUS, LIQUID, AND SOLID STATES AND OF MOLECULAR STRUCTURE AND SPECTRA



Heats of Formation and Combustion of the Normal Alkylcyclopentanes and Cyclohexanes and the Increment per CH_2 Group for Several Homologous Series of Hydrocarbons[1]

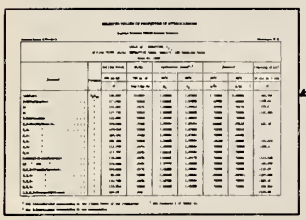
I. Introduction

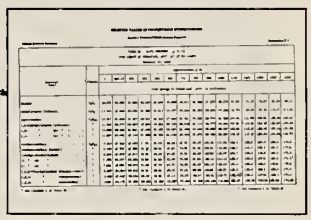
PUBLICATION OF REPORTS OF INVESTIGATIONS



Heats, Equilibrium Constants, and Free Energies of Formation of the Alkylbenzenes[1]

COMPILATION AND PERIODIC REVISION OF A COMPLETE AND SELF-CONSISTENT SET OF TABLES OF SELECTED VALUES OF PHYSICAL AND THERMODYNAMIC PROPERTIES



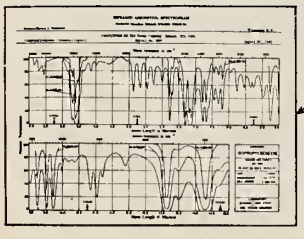


CATALOGS OF SELECTED SPECTROGRAMS

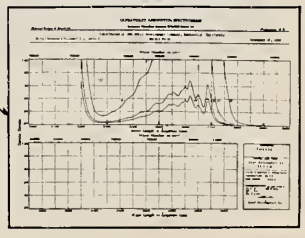
CONTRIBUTION OF SPECTROGRAMS AND SPECTRAL DATA, ON STANDARD FORMS, BY INDUSTRIAL, EDUCATIONAL, AND GOVERNMENT LABORATORIES

FOR EDITING, COMPILATION AND DISTRIBUTION OF CATALOGS OF SELECTED SPECTROGRAMS AND SPECTRAL DATA BY THE API RESEARCH PROJECT 44

INFRARED SPECTROGRAMS



ULTRAVIOLET SPECTROGRAMS



RAMAN AND MASS SPECTRAL DATA

CONTENTS

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I. INTRODUCTION

Fundamental Constants and Conversion Factors

The values selected for the fundamental and derived constants required in the preparation of the tables of selected values of properties of hydrocarbons issued by the American Petroleum Institute Research Project 44 are in all cases those given in table α (parts 1, 2, and 3). The original sources upon which this set of self-consistent values of the constants is based are listed in the footnote to table α (part 3). The conversion factors in table β (parts 1 to 11) and the numerical constants in table γ are calculated directly from the values of the fundamental constants given in table α (parts 1, 2, and 3). In the few cases in which a special constant or conversion factor not included in table α (parts 1, 2, and 3) or table β (parts 1 to 11) has been required in the preparation of a table, the value selected is indicated in a footnote to the appropriate table. Values of molecular weights are given in table δ.

Temperature Scale

In these tables temperatures given in degrees centigrade (°C) which are based on experimental measurements, as for example, boiling points and freezing points, are referred to the International Centigrade Temperature Scale (see Burgess[1] and Mueller[1] in section V). As appropriate, these temperatures have been converted to degrees Kelvin (°K) by the relation (°K) = (°C) +273.160, and to degrees Fahrenheit (°F) by the relation (°F) =1.8(°C) +32. The differences between temperatures on the international and thermodynamic scales are discussed by E. F. Mueller in the reference cited.

Temperatures given in degrees Kelvin (°K) in the tables of thermodynamic functions (tables designated by the letters *r*, *s*, *t*, *u*, *v*, *w*, *x*, and *y*) are on the Kelvin thermodynamic temperature scale. These temperatures have been converted to degrees centigrade (°C), in the *u-G* and *v-G* tables, by the relation (°C) = (°K) −273.160, and to degrees Fahrenheit (°F), in the *u-E* and *v-E* tables, by the relation (°F) =1.8(°K) − 459.688.

Internal Consistency

The tables of the API Research Project 44 are internally consistent in the sense that all the known physical and thermodynamic relations existing between the properties in the several tables are satisfied by the tabulated values of these properties. Thus, the values in the *a-E* and *b* tables are based on the appropriate values in the *a* tables, and the boiling and freezing points in the *a* tables are, insofar as possible, consistent with the corresponding values in the *k* and *z* tables, respectively. The thermodynamic relations that exist between the properties in the *k*, *m*, *n*, *p*, *q*, *r*, *s*, *t*, *u*, *u-E*, *u-G*, *v*, *v-E*, *v-G*, *w*, *x*, *y*, and *z* tables are satisfied by the tabulated values, and they therefore form an internally consistent set of tables of the thermodynamic properties.

Sources of Data

The sources of data are given specifically for each property of each compound, as appropriate, in section IV on Specific References for Tables of Properties. Section IV gives the names of the author or authors of a given publication, together with a numeral superscript on the last author's name, indicating the number of the publication for that particular author or group of authors. From this, the complete reference to the publication in the literature is obtained from the General List of References in section V, in which the names are arranged alphabetically, with the publications of each author or group of authors listed in numerical order. Initials of authors are not given unless two or more authors or groups of authors have identical surnames.

The specific references in section IV apply as of the date indicated. In general, the specific references are intended to include all significant work published since 1936, but only the more important work published prior to that time. At the beginning of the work of the Project, original publications were located principally through searches of Chemical Abstracts, Annalen der Chemie, the bibliographies given in the existing compilations of Egloff[1,2,3,4],

Doss[1], Francis[1], Ward and Kurtz[1], International Critical Tables[1,2] and Landolt-Bornstein-Roth[1]. The bibliographies of Egloff represent searches of Beilstein's Handbuch der Organischen Chemie, Chemisches Zentralblatt, and British Chemical Abstracts. Credit for the considerable amount of as yet unpublished data that has been made available to the Project is given in the appropriate places in section IV on specific references.

Methods of Calculation

The methods of calculation have been, or will be, described in comprehensive reports of investigations published as part of the work of the API Research Project 44. References to such reports as have been published are given in the appropriate places in section IV. Information concerning unpublished work of this nature may be obtained by writing the National Bureau of Standards. A list of the publications of the API Research Project 44 is given in section VI of this volume.

Explanation of Numbers in Titles of Tables

The numbers in the titles of the tables of properties represent the following groups of compounds:

Number	*Compounds*
00	O, H, N, C.
0	O_2,H_2,OH, H_2O, N_2,NO,C, CO, CO_2.
1	Paraffins, C_1 to C_6
2	Paraffins, C_6 and C_7.
3	Paraffins, C_8.
4	Paraffins, C_9.
5	Alkylbenzenes, C_6 to C_9.
6	Alkylcyclopentanes, C_6 to C_7.
7	Alkylcyclohexanes, C_6 to C_8.
8	Monoolefins, C_2 to C_6.
9	Monoolefins, C_7.
10	Monoolefins, C_8.
11	Diolefins, C_3 to C_6.
12	Acetylenes, C_2 to C_5.
13	Styrenes, C_8 and C_9.
14	Alkylbenzenes, C_{10}.
15	Alkylcyclopentanes, C_8.
20	Normal paraffins, C_1 to C_{20}.
21	Normal alkylbenzenes, C_6 to C_{22}.
22	Normal alkylcyclopentanes, C_5 to C_{21}.
23	Normal alkylcyclohexanes, C_6 to C_{22}.
24	Normal monoolefins (1–Alkenes), C_2 to C_{20}.
25	Normal acetylenes (1–Alkynes), C_2 to C_{20}.

Frequently, one page will not accommodate all the values of a given group of properties for the entire lot of compounds coming under one number. In such cases, the given lot of compounds will be subdivided, as table 10 (part 1), table 10 (part 2), etc.

Explanation of Letters in Titles of Tables

The letters in the titles of the tables of properties represent the following properties:

Letter	*Properties*
α	Values of fundamental constants.
β	Conversion factors.
γ	Useful equations with numerical constants.
δ	Molecular weights.
a	Boiling point (°C), dt/dp (°C/mm Hg), refractive index, density (g/ml), and freezing point (°C).
a-E	Boiling point (°F), dt/dp (°F/in. Hg), refractive index, density (lb/ft³ and lb/gal), specific gravity (60° F/60° F), and freezing point (°F).
b	Molecular volume (ml/mole), molecular refraction (ml/mole), specific refraction (ml/g), refractivity intercept, and specific dispersion (ml/g).
c	Viscosity (absolute) (centipoises), at temperatures in °C.
c-E	Kinematic viscosity (centistokes), at temperatures in °F.
c-K	Kinematic viscosity (centistokes), at temperatures in °C.
k	Vapor pressures (mm Hg) and boiling points (°C) at 10 to 1,500 mm Hg.
m	Heat of vaporization (kcal/mole, cal/g, Btu/lb) and entropy of vaporization (cal/deg mole), at 25°C and the normal boiling point.
n	Heat of combustion (kcal/mole, cal/g, and Btu/lb), at 25°C.
p	Heat of formation (kcal/mole), entropy (cal/deg mole), and free energy of formation (kcal/mole), at 25° C.
q	Standard heat of vaporization (kcal/mole), entropy of vaporization (cal/deg mole), and free energy of formation (kcal/mole), at 25° C.
r	Heat-content function, $(H°-H_0°)/T$, (cal/deg mole) at 0° to 1,500°K.
s	Free-energy function, $(F°-H_0°)/T$, (cal/deg mole) at 0° to 1,500°K.
t	Entropy, $S°$, (cal/deg mole) at 0° to 1,500°K.
u	Heat content, $H°-H_0°$ (cal/mole), at 0° to 1,500° K.
u-E	Heat content, $H°-H_0°$, (Btu/lb), at −459.69° to 2,200° F.
u-G	Heat content, $H°-H_0°$, (cal/g), at −273.16° to 1,200° C.
v	Heat capacity, $C_p°$, (cal/deg mole), at 0° to 1,500° K.
v-E	Heat capacity, $C_p°$, (Btu/lb °F), at −459.69° to 2,200° F.
v-G	Heat capacity, $C_p°$, (cal/g °C), at −273.16° to 1,200° C.
w	Heat of formation, $\Delta Hf°$, (kcal/mole), at 0° to 1,500° K.
x	Free energy of formation, $\Delta Ff°$, (kcal/mole), at 0° to 1,500° K.
y	Logarithm of equilibrium constant of formation, $\log_{10}Kf$, at 0° to 1,500° K.
z	Heat of fusion (kcal/mole), entropy of fusion (cal/deg mole), freezing points (°C and °K), and cryoscopic constants (deg^{-1}).

Uncertainties

It is not feasible to give estimated uncertainties for each of the individual numerical values of the physical and thermodynamic properties. However, an indication of the magnitude of the estimated uncertainties is given in the accompanying table.

MAGNITUDE OF THE ESTIMATED UNCERTAINTIES

Property	Units	WHEN VALUE IS WRITTEN TO—					
		1	0.1	0.01	0.001	0.0001	0.00001
		Uncertainty is estimated to be—					
Boiling point	deg C	> 1	0.2 to 1.0	0.03 to 0.15	0.005 to 0.020		
Freezing point	deg C	> 1	0.2 to 1.0	0.03 to 0.15	0.005 to 0.020		
Refractive index	n_D	.....	.....	> 0.02	0.003 to 0.020	0.0002 to 0.0020	0.00005 to 0.00015
Density	g/ml	.....	.....	> 0.02	0.003 to 0.020	0.0002 to 0.0020	0.00005 to 0.00015
Viscosity (absolute)	Centipoise	.....	> 0.1	0.02 to 0.20	0.002 to 0.020	0.0010 to 0.0030	
Kinematic viscosity	Centistoke	.....	> 0.1	0.02 to 0.20	0.002 to 0.020	0.0010 to 0.0030	
Heat content function[1]	cal/deg mole	.....	> 0.75	0.10 to 0.75	0.005 to 0.050		
Free energy function[1]	cal/deg mole	.....	> 0.75	0.10 to 0.75	0.005 to 0.050		
Entropy[1]	cal/deg mole	.....	> 0.75	0.10 to 0.75	0.005 to 0.050		
Heat capacity[1]	cal/deg mole	.....	> 0.75	0.10 to 0.75	0.005 to 0.050		
Heat of formation	kcal/mole	.....	> 1.0	0.15 to 1.00	0.015 to 0.200		
Free energy of formation	kcal/mole	.....	> 1.0	0.15 to 1.00	0.015 to 0.200		
Heat of vaporization	kcal/mole	.....	> 0.2	0.04 to 0.20	0.010 to 0.040		
Heat of fusion	kcal/mole	.....	> 0.2	0.04 to 0.20	0.004 to 0.040	0.0010 to 0.0040	

[1] The values at 298.16° and 300° K. are frequently given to one more decimal place than are the corresponding values at higher temperatures. In these cases the estimated uncertainty is indicated by the number of decimal places retained at the next higher temperature.

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Summary of Tables

A summary of the tables of numerical values prepared as of May 31, 1947, is given in the following table:

Summary of Tables as of May 31, 1947

Properties	No.	00	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
	COMPOUNDS	O, H, N, C	O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2	Paraffins, C_1 to C_5	Paraffins, C_6 and C_7	Paraffins, C_8	Paraffins, C_9	Alkylbenzenes, C_6 to C_9	Alkylcyclopentanes, C_5 to C_7	Alkylcyclohexanes, C_6 to C_8	Monoolefins, C_2 to C_6	Monoolefins, C_7	Monoolefins, C_8	Diolefins, C_3 to C_6	Acetylenes, C_2 to C_4	Styrenes, C_8 and C_9	Alkylbenzenes, C_{10}	Alkylcyclopentanes, C_6	Alkylcyclohexanes, C_9	Paraffins, C_{10}	Alkylcyclopentenes, C_5 to C_7	Alkylcyclohexenes, C_8 to C_9	Normal paraffins	Normal alkylbenzenes	Normal alkylcyclopentanes	Normal alkylcyclohexanes	Normal monoolefins (1-alkenes)	Normal acetylenes (1-alkynes)	
	Letter	Number in block indicates number of pages																											
Boiling point in °C at 760 mm Hg; dt/dp in °C/mm Hg; refractive index, n_D, and density in g/ml, at 20° and 25°C; freezing point in °C at 1 atm	a	...	...	1	2	1	2	1	1	1	2	2	5	2	1	1	1	1	...	...	...	...	...	...	...	...	...	...	24
Boiling point in °F at 29.921 in. Hg; dt/dp in °F/in. Hg; refractive index, n_D, at 68° and 77°F; density, in lb/ft³, lb/gal at 60°, 68°, and 77°F; specific gravity (60°F/60°F); freezing point, in °F at 1 atm	a-E	...	...	1	2	1	2	1	1	1	2	2	5	2	1	1	1	1	...	...	...	...	...	...	...	...	...	...	24
Molecular volume and refraction in ml/mole; specific refraction and dispersion in ml/g; refractivity intercept; all at 20° and 25°C	b	...	...	1	2	1	2	1	1	1	2	2	5	2	1	1	1	1	...	...	...	...	...	...	...	...	...	...	24
Viscosity (absolute) in centipoise at given temperatures in °C	c	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	4
Kinematic viscosity in centistokes at given temperatures in °F	c-E	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	4
Kinematic viscosity in centistokes at given temperatures in °C	c-K	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	4
Critical constants	i	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pressure-volume-temperature relations	j	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vapor pressures and boiling points in °C; at 10 to 1,500 mm Hg	k	...	...	1	2	2	...	2	1	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11
Vapor pressure and boiling points (lb/sq in; °F)	k-E	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Heat of vaporization, ΔHv, at 25°C and boiling point in kcal/mole, cal/g, and Btu/lb. Entropy of vaporization, ΔSv, at boiling point in cal/deg mole	m	...	...	1	1	1	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Heat of combustion, $\Delta Hc°$, at 25°C, for liquid and gas, in kcal/mole, cal/g, and Btu/lb	n	...	1	1	1	1	...	1	...	...	2	2	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	16

Properties	No.	00	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	COMPOUNDS	O, H, N, C	O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2	Paraffins, C_1 to C_5	Paraffins, C_6 and C_7	Paraffins, C_8	Paraffins, C_9	Alkylbenzenes, C_6 to C_9	Alkylcyclopentanes, C_5 to C_7	Alkylcyclohexanes, C_6 to C_8	Monoolefins, C_2 to C_6	Monoolefins, C_7	Monoolefins, C_8	Diolefins, C_3 to C_6	Acetylenes, C_2 to C_5	Styrenes, C_8 and C_9	Alkylbenzenes, C_{10}	Alkylcyclopentanes, C_8	Alkylcyclohexanes, C_9	Paraffins, C_{10}	Alkylcyclopentenes, C_5 to C_7	Alkylcyclohexenes, C_6 to C_8	Normal paraffins	Normal alkylbenzenes	Normal alkylcyclopentanes	Normal alkylcyclohexanes	Normal monoolefins (1-alkenes)	Normal acetylenes (1-alkynes)	Total
	Letter	Number in block indicates number of pages																											
Heat of formation, $\triangle Hf°$, and free energy of formation, $\triangle Ff°$, in kcal/mole; Entropy, $S°$, in cal/deg mole, all for liquid and gas, at 25°C	p	...	1	1	1	1	...	1	...	...	2	...	...	...	1	...	...	...	...	...	...	...	1	1	...	...	1	1	12
Standard heat of vaporization, $\triangle Hv°$, and free energy of vaporization, $\triangle Fv°$ in kcal/mole, at 25°C; standard entropy of vaporization, $\triangle Sv°$, in cal/deg mole, at 25°C	q	...	...	1	1	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
Heat-content function, $(H° - H_0°)/T$, to 1,500°K, in cal/deg mole	r	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Free-energy function, $(F° - H_0°)/T$, to 1,500°K, in cal/deg mole	s	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Entropy, $S°$, to 1,500°K, in cal/deg mole	t	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Heat content, $H° - H_0°$, to 1,500°K, in cal/mole	u	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Heat content, $H° - H_0°$, to 2,200°F, in Btu/lb	u-E	...	1	1	2	2	...	2	...	...	4	...	...	...	1	...	...	...	...	...	...	...	2	2	...	...	2	2	21
Heat content, $H° - H°_0$, to 1,200°C, in cal/g	u-G	...	1	1	2	1	...	1	...	...	3	...	...	...	1	...	...	...	...	...	...	...	1	1	...	...	1	1	14
Heat capacity, $C_p°$, to 1,500°K, in cal/deg mole	v	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Heat capacity, $C_p°$, to 2,200°F, in Btu/lb °F	v-E	...	1	1	2	1	...	2	...	...	4	...	...	...	1	...	...	...	...	...	...	...	2	2	...	...	2	2	20
Heat capacity, $C_p°$, to 1,200°C, in cal/g °C	v-G	...	1	1	2	1	...	1	...	...	3	...	...	...	1	...	...	...	...	...	...	...	1	1	...	...	1	1	14
Heat of formation, $\triangle Hf°$, to 1,500°K, in kcal/mole	w	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Free energy of formation, $\triangle Ff°$, to 1,500°K, in kcal/mole	x	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Logarithm of equilibrium constant of formation, $\log_{10} Kf$, to 1,500°K	y	1	1	1	2	1	...	1	...	1	3	...	...	...	1	...	...	...	...	...	...	...	1	1	1	1	1	1	18
Heat of fusion, $\triangle Hm°$, in kcal/mole; entropy of fusion, $\triangle Sm°$, in cal/deg mole; cryoscopic constants (A,B) freezing point in °C and °K at 1 atm	z	...	...	1	2	1	...	1	1	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9
Total	.....	8	14	21	38	23	7	24	6	16	52	8	15	6	17	3	3	3	...	...	...	...	28	16	9	9	16	16	358
Values of fundamental constants	α	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Conversion factors	β	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7
Useful equations with numerical constants	γ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Molecular weights	δ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	16

II. TABLES OF FUNDAMENTAL CONSTANTS, CONVERSION FACTORS, USEFUL EQUATIONS, AND MOLECULAR WEIGHTS

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE α (Part 1) - VALUES OF CONSTANTS[a]

December 31, 1944; revised March 31, 1945

1 sec = 1.00273791 sidereal second	sec = mean solar second
g_o = 980.665 cm/sec^2	Definition; g_o = standard gravity
1 liter = 1000.028 ± 0.004 cm^3	
1 atm = 1,013,250. dynes/cm^2	Definition; atm = standard atmosphere
1 mm Hg = (1/760) atm = 1333.2237 dynes/cm^2	mm Hg = standard millimeter mercury
1 int. ohm = 1.000494 ± 0.000015 abs.ohm	[b] int. = international; abs. = absolute
1 int. amp = 0.999838 ± 0.000025 abs.amp	[b] amp = ampere
1 int. coul = 0.999838 ± 0.000025 abs.coul	[b] coul = coulomb
1 int. volt = 1.000332 ± 0.000029 abs.volt	[b]
1 int. watt = 1.000170 ± 0.000052 abs.watt	[b]
1 int.joule = 1.000170 ± 0.000052 abs.joule	[b]
1 cal = 4.1833 int.joule = 4.18401 ± 0.00020 abs.joule = 41.2930 ± 0.0020 cm^{3}atm = 0.0412918 ± 0.0000020 liter atm	Definition; cal = thermochemical calorie
$T_{0\,^oC}$ = 273.160 ± 0.010°K	Absolute temperature of the ice-point, 0°C
$(PV)^{P=0}_{0\,^oC} = (RT)_{0\,^oC}$ = 2271.16 ± 0.04 abs.joule/mole = 22414.6 ± 0.4 cm^{3}atm/mole = 22.4140 ± 0.0004 liter atm/mole	PV product for ideal gas at 0°C
R = 8.31439 ± 0.00034 abs.joule/deg mole = 8.31298 ± 0.00054 int.joule/deg mole = 1.98718 ± 0.00013 cal/deg mole = 82.0567 ± 0.0034 cm^3 atm/deg mole = 0.0820544 ± 0.0000034 liter atm/deg mole	R = gas constant per mole
ln 10 = 2.302585	ln = natural logarithm (base e)
R ln 10 = 19.14459 ± 0.00078 abs.joule/deg mole = 19.14134 ± 0.00124 int.joule/deg mole = 4.57566 ± 0.00030 cal/deg mole	
N = (6.02283 ± 0.0022) x 10^{23} /mole	N = Avogadro number
k = (R/N)= (1.38048 ± 0.00050) x 10^{-16} erg/deg	k = Boltzmann constant

[a] See footnote to Table α (Part 3).

[b] The international electrical units used in these tables are those in terms of which certification of standard cells, standard resistances, etc., is made by the National Bureau of Standards.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE α (Part 2) - VALUES OF CONSTANTS[a]

December 31, 1944; revised March 31, 1945

$h = (6.6242 \pm 0.0044) \times 10^{-27}$ erg sec	h = Planck constant
$c = (2.99776 \pm 0.00008) \times 10^{10}$ cm/sec	c = Velocity of light
$(h^2/8\pi^2 k) = (4.0258 \pm 0.0037) \times 10^{-39}$ g cm^2 deg	Constant in rotational partition function of gases
$(h/8\pi^2 c) = (2.7986 \pm 0.0018) \times 10^{-39}$ g cm	Constant relating wave number and moment of inertia
$Z = Nhc = 11.9600 \pm 0.0036$ abs. joule cm/mole	Z = Constant relating wave number and energy per mole
$= 11.9580 \pm 0.0036$ int. joule cm/mole	
$= 2.85850 \pm 0.0009$ cal cm/mole	
$(Z/R) = (hc/k) = c_2 = 1.43847 \pm 0.00045$ cm deg	c_2 = Second radiation constant
$\mathcal{F} = 96501.2 \pm 10.0$ int. coul/g-equiv, or int. joule/int.volt g-equiv	$\mathcal{F}$ = Faraday constant
$= 96485.6 \pm 10.0$ abs. coul/g-equiv, or abs. joule/abs.volt g-equiv	
$= 23068.2 \pm 2.4$ cal/int.volt g-equiv	
$= 23060.6 \pm 2.5$ cal/abs.volt g-equiv	
$(\mathcal{F}/R) = 11608.50 \pm 1.40$ deg/int.volt	
$= 11604.65 \pm 1.30$ deg/abs.volt	
$(\mathcal{F}/R \ln 10) = 5041.51 \pm 0.62$ deg/int.volt	
$= 5039.84 \pm 0.57$ deg/abs.volt	
$e = (1.60200 \pm 0.00060) \times 10^{-19}$ abs.coul	e = Electronic charge
$= (1.60200 \pm 0.00060) \times 10^{-20}$ abs.e.m.u.	
$= (4.80240 \pm 0.00180) \times 10^{-10}$ abs.e.s.u.	
1 int.electron-volt/molecule = 96501.2 ± 10. int.joule/mole	
= 23068.2 ± 2.4 cal/mole	
1 abs.electron-volt/molecule = 96485.6 ± 10. abs.joule/mole	
= 23060.6 ± 2.5 cal/mole	
1 int.electron-volt $= (1.60253 \pm 0.00060) \times 10^{-12}$ erg	
1 abs.electron-volt $= (1.60200 \pm 0.00060) \times 10^{-12}$ erg	
$hc = (1.23915 \pm 0.00032) \times 10^{-4}$ int.electron-volt cm	Constant relating wave number and energy per molecule
$= (1.23956 \pm 0.00032) \times 10^{-4}$ abs.electron-volt cm	
$k = (8.61438 \pm 0.00100) \times 10^{-5}$ int.electron-volt/deg	k = Boltzmann constant
$= (8.61723 \pm 0.00100) \times 10^{-5}$ abs.electron-volt/deg	

[a] See footnote to Table α (Part 3).

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE α (Part 3) - VALUES OF CONSTANTS[a]

December 31, 1944; revised March 31, 1945

1 I.T. cal = (1/860) = 0.00116279 int.watt-hr	Definition of I.T. cal; I.T. = International steam tables
= 4.18605 int. joule	
= 4.18676 abs. joule	
= 1.000657 cal	cal = thermochemical calorie
1 I.T. cal/g = 1.8 BTU/lb	Definition of BTU; BTU = I.T. British Thermal Unit
1 BTU = 251.996 I.T. cal	
= 0.293018 int.watt-hr	
= 1054.866 int. joule	
= 1055.045 abs. joule	
= 252.161 cal	cal = thermochemical calorie
1 horsepower = 550 ft-lb(wt)/sec	Definition of horsepower (mechanical); lb(wt) = weight of 1 lb at standard gravity
= 745.575 int.watt	
1 in. = (1/0.3937) = 2.54000508 cm	Definition of in.; in. = U.S. inch
1 ft = 30.4800610 cm	ft = U.S. foot (1 ft = 12 in.)
1 lb = 453.5924277 g	Definition; lb = avoirdupois pound
1 gal = 231 cu in.	Definition; gal = U.S. gallon
= 0.133680555 cu ft	
= 3785.43449 cm^3	
= 3.785329 liter	

[a] For details, reference is made to the following reports:

Baxter, Guichard, Honigschmid, and Whytlaw-Gray[1].
Birge[1]
Birge[2]
Burgess[1]
Cragoe[3]
Curtis[1]
Mueller and Rossini[1]
National Bureau of Standards[2]
Peffer and Mulligan[1]
Wagman, Kilpatrick, Taylor, Pitzer and Rossini[1]

TABLE β (Part 1) - CONVERSION FACTORS[a]
UNITS OF LENGTH
January 31, 1945

Units → / ↓	cm	μ	mμ	Å
1 centimeter (cm) =	1	10^4	10^7	10^8
1 micron (μ) =	10^{-4}	1	10^3	10^4
1 millimicron (mμ) =	10^{-7}	10^{-3}	1	10
1 Ångstrom unit (Å) =	10^{-8}	10^{-4}	10^{-1}	1

TABLE β (Part 2) - CONVERSION FACTORS[a]
UNITS OF LENGTH
January 31, 1945

Units → / ↓	cm	m	in.	ft	yd
1 cm =	1	0.01	0.3937	0.032808333	0.010936111
1 m =	100.	1	39.37	3.2808333	1.0936111
1 in. =	2.5400051	0.025400051	1	0.083333333	0.027777778
1 ft =	30.480061	0.30480061	12.	1	0.33333333
1 yd =	91.440183	0.91440183	36.	3.	1

TABLE β (Part 3) - CONVERSION FACTORS[a]
UNITS OF AREA
January 31, 1945

Units → / ↓	cm^2	m^2	sq in.	sq ft	sq yd
1 cm^2 =	1	10^{-4}	0.15499969	1.0763867×10^{-3}	1.1959853×10^{-4}
1 m^2 =	10^4	1	1549.9969	10.763867	1.1959853
1 sq in. =	6.4516258	6.4516258×10^{-4}	1	6.9444444×10^{-3}	7.7160494×10^{-4}
1 sq ft =	929.03412	0.092903412	144.	1	0.11111111
1 sq yd =	8361.3070	0.83613070	1296.	9.	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE β (Part 4) - CONVERSION FACTORS[a]

UNITS OF VOLUME

January 31, 1945

Units → / ↓		cm^3	cu in.	cu ft.	ml	liter	gal
1 cm^3	=	1	0.061023378	3.5314455 x10^{-5}	0.9999720	0.9999720 x10^{-3}	2.6417047 x10^{-4}
1 cu in.	=	16.387162	1	5.7870370 x10^{-4}	16.38670	1.638670 x10^{-2}	4.3290043 x10^{-3}
1 cu ft	=	28317.017	1728.	1	28316.22	28.31622	7.4805.95
1 ml	=	1.000028	0.06102509	3.531544 x10^{-5}	1	0.001	2.641779 x10^{-4}
1 liter	=	1000.028	61.02509	0.03531544	1000.	1	0.2641779
1 gal	=	3785.4345	231.	0.13368056	3785.329	3.785329	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

TABLE β (Part 5) - CONVERSION FACTORS[a]
UNITS OF MASS
January 31, 1945

Units → / ↓	g	kg	lb	metric ton	ton
1 g =	1	10^{-3}	2.2046223 x10^{-3}	10^{-6}	1.1023112 x10^{-6}
1 kg =	10^{3}	1	2.2046223	10^{-3}	1.1023112 x10^{-3}
1 lb =	453.59243	0.45359243	1	4.5359243 x10^{-4}	0.0005
1 metric ton =	10^{6}	10^{3}	2204.6223	1	1.1023112
1 ton =	907184.86	907.18486	2000.	0.90718486	1

TABLE β (Part 6) - CONVERSION FACTORS[a]
UNITS OF DENSITY
January 31, 1945

Units → / ↓	g/cm^3	g/ml	lb/cu in	lb/cu ft	lb/gal
1 g/cm =	1	1.000028	0.036127504	62.428327	8.3454535
1 g/ml =	0.9999720	1	0.03612649	62.42658	8.345220
1 lb/cu in =	27.679742	27.68052	1	1728.	231.
1 lb/cu ft =	0.016018369	0.01601882	5.7870370 x10^{-4}	1	0.13368056
1 lb/gal =	0.11982572	0.1198291	4.3290043 x10^{-3}	7.4805195	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 7) - CONVERSION FACTORS[a]

UNITS OF PRESSURE

January 31, 1945

Units → / ↓		dyne/cm^2	bar	atm	kg(wt)/cm^2	mm Hg	in. Hg	lb(wt)/sq in.
1 dyne/cm^2	=	1	10^{-6}	0.9869233 x10^{-6}	1.0197162 x10^{-6}	7.500617 x10^{-4}	2.952993 x10^{-5}	1.4503830 x10^{-5}
1 bar	=	10^6	1	0.9869233	1.0197162	750.0617	29.52993	14.503830
1 atm	=	1013250.	1.013250	1	1.0332275	760.	29.92120	14.696006
1 kg(wt)/cm^2	=	980665.	0.980665	0.9678411	1	735.5592	28.95897	14.223398
1 mm Hg	=	1333.2237	1.3332237 x10^{-3}	1.3157895 x10^{-3}	1.3595098 x10^{-3}	1	0.03937	0.019336850
1 in. Hg	=	33863.95	0.03386395	0.03342112	0.03453162	25.40005	1	0.4911570
1 lb(wt)/sq in.	=	68947.31	0.06894731	0.06804570	0.07030669	51.71473	2.036009	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

TABLE 3 (Part 8) - CONVERSION FACTORS[a]

UNITS OF ENERGY

January 31, 1945; revised March 31, 1945

Units → / ↓	abs.joule	int.joule	cal	I.T. cal	BTU	int.kilowatt - hr	horsepower-hr	ft-lb(wt)	cu ft-lb(wt)/sq in.	liter-atm
1 abs.joule =	1	0.999830	0.239005	0.238848	0.947827×10^{-3}	2.77731×10^{-7}	3.72505×10^{-7}	0.737561	5.12195×10^{-3}	9.86896×10^{-3}
1 int.joule =	1.000170	1	0.239046	0.238889	0.947988×10^{-3}	2.77778×10^{-7}	3.72569×10^{-7}	0.737686	5.12282×10^{-3}	9.87063×10^{-3}
1 cal =	4.18401	4.1833	1	0.999344	3.96572×10^{-3}	1.162028×10^{-6}	1.558566×10^{-6}	3.08596	2.14303×10^{-2}	4.12918×10^{-2}
1 I.T. cal =	4.18676	4.18605	1.000657	1	3.96832×10^{-3}	1.162791×10^{-6}	1.559590×10^{-6}	3.08799	2.14444×10^{-2}	4.13189×10^{-2}
1 BTU =	1055.045	1054.866	252.161	251.996	1	2.93018×10^{-4}	3.93010×10^{-4}	778.160	5.40389	10.41220
1 int.kilowatt-hr =	3,600,612.	3,600,000.	860,565.	860,000.	3412.76	1	1.341247	2,655,669.	18442.15	35534.3
1 horsepower-hr =	2,684,525.	2,684,069.	641,615.	641,194.	2544.46	0.745575	1	1,980,000.	13750.	26493.5
1 ft-lb(wt) =	1.355821	1.355591	0.324048	0.323836	1.285083×10^{-3}	3.76553×10^{-7}	5.05051×10^{-7}	1	6.94444×10^{-3}	1.338054×10^{-2}
1 cu ft-lb(wt)/sq in.=	195.2382	195.2050	46.6629	46.6323	0.1850520	5.42236×10^{-5}	7.27273×10^{-5}	144.	1	1.926797
1 liter-atm =	101.3278	101.3106	24.2179	24.2020	0.0960412	2.81418×10^{-5}	3.77452×10^{-5}	74.7354	0.518996	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE β (Part 9) - CONVERSION FACTORS[a]

UNITS OF MOLECULAR ENERGY

January 31, 1945; revised March 31, 1945

Units →		erg/molecule	abs.joule/mole	int.joule/mole	cal/mole	abs.electron-volt/molecule	int.electron-volt/molecule	wave no. (cm^{-1})
1 erg/molecule	=	1	6.02283×10^{16}	6.02181×10^{16}	1.439487×10^{16}	6.24221×10^{11}	6.24014×10^{11}	5.03581×10^{15}
1 abs.joule/mole	=	1.660349×10^{-17}	1	0.999830	0.239005	1.036424×10^{-5}	1.036081×10^{-5}	8.36121×10^{-2}
1 int.joule/mole	=	1.660631×10^{-17}	1.000170	1	0.239046	1.036601×10^{-5}	1.036257×10^{-5}	8.36263×10^{-2}
1 cal/mole	=	6.94692×10^{-17}	4.18401	4.1833	1	4.33641×10^{-5}	4.33497×10^{-5}	0.349834
1 abs.electron-volt/molecule	=	1.601997×10^{-12}	96485.6	96469.2	23060.5	1	0.999668	8067.36
1 int.electron-volt/molecule	=	1.602529×10^{-12}	96517.6	96501.2	23068.2	1.000332	1	8070.04
1 wave no. (cm^{-1})	=	1.985776×10^{-16}	11.95999	11.95796	2.85850	1.239563×10^{-4}	1.239152×10^{-4}	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

TABLE β (Part 10) - CONVERSION FACTORS[a]
UNITS OF SPECIFIC ENERGY
January 31, 1945; revised March 31, 1945

Units → / ↓		abs.joule/g	int.joule/g	cal/g	I.T. cal/g	BTU/lb
1 abs.joule/g	=	1	0.999830	0.239005	0.238848	0.429927
1 int.joule/g	=	1.000170	1	0.239046	0.238889	0.430000
1 cal/g	=	4.18401	4.1833	1	0.999344	1.798819
1 I.T. cal/g	=	4.18676	4.18605	1.000657	1	1.8
1 BTU/lb	=	2.32598	2.32558	0.555920	0.555556	1

TABLE β (Part 11) - CONVERSION FACTORS[a]
UNITS OF SPECIFIC ENERGY PER DEGREE
January 31, 1945; revised March 31, 1945

Units → / ↓		abs.joule/ g deg C	int.joule/ g deg C	cal/ g deg C	I.T. cal/ g deg C	BTU/ lb deg F
1 abs.joule/g deg C	=	1	0.999830	0.239005	0.238848	0.238848
1 int.joule/g deg C	=	1.000170	1	0.239046	0.238889	0.238889
1 cal/g deg C	=	4.18401	4.1833	1	0.999344	0.999344
1 I.T. cal/g deg C	=	4.18676	4.18605	1.000657	1	1
1 BTU/lb deg F	=	4.18676	4.18605	1.000657	1	1

[a] To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

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TABLE 7 (Part 1) - USEFUL EQUATIONS WITH NUMERICAL CONSTANTS

FOR CALCULATING THE THERMODYNAMIC FUNCTIONS FOR

TRANSLATION (OF ALL MOLECULES) AND ROTATION (OF RIGID MOLECULES)

January 31, 1945

Definitions and Units: The equations in this table may be used to calculate the translational and rotational contributions (in cal/deg mole) to the heat content function, $(H^o - H_0^o)/T$, the free energy function, $(F^o - H_0^o)/T$, and the entropy, S^o, the translational heat capacity at constant pressure, C_p^o, and the rotational heat capacity, C^o; all for a gas in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere), at the given absolute temperature T(in °K). M is the molecular weight (g/mole). I (g-cm^2) is the value of the two equal moments of inertia of a linear molecule about axes perpendicular to the axis of the molecule; and I_1, I_2, and I_3 (g-cm^2) are the three principal moments of inertia of a nonlinear molecule. The symmetry number, σ (a dimensionless integer), is the number of ways the molecule may be superimposed upon itself by rotation of the entire molecule.[a] log - common logarithm (to the base 10).

TRANSLATION
(of all molecules)

$$(H^o - H_0^o)/T = C_p^o = 4.9680$$
$$(F^o - H_0^o)/T = -6.8635 \log M + 7.2820 - 11.4391 \log T$$
$$S^o = 6.8635 \log M - 2.3141 + 11.4391 \log T$$

ROTATION
(of rigid molecules)

I. Diatomic or linear polyatomic molecules

$$(H^o - H_0^o)/T = C^o = 1.9872$$

(a) σ (symmetry number) = 1:

$$(F^o - H_0^o)/T = -4.5757 \log(I \times 10^{39}) + 2.7676 - 4.5757 \log T$$
$$S^o = 4.5757 \log(I \times 10^{39}) - 0.7804 + 4.5757 \log T$$

(b) σ (symmetry number) = 2:

$$(F^o - H_0^o)/T = -4.5757 \log(I \times 10^{39}) + 4.1450 - 4.5757 \log T$$
$$S^o = 4.5757 \log(I \times 10^{39}) - 2.1578 + 4.5757 \log T$$

II. Nonlinear polyatomic molecules

$$(H^o - H_0^o)/T = C^o = 2.9808$$
$$(F^o - H_0^o)/T = -2.2878 \log(I_1 I_2 I_3 \times 10^{117}) + 4.5757 \log \sigma + 3.0140 - 6.8635 \log T$$
$$S^o = 2.2878 \log(I_1 I_2 I_3 \times 10^{117}) - 4.5757 \log \sigma - 0.0332 + 6.8635 \log T$$

[a] For further details, reference may be made to Tolman[1] or Mayer and Mayer[1].

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TABLE 8 - MOLECULAR WEIGHTS

Index to Parts

December 31, 1946

Number of H atoms	Number of C atoms: 0 to 10	10 to 20	20 to 30	30 to 40	40 to 50
0 to 22	Part 1	Part 2	Part 4	Part 7	Part 11
22 to 42		Part 3	Part 5	Part 8	Part 12
42 to 62			Part 6	Part 9	Part 13
62 to 82				Part 10	Part 14
82 to 102					Part 15

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8 (Part 1) - MOLECULAR WEIGHTS[a]

Range: C_0 to C_{10}; H_0 to H_{22}

December 31, 1946

No. of H atoms	Number of C atoms										
	0	1	2	3	4	5	6	7	8	9	10
0	0.000	12.010	24.020	36.030	48.040	60.050	72.060	84.070	96.080	108.090	120.100
1	1.008	13.018	25.028	37.038	49.048	61.058	73.068	85.078	97.088	109.098	121.108
2	2.016	14.026	26.036	38.046	50.056	62.066	74.076	86.086	98.096	110.106	122.116
3	.....	15.034	27.044	39.054	51.064	63.074	75.084	87.094	99.104	111.114	123.124
4	.....	16.042	28.052	40.062	52.072	64.082	76.092	88.102	100.112	112.122	124.132
5	.....	.....	29.060	41.070	53.080	65.090	77.100	89.110	101.120	113.130	125.140
6	.....	.....	30.068	42.078	54.088	66.098	78.108	90.118	102.128	114.138	126.148
7	.....	.....	.....	43.086	55.096	67.106	79.116	91.126	103.136	115.146	127.156
8	.....	.....	.....	44.094	56.104	68.114	80.124	92.134	104.144	116.154	128.164
9	.....	.....	.....	.....	57.112	69.122	81.132	93.142	105.152	117.162	129.172
10	.....	.....	.....	.....	58.120	70.130	82.140	94.150	106.160	118.170	130.180
11	.....	.....	.....	.....	.....	71.138	83.148	95.158	107.168	119.178	131.188
12	.....	.....	.....	.....	.....	72.146	84.156	96.166	108.176	120.186	132.196
13	.....	.....	.....	.....	.....	.....	85.164	97.174	109.184	121.194	133.204
14	....	.....	.....	.....	.....	.....	86.172	98.182	110.192	122.202	134.212
15	.....	.....	.....	.....	.....	.....	.....	99.190	111.200	123.210	135.220
16	.....	.....	.....	.....	.....	.....	.....	100.198	112.208	124.218	136.228
17	.....	.....	.....	.....	.....	.....	.....	.....	113.216	125.226	137.236
18	.....	.....	.....	.....	.....	.....	.....	.....	114.224	126.234	138.244
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	127.242	139.252
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	128.250	140.260
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	141.268
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	142.276

[a] The values of molecular weights in this table are based on the atomic weights, C= 12.010, H= 1.0080, as given in the Thirteenth Report of the Committee on Atomic Weights of the International Union of Chemistry, Baxter, Guichard, and Whytlaw-Gray].

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TABLE 8 (Part 2) - MOLECULAR WEIGHTS

Range: C_{10} to C_{20}; H_0 to H_{22}

December 31, 1946

No. of H atoms	Number of C atoms										
	10	11	12	13	14	15	16	17	18	19	20
0	120.100	132.110	144.120	156.130	168.140	180.150	192.160	204.170	216.180	228.190	240.200
1	121.108	133.118	145.128	157.138	169.148	181.158	193.168	205.178	217.188	229.198	241.208
2	122.116	134.126	146.136	158.146	170.156	182.166	194.176	206.186	218.196	230.206	242.216
3	123.124	135.134	147.144	159.154	171.164	183.174	195.184	207.194	219.204	231.214	243.224
4	124.132	136.142	148.152	160.162	172.172	184.182	196.192	208.202	220.212	232.222	244.232
5	125.140	137.150	149.160	161.170	173.180	185.190	197.200	209.210	221.220	233.230	245.240
6	126.148	138.158	150.168	162.178	174.188	186.198	198.208	210.218	222.228	234.238	246.248
7	127.156	139.166	151.176	163.186	175.196	187.206	199.216	211.226	223.236	235.246	247.256
8	128.164	140.174	152.184	164.194	176.204	188.214	200.224	212.234	224.244	236.254	248.264
9	129.172	141.182	153.192	165.202	177.212	189.222	201.232	213.242	225.252	237.262	249.272
10	130.180	142.190	154.200	166.210	178.220	190.230	202.240	214.250	226.260	238.270	250.280
11	131.188	143.198	155.208	167.218	179.228	191.238	203.248	215.258	227.268	239.278	251.288
12	132.196	144.206	156.216	168.226	180.236	192.246	204.256	216.266	228.276	240.286	252.296
13	133.204	145.214	157.224	169.234	181.244	193.254	205.264	217.274	229.284	241.294	253.304
14	134.212	146.222	158.232	170.242	182.252	194.262	206.272	218.282	230.292	242.302	254.312
15	135.220	147.230	159.240	171.250	183.260	195.270	207.280	219.290	231.300	243.310	255.320
16	136.228	148.238	160.248	172.258	184.268	196.278	208.288	220.298	232.308	244.318	256.328
17	137.236	149.246	161.256	173.266	185.276	197.286	209.296	221.306	233.316	245.326	257.336
18	138.244	150.254	162.264	174.274	186.284	198.294	210.304	222.314	234.324	246.334	258.344
19	139.252	151.262	163.272	175.282	187.292	199.302	211.312	223.322	235.332	247.342	259.352
20	140.260	152.270	164.280	176.290	188.300	200.310	212.320	224.330	236.340	248.350	260.360
21	141.268	153.278	165.288	177.298	189.308	201.318	213.328	225.338	237.348	249.358	261.368
22	142.276	154.286	166.296	178.306	190.316	202.326	214.336	226.346	238.356	250.366	262.376

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 3) - MOLECULAR WEIGHTS

Range: C_{10} to C_{20}; H_{22} to H_{42}

December 31, 1946

No. of H atoms	Number of C atoms										
	10	11	12	13	14	15	16	17	18	19	20
22	142.276	154.286	166.296	178.306	190.316	202.326	214.336	226.346	238.356	250.366	262.376
23	.....	155.294	167.304	179.314	191.324	203.334	215.344	227.354	239.364	251.374	263.384
24	.....	156.302	168.312	180.322	192.332	204.342	216.352	228.362	240.372	252.382	264.392
25	.....	.....	169.320	181.330	193.340	205.350	217.360	229.370	241.380	253.390	265.400
26	.....	.....	170.328	182.338	194.348	206.358	218.368	230.378	242.388	254.398	266.408
27	.....	.....	.....	183.346	195.356	207.366	219.376	231.386	243.396	255.406	267.416
28	.....	.....	.....	184.354	196.364	208.374	220.384	232.394	244.404	256.414	268.424
29	.....	.....	.....	.....	197.372	209.382	221.392	233.402	245.412	257.422	269.432
30	.....	.....	.....	.....	198.380	210.390	222.400	234.410	246.420	258.430	270.440
31	.....	.....	.....	.....	.....	211.398	223.408	235.418	247.428	259.438	271.448
32	.....	.....	.....	.....	.....	212.406	224.416	236.426	248.436	260.446	272.456
33	.....	.....	.....	.....	.....	.....	225.424	237.434	249.444	261.454	273.464
34	.....	.....	.....	.....	.....	.....	226.432	238.442	250.452	262.462	274.472
35	.....	.....	.....	.....	.....	.....	.....	239.450	251.460	263.470	275.480
36	.....	.....	.....	.....	.....	.....	.....	240.458	252.468	264.478	276.488
37	.....	.....	.....	.....	.....	.....	.....	.....	253.476	265.486	277.496
38	.....	.....	.....	.....	.....	.....	.....	.....	254.484	266.494	278.504
39	.....	.....	.....	.....	.....	.....	.....	.....	.....	267.502	279.512
40	.....	.....	.....	.....	.....	.....	.....	.....	.....	268.510	280.520
41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	281.528
42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	282.536

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TABLE 8 (Part 4) - MOLECULAR WEIGHTS

Range: C_{20} to C_{30}; H_0 to H_{22}

December 31, 1946

No. of H atoms	Number of C atoms										
	20	21	22	23	24	25	26	27	28	29	30
0	240.200	252.210	264.220	276.230	288.240	300.250	312.260	324.270	336.280	348.290	360.300
1	241.208	253.218	265.228	277.238	289.248	301.258	313.268	325.278	337.288	349.298	361.308
2	242.216	254.226	266.236	278.246	290.256	302.266	314.276	326.286	338.296	350.306	362.316
3	243.224	255.234	267.244	279.254	291.264	303.274	315.284	327.294	339.304	351.314	363.324
4	244.232	256.242	268.252	280.262	292.272	304.282	316.292	328.302	340.312	352.322	364.332
5	245.240	257.250	269.260	281.270	293.280	305.290	317.300	329.310	341.320	353.330	365.340
6	246.248	258.258	270.268	282.278	294.288	306.298	318.308	330.318	342.328	354.338	366.348
7	247.256	259.266	271.276	283.286	295.296	307.306	319.316	331.326	343.336	355.346	367.356
8	248.264	260.274	272.284	284.294	296.304	308.314	320.324	332.334	344.344	356.354	368.364
9	249.272	261.282	273.292	285.302	297.312	309.322	321.332	333.342	345.352	357.362	369.372
10	250.280	262.290	274.300	286.310	298.320	310.330	322.340	334.350	346.360	358.370	370.380
11	251.288	263.298	275.308	287.318	299.328	311.338	323.348	335.358	347.368	359.378	371.388
12	252.296	264.306	276.316	288.326	300.336	312.346	324.356	336.366	348.376	360.386	372.396
13	253.304	265.314	277.324	289.334	301.344	313.354	325.364	337.374	349.384	361.394	373.404
14	254.312	266.322	278.332	290.342	302.352	314.362	326.372	338.382	350.392	362.402	374.412
15	255.320	267.330	279.340	291.350	303.360	315.370	327.380	339.390	351.400	363.410	375.420
16	256.328	268.338	280.348	292.358	304.368	316.378	328.388	340.398	352.408	364.418	376.428
17	257.336	269.346	281.356	293.366	305.376	317.386	329.396	341.406	353.416	365.426	377.436
18	258.344	270.354	282.364	294.374	306.384	318.394	330.404	342.414	354.424	366.434	378.444
19	259.352	271.362	283.372	295.382	307.392	319.402	331.412	343.422	355.432	367.442	379.452
20	260.360	272.370	284.380	296.390	308.400	320.410	332.420	344.430	356.440	368.450	380.460
21	261.368	273.378	285.388	297.398	309.408	321.418	333.428	345.438	357.448	369.458	381.468
22	262.376	274.386	286.396	298.406	310.416	322.426	334.436	346.446	358.456	370.466	382.476

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 8 (Part 5) - MOLECULAR WEIGHTS

Range: C_{20} to C_{30}; H_{22} to H_{42}

December 31, 1946

No. of H atoms	Number of C atoms										
	20	21	22	23	24	25	26	27	28	29	30
22	282.376	294.386	306.396	318.406	330.416	342.426	354.436	366.446	378.456	390.466	402.476
23	283.384	295.394	307.404	319.414	331.424	343.434	355.444	367.454	379.464	391.474	403.484
24	284.392	296.402	308.412	320.422	332.432	344.442	356.452	368.462	380.472	392.482	404.492
25	285.400	297.410	309.420	321.430	333.440	345.450	357.460	369.470	381.480	393.490	405.500
26	286.408	298.418	310.428	322.438	334.448	346.458	358.468	370.378	382.488	394.498	406.508
27	287.416	299.426	311.436	323.446	335.456	347.466	359.476	371.486	383.496	395.506	407.516
28	288.424	300.434	312.444	324.454	336.464	348.474	360.484	372.494	384.504	396.514	408.524
29	289.432	301.442	313.452	325.462	337.472	349.482	361.492	373.502	385.512	397.522	409.532
30	290.440	302.450	314.460	326.470	338.480	350.490	362.500	374.510	386.520	398.530	410.540
31	291.448	303.458	315.468	327.478	339.488	351.498	363.508	375.518	387.528	399.538	411.548
32	292.456	304.466	316.476	328.486	340.496	352.506	364.516	376.526	388.536	400.546	412.556
33	293.464	305.474	317.484	329.494	341.504	353.514	365.524	377.534	389.544	401.554	413.564
34	294.472	306.482	318.492	330.502	342.512	354.522	366.532	378.542	390.552	402.562	414.572
35	295.480	307.490	319.500	331.510	343.520	355.530	367.540	379.550	391.560	403.570	415.580
36	296.488	308.498	320.508	332.518	344.528	356.538	368.548	380.558	392.568	404.578	416.588
37	297.496	309.506	321.516	333.526	345.536	357.546	369.556	381.566	393.576	405.586	417.596
38	298.504	310.514	322.524	334.534	346.544	358.554	370.564	382.574	394.584	406.594	418.604
39	299.512	311.522	323.532	335.542	347.552	359.562	371.572	383.582	395.592	407.602	419.612
40	300.520	312.530	324.540	336.550	348.560	360.570	372.580	384.590	396.600	408.610	420.620
41	301.528	313.538	325.548	337.558	349.568	361.578	373.588	385.598	397.608	409.618	421.628
42	302.536	314.546	326.556	338.566	350.576	362.586	374.596	386.606	398.616	410.626	422.636

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TABLE 8 (Part 6) - MOLECULAR WEIGHTS

Range: C_{20} to C_{30}; H_{42} to H_{62}

December 31, 1946

No. of H atoms	Number of C atoms										
	20	21	22	23	24	25	26	27	28	29	30
42	282.536	294.546	306.556	318.566	330.576	342.586	354.596	366.606	378.616	390.626	402.636
43	.....	295.554	307.564	319.574	331.584	343.594	355.604	367.614	379.624	391.634	403.644
44	.....	296.562	308.572	320.582	332.592	344.602	356.612	368.622	380.632	392.642	404.652
45	.....	.....	309.580	321.590	333.600	345.610	357.620	369.630	381.640	393.650	405.660
46	.....	.....	310.588	322.598	334.608	346.618	358.628	370.638	382.648	394.658	406.668
47	.....	.....	.....	323.606	335.616	347.626	359.636	371.646	383.656	395.666	407.676
48	.....	.....	.....	324.614	336.624	348.634	360.644	372.654	384.664	396.674	408.684
49	.....	.....	.....	.....	337.632	349.642	361.652	373.662	385.672	397.682	409.692
50	.....	.....	.....	.....	338.640	350.650	362.660	374.670	386.680	398.690	410.700
51	.....	.....	.....	.....	.....	351.658	363.668	375.678	387.688	399.698	411.708
52	.....	.....	.....	.....	.....	352.666	364.676	376.686	388.696	400.706	412.716
53	.....	.....	.....	.....	.....	.....	365.684	377.694	389.704	401.714	413.724
54	.....	.....	.....	.....	.....	.....	366.692	378.702	390.712	402.722	414.732
55	.....	.....	.....	.....	.....	.....	.....	379.710	391.720	403.730	415.740
56	.....	.....	.....	.....	.....	.....	.....	380.718	392.728	404.738	416.748
57	.....	.....	.....	.....	.....	.....	.....	.....	393.736	405.746	417.756
58	.....	.....	.....	.....	.....	.....	.....	.....	394.744	406.754	418.764
59	.....	.....	.....	.....	.....	.....	.....	.....	.....	407.762	419.772
60	.....	.....	.....	.....	.....	.....	.....	.....	.....	408.770	420.780
61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	421.788
62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	422.796

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE (Part 7) - MOLECULAR WEIGHTS

Range: C_{30} to C_{40}; H_0 to H_{22}

December 31, 1946

No. of H atoms	Number of C atoms										
	30	31	32	33	34	35	36	37	38	39	40
0	360.300	372.310	384.320	396.330	408.340	420.350	432.360	444.370	456.380	468.390	480.400
1	361.308	373.318	385.328	397.338	409.348	421.358	433.368	445.378	457.388	469.398	481.408
2	362.316	374.326	386.336	398.346	410.356	422.366	434.376	446.386	458.396	470.406	482.416
3	363.324	375.334	387.344	399.354	411.364	423.374	435.384	447.394	459.404	471.414	483.424
4	364.332	376.342	388.352	400.362	412.372	424.382	436.392	448.402	460.412	472.422	484.432
5	365.340	377.350	389.360	401.370	413.380	425.390	437.400	449.410	461.420	473.430	485.440
6	366.348	378.358	390.368	402.378	414.388	426.398	438.408	450.418	462.428	474.438	486.448
7	367.356	379.366	391.376	403.386	415.396	427.406	439.416	451.426	463.436	475.446	487.456
8	368.364	380.374	392.384	404.394	416.404	428.414	440.424	452.434	464.444	476.454	488.464
9	369.372	381.382	393.392	405.402	417.412	429.422	441.432	453.442	465.452	477.462	489.472
10	370.380	382.390	394.400	406.410	418.420	430.430	442.440	454.450	466.460	478.470	490.480
11	371.388	383.398	395.408	407.418	419.428	431.438	443.448	455.458	467.468	479.478	491.488
12	372.396	384.406	396.416	408.426	420.436	432.446	444.456	456.466	468.476	480.486	492.496
13	373.404	385.414	397.424	409.434	421.444	433.454	445.464	457.474	469.484	481.494	493.504
14	374.412	386.422	398.432	410.442	422.452	434.462	446.472	458.482	470.492	482.502	494.512
15	375.420	387.430	399.440	411.450	423.460	435.470	447.480	459.490	471.500	483.510	495.520
16	376.428	388.438	400.448	412.458	424.468	436.478	448.488	460.498	472.508	484.518	496.528
17	377.436	389.446	401.456	413.466	425.476	437.486	449.496	461.506	473.516	485.526	497.536
18	378.444	390.454	402.464	414.474	426.484	438.494	450.504	462.514	474.524	486.534	498.544
19	379.452	391.462	403.472	415.482	427.492	439.502	451.512	463.522	475.532	487.542	499.552
20	380.460	392.470	404.480	416.490	428.500	440.510	452.520	464.530	476.540	488.550	500.560
21	381.468	393.478	405.488	417.498	429.508	441.518	453.528	465.538	477.548	489.558	501.568
22	382.476	394.486	406.496	418.506	430.516	442.526	454.536	466.546	478.556	490.566	502.576

TABLE 8 (Part 8) - MOLECULAR WEIGHTS

Range: C_{30} to C_{40}; H_{22} to H_{42}

December 31, 1946

No. of H atoms	Number of C atoms										
	30	31	32	33	34	35	36	37	38	39	40
22	382.476	394.486	406.496	418.506	430.516	442.526	454.536	466.546	478.556	490.566	502.576
23	383.484	395.494	407.504	419.514	431.524	443.534	455.544	467.554	479.564	491.574	503.584
24	384.492	396.502	408.512	420.522	432.532	444.542	456.552	468.562	480.572	492.582	504.592
25	385.500	397.510	409.520	421.530	433.540	445.550	457.560	469.570	481.580	493.590	505.600
26	386.508	398.518	410.528	422.538	434.548	446.558	458.568	470.578	482.588	494.598	506.608
27	387.516	399.526	411.536	423.546	435.556	447.566	459.576	471.586	483.596	495.606	507.616
28	388.524	400.534	412.544	424.554	436.564	448.574	460.584	472.594	484.604	496.614	508.624
29	389.532	401.542	413.552	425.562	437.572	449.582	461.592	473.602	485.612	497.622	509.632
30	390.540	402.550	414.560	426.570	438.580	450.590	462.600	474.610	486.620	498.630	510.640
31	391.548	403.558	415.568	427.578	439.588	451.598	463.608	475.618	487.628	499.638	511.648
32	392.556	404.566	416.576	428.586	440.596	452.606	464.616	476.626	488.636	500.646	512.656
33	393.564	405.574	417.584	429.594	441.604	453.614	465.624	477.634	489.644	501.654	513.664
34	394.572	406.582	418.592	430.602	442.612	454.622	466.632	478.642	490.652	502.662	514.672
35	395.580	407.590	419.600	431.610	443.620	455.630	467.640	479.650	491.660	503.670	515.680
36	396.588	408.598	420.608	432.618	444.628	456.638	468.648	480.658	492.668	504.678	516.688
37	397.596	409.606	421.616	433.626	445.636	457.646	469.656	481.666	493.676	505.686	517.696
38	398.604	410.614	422.624	434.634	446.644	458.654	470.664	482.674	494.684	506.694	518.704
39	399.612	411.622	423.632	435.642	447.652	459.662	471.672	483.682	495.692	507.702	519.712
40	400.620	412.630	424.640	436.650	448.660	460.670	472.680	484.690	496.700	508.710	520.720
41	401.628	413.638	425.648	437.658	449.668	461.678	473.688	485.698	497.708	509.718	521.728
42	402.636	414.646	426.656	438.666	450.676	462.686	474.696	486.706	498.716	510.726	522.736

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 9) - MOLECULAR WEIGHTS

Range: C_{30} to C_{40}; H_{42} to H_{62}

December 31, 1946

No. of H atoms	Number of C atoms										
	30	31	32	33	34	35	36	37	38	39	40
42	402.636	414.646	426.656	438.666	450.676	462.686	474.696	486.706	498.716	510.726	522.736
43	403.644	415.654	427.664	439.674	451.684	463.694	475.704	487.714	499.724	511.734	523.744
44	404.652	416.662	428.672	440.682	452.692	464.702	476.712	488.722	500.732	512.742	524.752
45	405.660	417.670	429.680	441.690	453.700	465.710	477.720	489.730	501.740	513.750	525.760
46	406.668	418.678	430.688	442.698	454.708	466.718	478.728	490.738	502.748	514.758	526.768
47	407.676	419.686	431.696	443.706	455.716	467.726	479.736	491.746	503.756	515.766	527.776
48	408.684	420.694	432.704	444.714	456.724	468.734	480.744	492.754	504.764	516.774	528.784
49	409.692	421.702	433.712	445.722	457.732	469.742	481.752	493.762	505.772	517.782	529.792
50	410.700	422.710	434.720	446.730	458.740	470.750	482.760	494.770	506.780	518.790	530.800
51	411.708	423.718	435.728	447.738	459.748	471.758	483.768	495.778	507.788	519.798	531.808
52	412.716	424.726	436.736	448.746	460.756	472.766	484.776	496.786	508.796	520.806	532.816
53	413.724	425.734	437.744	449.754	461.764	473.774	485.784	497.794	509.804	521.814	533.824
54	414.732	426.742	438.752	450.762	462.772	474.782	486.792	498.802	510.812	522.822	534.832
55	415.740	427.750	439.760	451.770	463.780	475.790	487.800	499.810	511.820	523.830	535.840
56	416.748	428.758	440.768	452.778	464.788	476.798	488.808	500.818	512.828	524.838	536.848
57	417.756	429.766	441.776	453.786	465.796	477.806	489.816	501.826	513.836	525.846	537.856
58	418.764	430.774	442.784	454.794	466.804	478.814	490.824	502.834	514.844	526.854	538.864
59	419.772	431.782	443.792	455.802	467.812	479.822	491.832	503.842	515.852	527.862	539.872
60	420.780	432.790	444.800	456.810	468.820	480.830	492.840	504.850	516.860	528.870	540.880
61	421.788	433.798	445.808	457.818	469.828	481.838	493.848	505.858	517.868	529.878	541.888
62	422.796	434.806	446.816	458.826	470.836	482.846	494.856	506.866	518.876	530.886	542.896

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 10) - MOLECULAR WEIGHTS

Range: C_{30} to C_{40}; H_{62} to H_{82}

December 31, 1946

No. of H atoms	Number of C atoms										
	30	31	32	33	34	35	36	37	38	39	40
62	422.796	434.806	446.816	458.826	470.836	482.846	494.856	506.866	518.876	530.886	542.896
63	.....	435.814	447.824	459.834	471.844	483.854	495.864	507.874	519.884	531.894	543.904
64	.....	436.822	448.832	460.842	472.852	484.862	496.872	508.882	520.892	532.902	544.912
65	.....	.....	449.840	461.850	473.860	485.870	497.880	509.890	521.900	533.910	545.920
66	.....	.....	450.848	462.858	474.868	486.878	498.888	510.898	522.908	534.918	546.928
67	.....	.....	.....	463.866	475.876	487.886	499.896	511.906	523.916	535.926	547.936
68	.....	.....	.....	464.874	476.884	488.894	500.904	512.914	524.924	536.934	548.944
69	.....	.....	.....	.....	477.892	489.902	501.912	513.922	525.932	537.942	549.952
70	.....	.....	.....	.....	478.900	490.910	502.920	514.930	526.940	538.950	550.960
71	.....	.....	.....	.....	.....	491.918	503.928	515.938	527.948	539.958	551.968
72	.....	.....	.....	.....	.....	492.926	504.936	516.946	528.956	540.966	552.976
73	.....	.....	.....	.....	.....	.....	505.944	517.954	529.964	541.974	553.984
74	.....	.....	.....	.....	.....	.....	506.952	518.962	530.972	542.982	554.992
75	.....	.....	.....	.....	.....	.....	.....	519.970	531.980	543.990	556.000
76	.....	.....	.....	.....	.....	.....	.....	520.978	532.988	544.998	557.008
77	.....	.....	.....	.....	.....	.....	.....	.....	533.996	546.006	558.016
78	.....	.....	.....	.....	.....	.....	.....	.....	535.004	547.014	559.024
79	.....	.....	.....	.....	.....	.....	.....	.....	.....	548.022	560.032
80	.....	.....	.....	.....	.....	.....	.....	.....	.....	549.030	561.040
81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	562.048
82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	563.056

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE (Part 11) - MOLECULAR WEIGHTS

Range: C_{40} to C_{50}; H_0 to H_{22}

December 31, 1946

No. of H atoms	Number of C atoms										
	40	41	42	43	44	45	46	47	48	49	50
0	480.400	492.410	504.420	516.430	528.440	540.450	552.460	564.470	576.480	588.490	600.500
1	481.408	493.418	505.428	517.438	529.448	541.458	553.468	565.478	577.488	589.498	601.508
2	482.416	494.426	506.436	518.446	530.456	542.466	554.476	566.486	578.496	590.506	602.516
3	483.424	495.434	507.444	519.454	531.464	543.474	555.484	567.494	579.504	591.514	603.524
4	484.432	496.442	508.452	520.462	532.472	544.482	556.492	568.502	580.512	592.522	604.532
5	485.440	497.450	509.460	521.470	533.480	545.490	557.500	569.510	581.520	593.530	605.540
6	486.448	498.458	510.468	522.478	534.488	546.498	558.508	570.518	582.528	594.538	606.548
7	487.456	499.466	511.476	523.486	535.496	547.506	559.516	571.526	583.536	595.546	607.556
8	488.464	500.474	512.484	524.494	536.504	548.514	560.524	572.534	584.544	596.554	608.564
9	489.472	501.482	513.492	525.502	537.512	549.522	561.532	573.542	585.552	597.562	609.572
10	490.480	502.490	514.500	526.510	538.520	550.530	562.540	574.550	586.560	598.570	610.580
11	491.488	503.498	515.508	527.518	539.528	551.538	563.548	575.558	587.568	599.578	611.588
12	492.496	504.506	516.516	528.526	540.536	552.546	564.556	576.566	588.576	600.586	612.596
13	493.504	505.514	517.524	529.534	541.544	553.554	565.564	577.574	589.584	601.594	613.604
14	494.512	506.522	518.532	530.542	542.552	554.562	566.572	578.582	590.592	602.602	614.612
15	495.520	507.530	519.540	531.550	543.560	555.570	567.580	579.590	591.600	603.610	615.620
16	496.528	508.538	520.548	532.558	544.568	556.578	568.588	580.598	592.608	604.618	616.628
17	497.536	509.546	521.556	533.566	545.576	557.586	569.596	581.606	593.616	605.626	617.636
18	498.544	510.554	522.564	534.574	546.584	558.594	570.604	582.614	594.624	606.634	618.644
19	499.552	511.562	523.572	535.582	547.592	559.602	571.612	583.622	595.632	607.642	619.652
20	500.560	512.570	524.580	536.590	548.600	560.610	572.620	584.630	596.640	608.650	620.660
21	501.568	513.578	525.588	537.598	549.608	561.618	573.628	585.638	597.648	609.658	621.668
22	502.576	514.586	526.596	538.606	550.616	562.626	574.636	586.646	598.656	610.666	622.676

TABLE 8 (Part 12) - MOLECULAR WEIGHTS

Range: C_{40} to C_{50}; H_{22} to H_{42}

December 31, 1946

No. of H atoms	Number of C atoms										
	40	41	42	43	44	45	46	47	48	49	50
22	502.576	514.586	526.596	538.606	550.616	562.626	574.636	586.646	598.656	610.666	622.676
23	503.584	515.594	527.604	539.614	551.624	563.634	575.644	587.654	599.664	611.674	623.684
24	504.592	516.602	528.612	540.622	552.632	564.642	576.652	588.662	600.672	612.682	624.692
25	505.600	517.610	529.620	541.630	553.640	565.650	577.660	589.670	601.680	613.690	625.700
26	506.608	518.618	530.628	542.638	554.648	566.658	578.668	590.678	602.688	614.698	626.708
27	507.616	519.626	531.636	543.646	555.656	567.666	579.676	591.686	603.696	615.706	627.716
28	508.624	520.634	532.644	544.654	556.664	568.674	580.684	592.694	604.704	616.714	628.724
29	509.632	521.642	533.652	545.662	557.672	569.682	581.692	593.702	605.712	617.722	629.732
30	510.640	522.650	534.660	546.670	558.680	570.690	582.700	594.710	606.720	618.730	630.740
31	511.648	523.658	535.668	547.678	559.688	571.698	583.708	595.718	607.728	619.738	631.748
32	512.656	524.666	536.676	548.686	560.696	572.706	584.716	596.726	608.736	620.746	632.756
33	513.664	525.674	537.684	549.694	561.704	573.714	585.724	597.734	609.744	621.754	633.764
34	514.672	526.682	538.692	550.702	562.712	574.722	586.732	598.742	610.752	622.762	634.772
35	515.680	527.690	539.700	551.710	563.720	575.730	587.740	599.750	611.760	623.770	635.780
36	516.688	528.698	540.708	552.718	564.728	576.738	588.748	600.758	612.768	624.778	636.788
37	517.696	529.706	541.716	553.726	565.736	577.746	589.756	601.766	613.776	625.786	637.796
38	518.704	530.714	542.724	554.734	566.744	578.754	590.764	602.774	614.784	626.794	638.804
39	519.712	531.722	543.732	555.742	567.752	579.762	591.772	603.782	615.792	627.802	639.812
40	520.720	532.730	544.740	556.750	568.760	580.770	592.780	604.790	616.800	628.810	640.820
41	521.728	533.738	545.748	557.758	569.768	581.778	593.788	605.798	617.808	629.818	641.828
42	522.736	534.746	546.756	558.766	570.776	582.786	594.796	606.806	618.816	630.826	642.836

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 13) - MOLECULAR WEIGHTS

Range: C_{40} to C_{50}; H_{42} to H_{62}

December 31, 1946

No. of H atoms	Number of C atoms										
	40	41	42	43	44	45	46	47	48	49	50
42	522.736	534.746	546.756	558.766	570.776	582.786	594.796	606.806	618.816	630.826	642.836
43	523.744	535.754	547.764	559.774	571.784	583.794	595.804	607.814	619.824	631.834	643.844
44	524.752	536.762	548.772	560.782	572.792	584.802	596.812	608.822	620.832	632.842	644.852
45	525.760	537.770	549.780	561.790	573.800	585.810	597.820	609.830	621.840	633.850	645.860
46	526.768	538.778	550.788	562.798	574.808	586.818	598.828	610.838	622.848	634.858	646.868
47	527.776	539.786	551.796	563.806	575.816	587.826	599.836	611.846	623.856	635.866	647.876
48	528.784	540.794	552.804	564.814	576.824	588.834	600.844	612.854	624.864	636.874	648.884
49	529.792	541.802	553.812	565.822	577.832	589.842	601.852	613.862	625.872	637.882	649.892
50	530.800	542.810	554.820	566.830	578.840	590.850	602.860	614.870	626.880	638.890	650.900
51	531.808	543.818	555.828	567.838	579.848	591.858	603.868	615.878	627.888	639.898	651.908
52	532.816	544.826	556.836	568.846	580.856	592.866	604.876	616.886	628.896	640.906	652.916
53	533.824	545.834	557.844	569.854	581.864	593.874	605.884	617.894	629.904	641.914	653.924
54	534.832	546.842	558.852	570.862	582.872	594.882	606.892	618.902	630.912	642.922	654.932
55	535.840	547.850	559.860	571.870	583.880	595.890	607.900	619.910	631.920	643.930	655.940
56	536.848	548.858	560.868	572.878	584.888	596.898	608.908	620.918	632.928	644.938	656.948
57	537.856	549.866	561.876	573.886	585.896	597.906	609.916	621.926	633.936	645.946	657.956
58	538.864	550.874	562.884	574.894	586.904	598.914	610.924	622.934	634.944	646.954	658.964
59	539.872	551.882	563.892	575.902	587.912	599.922	611.932	623.942	635.952	647.962	659.972
60	540.880	552.890	564.900	576.910	588.920	600.930	612.940	624.950	636.960	648.970	660.980
61	541.888	553.898	565.908	577.918	589.928	601.938	613.948	625.958	637.968	649.978	661.988
62	542.896	554.906	566.916	578.926	590.936	602.946	614.956	626.966	638.976	650.986	662.996

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8 (Part 14) - MOLECULAR WEIGHTS

Range: C_{40} to C_{50}; H_{62} to H_{82}

December 31, 1946

No. of H atoms	Number of C atoms										
	40	41	42	43	44	45	46	47	48	49	50
62	542.896	554.906	566.916	578.926	590.936	602.946	614.956	626.966	638.976	650.986	662.996
63	543.904	555.914	567.924	579.934	591.944	603.954	615.964	627.974	639.984	651.994	664.004
64	544.912	556.922	568.932	580.942	592.952	604.962	616.972	628.982	640.992	653.002	665.012
65	545.920	557.930	569.940	581.950	593.960	605.970	617.980	629.990	642.000	654.010	666.020
66	546.928	558.938	570.948	582.958	594.968	606.978	618.988	630.998	643.008	655.018	667.028
67	547.936	559.946	571.956	583.966	595.976	607.986	619.996	632.006	644.016	656.026	668.036
68	548.944	560.954	572.964	584.974	596.984	608.994	621.004	633.014	645.024	657.034	669.044
69	549.952	561.962	573.972	585.982	597.992	610.002	622.012	634.022	646.032	658.042	670.052
70	550.960	562.970	574.980	586.990	599.000	611.010	623.020	635.030	647.040	659.050	671.060
71	551.968	563.978	575.988	587.998	600.008	612.018	624.028	636.038	648.048	660.058	672.068
72	552.976	564.986	576.996	589.006	601.016	613.026	625.036	637.046	649.056	661.066	673.076
73	553.984	565.994	578.004	590.014	602.024	614.034	626.044	638.054	650.064	662.074	674.084
74	554.992	567.002	579.012	591.022	603.032	615.042	627.052	639.062	651.072	663.082	675.092
75	556.000	568.010	580.020	592.030	604.040	616.050	628.060	640.070	652.080	664.090	676.100
76	557.008	569.018	581.028	593.038	605.048	617.058	629.068	641.078	653.088	665.098	677.108
77	558.016	570.026	582.036	594.046	606.056	618.066	630.076	642.086	654.096	666.106	678.116
78	559.024	571.034	583.044	595.054	607.064	619.074	631.084	643.094	655.104	667.114	679.124
79	560.032	572.042	584.052	596.062	608.072	620.082	632.092	644.102	656.112	668.122	680.132
80	561.040	573.050	585.060	597.070	609.080	621.090	633.100	645.110	657.120	669.130	681.140
81	562.048	574.058	586.068	598.078	610.088	622.098	634.108	646.118	658.128	670.138	682.148
82	563.056	575.066	587.076	599.086	611.096	623.106	635.116	647.126	659.136	671.146	683.156

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3 (Part 15) - MOLECULAR WEIGHTS

Range: C_{40} to C_{50}; H_{82} to H_{102}

December 31, 1946

No. of H atoms	Number of C atoms										
	40	41	42	43	44	45	46	47	48	49	50
82	563.056	575.066	587.076	599.086	611.096	623.106	635.116	647.126	659.136	671.146	683.156
83	.....	576.074	588.084	600.094	612.104	624.114	636.124	648.134	660.144	672.154	684.164
84	.....	577.082	589.092	601.102	613.112	625.122	637.132	649.142	661.152	673.162	685.172
85	.....	.....	590.100	602.110	614.120	626.130	638.140	650.150	662.160	674.170	686.180
86	.....	.....	591.108	603.118	615.128	627.138	639.148	651.158	663.168	675.178	687.188
87	.....	.....	.....	604.126	616.136	628.146	640.156	652.166	664.176	676.186	688.196
88	.....	.....	.....	605.134	617.144	629.154	641.164	653.174	665.184	677.194	689.204
89	.....	.....	.....	.....	618.152	630.162	642.172	654.182	666.192	678.202	690.212
90	.....	.....	.....	.....	619.160	631.170	643.180	655.190	667.200	679.210	691.220
91	.....	.....	.....	.....	.....	632.178	644.188	656.198	668.208	680.218	692.228
92	.....	.....	.....	.....	.....	633.186	645.196	657.206	669.216	681.226	693.236
93	.....	.....	.....	.....	.....	.....	646.204	658.214	670.224	682.234	694.244
94	.....	.....	.....	.....	.....	.....	647.212	659.222	671.232	683.242	695.252
95	.....	.....	.....	.....	.....	.....	.....	660.230	672.240	684.250	696.260
96	.....	.....	.....	.....	.....	.....	.....	661.238	673.248	685.258	697.268
97	.....	.....	.....	.....	.....	.....	.....	.....	674.256	686.266	698.276
98	.....	.....	.....	.....	.....	.....	.....	.....	675.264	687.274	699.284
99	.....	.....	.....	.....	.....	.....	.....	.....	.....	688.282	700.292
100	.....	.....	.....	.....	.....	.....	.....	.....	.....	689.290	701.300
101	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	702.308
102	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	703.316

III. TABLES OF SELECTED VALUES OF PROPERTIES

Explanation of Arrangement of Tables

The tables of selected values of properties in this section are identified by a *number,* which indicates the class of compounds included in the given table, followed by a *letter,* which indicates the property or properties which are tabulated in the given table (in some cases there is a second letter, which indicates a variation in properties or units). Tables bearing the same letter are grouped together, and these groups are arranged in alphabetical order by the identifying letters. The tables within each group are arranged in *numerical* order. In order to facilitate the location of individual tables there are given below: (1) A systematic classification of table numbers by classes of compounds; and (2) an index of letters identifying tables arranged alphabetically by names of properties.

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Systematic Classification Of Table Numbers By Classes Of Compounds

Index Of Letters Identifying Tables Arranged Alphabetically By Names Of Properties

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1a - PARAFFINS, C_1 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[d]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D.	n_D	g/ml	g/ml	°C
Methane	CH_4	-161.49	0.0160	-	-	-	-	-182.48[e]
Ethane	C_2H_6	-88.63	0.0244	-	-			-183.23[e]
Propane	C_3H_8	-42.07	0.0298	-	-	0.5005[c]	0.4928[c]	-187.65[e]
n-Butane	C_4H_{10}	-0.50	0.0347	-	-	0.5788[c]	0.5730[c]	-138.33
2-Methylpropane (Isobutane)	"	-11.73	.0337	-	-	.5572[c]	.5510[c]	-159.60
n-Pentane	C_5H_{12}	36.074	0.0386	1.35748	1.35475	0.62624	0.62139	-129.723
2-Methylbutane (Isopentane)	"	27.854	.0381	1.35373	1.35088	.61967	.61462	-159.890
2,2-Dimethylpropane (Neopentane)	"	9.50	.0365	-	-			-16.6

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated.

[b] For the sodium D line, for which the wave length is taken to be 5892.6 Ångstrom units, which is the intensity-weighted mean of the wave lengths of the D_1 and D_2 lines.

[c] At saturation pressure. [d] For air-saturated hydrocarbon at one atmosphere, unless otherwise indicated. [e] Triple point.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2a (Part 1) - PARAFFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Hexane	C_6H_{14}	68.742	0.0419	1.37486	1.37226	0.65937	0.65482	-95.320
2-Methylpentane	"	60.274	.0414	1.37145	1.36873	.65315	.64852	-153.680
3- "	"	63.284	.0418	1.37652	1.37384	.66433	.65977	
2,2-Dimethylbutane	"	49.743	.0411	1.36876	1.36595	.64917	.64446	-99.73
2,3- "	"	57.990	.0417	1.37495	1.37231	.66164	.65702	-128.41

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — **Washington, D. C.**

TABLE 2a (Part 2) - PARAFFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Heptane	C_7H_{16}	98.428	0.0448	1.38764	1.38517	0.68368	0.67947	-90.595
2-Methylhexane	"	90.05	.0443	1.38490	1.38230	.67865	.67434	-118.270
3- "	"	91.95	.0446	1.38865	1.38615	.6870	.6828	
3-Ethylpentane	"	93.468	.0448	1.39340	1.39085	.69818	.69377	-118.593
2,2-Dimethylpentane	"	79.205	.0439	1.38217	1.37956	.67386	.66956	-123.790
2,3- "	"	89.79	.0448	1.39200	1.38950	.69512	.69089	
2,4- "	"	80.51	.0437	1.38150	1.37888	.67280	.66842	-119.230
3,3- "	"	86.071	.0451	1.39090	1.38842	.69324	.68910	-134.46
2,2,3-Trimethylbutane	"	80.871	.0448	1.38946	1.38686	.69002	.68579	-24.96

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere. See Table 2z (Part 2) for the freezing points of the metastable crystalline forms.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3a - PARAFFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Octane	C_8H_{18}	125.667	0.0474	1.39745	1.39508	0.70260	0.69855	-56.798
2-Methylheptane	"	117.649	.0469	1.39495	1.39258	.69790	.69390	-109.04
3- "	"	118.927	.0471	1.39849	1.39612	.70582	.70176	-120.5
4- "	"	117.712	.0470	1.39792	1.39553	.70463	.70055	-120.955
3-Ethylhexane	"	118.537	.0472	1.40162	1.39919	.71358	.70948	
2,2-Dimethylhexane	"	106.843	.0465	1.39349	1.39104	.69528	.69112	-121.18
2,3- "	"	115.610	.0472	1.40128	1.39880	.71224	.70819	
2,4- "	"	109.432	.0466	1.39534	1.39291	.70036	.69620	
2,5- "	"	109.106	.0465	1.39246	1.39005	.69355	.68935	-91.200
3,3- "	"	111.972	.0474	1.40009	1.39782	.71000	.70596	-126.0
3,4- "	"	117.728	.0475	1.40418	1.40184	.71930	.71522	
2-Methyl-3-ethylpentane	"	115.653	.0475	1.40402	1.40170	.71931	.71521	-114.960
3- " -3- "	"	118.262	.0484	1.40775	1.40550	.72742	.72356	-90.870
2,2,3-Trimethylpentane	"	109.844	.0476	1.40295	1.40064	.71605	.71208	-112.27
2,2,4- "	"	99.237	.0465	1.39145	1.38898	.69193	.68781	-107.365
2,3,3- "	"	114.763	.0483	1.40752	1.40522	.72620	.72231	-100.70
2,3,4- "	"	113.470	.0476	1.40422	1.40195	.71905	.71504	-109.210
2,2,3,3-Tetramethylbutane	"	106.30	.048					+100.69

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

TABLE 4a (Part 1) - PARAFFINS, C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Nonane	C_9H_{20}	150.80	0.0495	1.40549	1.40316	0.71770	0.71384	-53.60
2-Methyloctane	"	143.26	.049	1.4031	1.4008	.7134	.7095	-80.4
3- "	"	144.18	.049	1.4062	1.4039	.7207	.7168	-107.6
4- "	"	142.48	.049	1.4061	1.4038	.7199	.7160	-113.2
3-Ethylheptane	"	143.0	.050	1.4092	1.4069	.727	.723	
4- "	"	141.2	.050	1.4109	1.4086	.730	.726	
2,2-Dimethylheptane	"	130.5	.049	1.402	1.400	.7105	.7066	
2,3- "	"	140.5	.050	1.4085	1.4062	.7260	.7221	
2,4- "	"	133.	.049	1.403	1.401	.716	.712	
2,5- "	"	136.	.049	1.4038	1.4015	.715	.711	
2,6- "	"	135.21	.049	1.4007	1.3983	.7089	.7049	-102.9
3,3- "	"	137.3	.049	1.4085	1.4062	.725	.721	
3,4- "	"	140.5	.050	1.4108	1.4086	.7314	.7275	
3,5- "	"	136.	.049	1.407	1.405	.723	.719	
4,4- "	"	138.	.049	1.408	1.406	.725	.721	

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

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National Bureau of Standards — Washington, D. C.

TABLE 4a (Part 2) - PARAFFINS, C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
2-Methyl-3-ethylhexane	C_9H_{20}	139.	0.050	1.411	1.409	0.731	0.727	
2- " -4- "	"	136.	.049	1.407	1.405	.723	.719	
3- " -3- "	"	143.	.050	1.415	1.413	.741	.737	
3- " -4- "	"	143.	.050	1.416	1.414	.742	.738	
2,2,3-Trimethylhexane	"	133.4	.049	1.4105	1.4082	.7292	.7254	
2,2,4- "	"	126.54	.049	1.4033	1.4010	.7156	.7118	-123.3
2,2,5- "	"	124.09	.049	1.3996	1.3973	.7071	.7031	-105.780
2,3,3- "	"	138.	.049	1.4143	1.4121	.738	.734	
2,3,4- "	"	140.	.050	1.415	1.413	.741	.737	
2,3,5- "	"	131.37	.049	1.4060	1.4036	.7219	.7179	-127.8
2,4,4- "	"	131.	.049	1.4075	1.4052	.725	.721	
3,3,4- "	"	139.	.049	1.4178	1.4156	.745	.741	
3,3-Diethylpentane	"	146.5	.050	1.4200	1.4178	.7524	.7486	-31.
2,2-Dimethyl-3-ethylpentane	"	133.83	.050	1.4123	1.4102	.7348	.7310	-99.2
2,3- " -3- "	"	142.	.050	1.419	1.417	.754	.750	
2,4- " -3- "	"	136.73	.050	1.4137	1.4115	.7379	.7341	
2,2,3,3-Tetramethylpentane	"	140.23	.050	1.4234	1.4212	.7566	.7528	-9.9
2,2,3,4- "	"	133.01	.050	1.4146	1.4125	.7390	.7351	-121.6
2,2,4,4- "	"	122.28	.049	1.4068	1.4045	.7196	.7157	-66.54
2,3,3,4- "	"	141.54	.051	1.4220	1.4199	.7547	.7510	-102.1

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

TABLE 5a - ALKYL BENZENES, C_6 to C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

March 31, 1943; June 30, 1943; June 30, 1945; May 31, 1947

Compound	Formula	Boiling point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Benzene	C_6H_6	80.103	0.0427	1.50110	1.49790	0.87903	0.87368	+5.533
Methylbenzene (Toluene)	C_7H_8	110.623	0.0463	1.49693	1.49413	0.86696	0.86231	-94.991
Ethylbenzene	C_8H_{10}	136.187	0.0490	1.49594	1.49330	0.86702	0.86264	-94.975
1,2-Dimethylbenzene (o-Xylene)	"	144.414	.0497	1.50543	1.50292	.88020	.87596	-25.175
1,3- " (m- ")	"	139.102	.0490	1.49721	1.49464	.86417	.85990	-47.872
1,4- " (p- ")	"	138.348	.0492	1.49581	1.49325	.86105	.85669	+13.263
n-Propylbenzene	C_9H_{12}	159.216	0.0514	1.49202	1.48950	0.86204	0.85780	-99.500
Isopropylbenzene (Cumene)	"	152.393	.0508	1.49146	1.48892	.86179	.85751	-96.028
1-Methyl-2-ethylbenzene	"	165.150	.0516	1,50451	1.50212	.88069	.87657	-80.833
1- " -3- "	"	161.301	.0509	1.49661	1.49408	.86452	.86040	-95.55
1- " -4- "	"	161.985	.0514	1.49497	1.49242	.86118	.85702	-62.350
1,2,3-Trimethylbenzene (Hemimellitene)	"	176.080	.0525	1.51392	1.51147	.89438	.89044	-25.375
1,2,4- " (Pseudocumene)	"	169.347	.0517	1.50485	1.50238	.87582	.87180	-43.80
1,3,5- " (Mesitylene)	"	164.711	.0510	1.49935	1.49684	.86518	.86111	-44.720

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere. See Table 5z for the freezing points of the metastable crystalline forms.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 6a - ALKYL CYCLOPENTANES, C_5 to C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1943; June 30, 1945; February 28, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Cyclopentane	C_5H_{10}	49.262	0.0400	1.40645	1.40363	0.74538	0.74045	-93.30
Methylcyclopentane	C_6H_{12}	71.812	0.0427	1.40970	1.40700	0.74864	0.74394	-142.445
Ethylcyclopentane	C_7H_{14}	103.46	0.0460	1.41976	1.41726	0.76647	0.76217	-138.435
1,1-Dimethylcyclopentane	"	87.84	.0450	1.41357	1.41092	.75448	.74991	-69.73
cis-1,2-Dimethylcyclopentane	"	99.53	.0460	1.42221	1.41965	.77262	.76807	-53.85
trans-1,2- "	"	91.87	.0445	1.41199	1.40939	.75144	.74686	-117.57
cis-1,3- "	"	91.9	.045	1.4111	1.4085	.7488	.7443	
trans-1,3- "	"	90.77	.0451	1.40891	1.40629	.74479	.74025	-133.680

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

TABLE 7a - ALKYL CYCLOHEXANES, C_6 to C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1943; June 30, 1945; March 31, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Cyclohexane	C_6H_{12}	80.738	0.0438	1.42623	1.42354	0.77855	0.77389	+6.554
Methylcyclohexane	C_7H_{14}	100.934	0.0467	1.42312	1.42058	0.76939	0.76506	-126.60
Ethylcyclohexane	C_8H_{16}	131.783	0.0497	1.43304	1.43073	0.78792	0.78390	-111.300
1,1-Dimethylcyclohexane	"	119.543	.0492	1.42895	1.42657	.78094	.77677	-33.54
cis-1,2-Dimethylcyclohexane	"	129.728	.0499	1.43596	1.43360	.79627	.79222	-50.00
trans-1,2- "	"	123.419	.0495	1.42695	1.42470	.77601	.77200	-88.180
cis-1,3-[d] "	"	120.088	.0488	1.42294	1.42063	.76603	.76196	-75.560
trans-1,3-[e] "	"	124.450	.0491	1.43085	1.42843	.78472	.78055	-90.100
cis-1,4- "	"	124.321	.0492	1.42966	1.42731	.78285	.77870	-87.425
trans-1,4- "	"	119.351	.0490	1.42090	1.41853	.76255	.75835	-36.92

[a] For air-saturated hydrocarbon in the liquid state, at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

[d] This isomer, formerly labeled "trans", has the following properties: boiling point at 1 atm., 120.09°C; refractive index, n_D at 25°C, 1.4206; density at 25°C, 0.7620 g/ml.

[e] This isomer, formerly labeled "cis", has the following properties: boiling point at 1 atm., 124.45°C; refractive index, n_D at 25°C, 1.4284; density, at 25°C, 0.7806 g/ml.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8a (Part 1) - MONOOLEFINS, C_2 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

September 30, 1943; June 30, 1945; May 31, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[d]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Ethene (Ethylene)	C_2H_4	-103.71	0.0224	-	-	-	-	-169.15[e]
Propene (Propylene)	C_3H_6	-47.70	0.0289	-	-	0.5139[c]	0.5053[c]	-185.25[e]
1-Butene	C_4H_8	-6.26	0.0337	-	-	0.5951[c]	0.5888[c]	-185.35[e]
cis-2-Butene	"	3.720	.0345	-	-	.6213[c]	.6154[c]	-138.91
trans-2- "	"	0.88	.0345	-	-	.6042[c]	.5984[c]	-105.55
2-Methylpropene (Isobutene)	"	-6.900	.0336	-	-	.5942[c]	.5879[c]	-140.35
1-Pentene	C_5H_{10}	29.97	0.038	1.3714	1.3683	0.6410	0.6359	-165.22
cis-2-Pentene	"	37.1	.038	1.3830	1.3798	.656	.651	-151.370
trans-2- "	"	36.36	.038	1.3793	1.3761	.6482	.6431	-140.235
2-Methyl-1-butene	"	31.10	.038	1.3778	1.3746	.6504	.6451	-137.560
3- " -1- "	"	20.06	.037	1.3643[f]		.6272[g]		-168.500
2- " -2- "	"	38.53	.038	1.3874	1.3842	.6623	.6570	-133.780

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [b] See footnote b of Table 1a.

[c] At saturation pressure. [d] For air-saturated hydrocarbon at one atmosphere, unless otherwise indicated. [e] Triple point.

[f] n_D = 1.3675 at 15°C. [g] Density = 0.6325 g/ml at 15°C.

TABLE 8a (Part 2) - MONOOLEFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
1-Hexene	C_6H_{12}	63.55	0.041	1.3876	1.3848	0.6734	0.6688	-139.
cis-2-Hexene	"	68.6	.041	1.3954	1.3926	.6845	.6799	-141.
trans-2- "	"	67.9	.041	1.3935	1.3907	.6780	.6734	-133.
cis-3- "	"	67.6	.041	1.3934	1.3907	.6796	.6749	-143.
trans-3- "	"	68.1	.041	1.3938	1.3911	.6779	.6732	-113.
2-Methyl-1-pentene	"	62.2	.040	1.3925	1.3897	.6820	.6772	
3- " -1- "	"	53.8	.040	1.384	1.381	.670	.665	
4- " -1- "	"	54.0	.040	1.384	1.381	.665	.660	
2- " -2- "	"	67.2	.041	1.4004	1.3976	.6863	.6815	-135.
cis(?)-3-Methyl-2-pentene	"	70.52	.041	1.4045	1.4018	.6986	.6942	-138.4
trans(?)-3- " -2- "	"	67.8	.041	1.4016	1.3989	.6942	.6898	-135.3
cis(?)-4- " -2- "	"	58.4	.040	1.389	1.386	.672	.667	
trans(?)-4- " -2- "	"	55.	.040	1.388	1.385	.670	.665	
2-Ethyl-1-butene	"	64.95	.041	1.3969	1.3941	.6894	.6847	
2,3-Dimethyl-1-butene	"	55.64	.043	1.3904	1.3874	.6779	.6731	-140.0
3,3- " -1- "	"	41.24	.040	1.3760	1.3730	.6529	.6479	-115.20
2,3- " -2- "	"	73.21	.042	1.4122	1.4094	.7080	.7034	-74.25

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

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National Bureau of Standards — Washington, D. C.

TABLE 9a (Part 1) - MONOOLEFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
1-Heptene	C_7H_{14}	93.3	0.045	1.3994	1.3968	0.6968	0.6925	-119.2
cis-2-Heptene	"	98.5	.044	1.406	1.403	.708	.704	
trans-2- "	"	98.0	.044	1.406	1.403	.704	.700	
cis-3- "	"	95.8	.044	1.404	1.401	.701	.697	
trans-3- "	"							
2-Methyl-1-hexene	"	91.3	.044	1.404	1.401	.700	.696	
3- " -1- "	"	84.	.044	1.397	1.394	.695	.691	
4- " -1- "	"	87.3	.044	1.399	1.396	.697	.693	
5- " -1- "	"	85.65	.044	1.3970	1.3942	.6924	.6880	
2- " -2- "	"	95.0	.044	1.410	1.407	.709	.705	
cis-3-Methyl-2-hexene	"	94.	.044	1.410	1.407	.712	.708	
trans-3- " -2- "	"							
cis-4- " -2- "	"	87.3	.044	1.399	1.396	.701	.697	
trans-4- " -2- "	"	85.4	.044	1.399	1.396	.698	.694	
cis-5- " -2- "	"	91.	.044	1.400	1.397	.700	.696	
trans-5- " -2- "	"	86.	.044	1.400	1.397	.700	.696	
cis-2- " -3- "	"	86.	.044	1.399	1.396	.694	.690	
trans-2- " -3- "	"							
cis-3- " -3- "	"	94.	.044	1.407	1.404	.703	.699	
trans-3- " -3- "	"							

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

[d] For completeness, all isomers are listed. However, when the data are inadequate, approximate values are given for mixtures of the cis and trans forms, as indicated by the braces.

TABLE 9a (Part 2) - MONOOLEFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
2-Ethyl-1-pentene	C_7H_{14}	94.	0.044	1.405	1.402	0.708	0.704	
3- " -1- "	"	85.	.044	1.398	1.395	.699	.695	
2,3-Dimethyl-1-pentene	"	85.	.044	1.403	1.400	.710	.706	
2,4- " -1- "	"	81.	.044	1.397	1.394	.694	.690	
3,3- " -1- "	"	77.	.044	1.399	1.396	.696	.692	
3,4- " -1- "	"	81.	.044	1.399	1.396	.701	.697	
4,4- " -1- "	"	72.2	.044	1.3918	1.3892	.6827	.6785	-136.6
3-Ethyl-2-pentene	"	95.	.044	1.4143	1.4117	.722	.718	
2,3-Dimethyl-2-pentene	"	97.	.044	1.421	1.418	.728	.724	-119.
2,4- " -2- "	"	82.4	.044	1.403	1.400	.6955	.6912	
cis-3,4-Dimethyl-2-pentene	"	87.	.044	1.407	1.404	.713	.709	
trans-3,4- " -2- "	"							
cis-4,4- " -2- "	"	76.	.044	1.399	1.396	.688	.684	
trans-4,4- " -2- "	"							
3-Methyl-2-ethyl-1-butene	"	89.	.044	1.410	1.407	.715	.711	
2,3,3-Trimethyl-1-butene	"	77.87	.045	1.4029	1.4000	.7050	.7005	-111.4

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere. [d] See footnote d of Table 9a (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 10a (Part 1) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
1-Octene	C_8H_{16}	121.27	0.046	1.4088	1.4063	0.7160	0.7118	-102.4
cis-2-Octene	"	125.6	.046	1.4150	1.4125	.7243	.7201	-100.
trans-2- "	"	125.0	.046	1.4132	1.4107	.7199	.7157	-87.7
cis-3- "	"	122.9	.046	1.4135	1.4111	.721	.717	
trans-3- "	"	123.3	.046	1.4126	1.4102	.7152	.7110	-110.
cis-4- "	"	122.8	.046	1.4144	1.4120	.7225	.7183	-120.
trans-4- "	"	122.4	.046	1.4118	1.4093	.7141	.7099	-93.7
2-Methyl-1-heptene	"	119.3	.046	1.4123	1.4098	.7205	.7164	-90.
3- " -1- "	"	111.	.045	1.406	1.404	.711	.707	
4- " -1- "	"	112.8	.045	1.410	1.408	.717	.713	
5- " -1- "	"	113.3	.045	1.4094	1.4069	.7164	.7122	
6- " -1- "	"	113.2	.045	1.4070	1.4045	.7120	.7079	
2- " -2- "	"	122.	.046	1.4170	1.4145	.7245	.7204	

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

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TABLE 10a (Part 2) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
cis-3-Methyl-2-heptene	C_8H_{16}	122.	0.046	1.419	1.417	0.729	0.725	
trans-3- " -2- "	"							
cis-4- " -2- "	"	114.	.045	1.410	1.408	.716	.712	
trans-4- " -2- "	"							
cis-5- " -2- "	"	118.	.046	1.414	1.412	.723	.719	
trans-5- " -2- "	"							
cis-6- " -2- "	"	117.	.046	1.412	1.410	.718	.714	
trans-6- " -2- "	"							
cis-2- " -3- "	"	112.	.045	1.407	1.405	.706	.702	
trans-2- " -3- "	"							
cis-3- " -3- "	"	121.	.046	1.418	1.416	.728	.724	
trans-3- " -3- "	"							
cis-4- " -3- "	"	122.	.046	1.417	1.415	.725	.721	
trans-4- " -3- "	"							
cis-5- " -3- "	"	112.	.045	1.410	1.408	.713	.709	
trans-5- " -3- "	"							
cis-6- " -3- "	"	115.	.045	1.410	1.408	.713	.709	
trans-6- " -3- "	"							

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

[d] See footnote d of Table 9a (Part 1).

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TABLE 10a (Part 3) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
2-Ethyl-1-hexene	C_8H_{16}	120.	0.046	1.4157	1.4132	0.7270	0.7228	
3- " -1- "	"	110.3	.046	1.407	1.405	.715	.711	
4- " -1- "	"	113.	.046	1.412	1.410	.726	.722	
2,3-Dimethyl-1-hexene	"	111.	.046	1.414	1.412	.725	.721	
2,4- " -1- "	"	111.2	.046	1.411	1.409	.720	.716	
2,5- " -1- "	"	111.6	.046	1.4105	1.4080	.7172	.7129	
3,3- " -1- "	"	104.	.046	1.4070	1.4046	.7140	.7099	
3,4- " -1- "	"	112.	.046	1.413	1.411	.724	.720	
3,5- " -1- "	"	104.	.045	1.404	1.402	.708	.704	
4,4- " -1- "	"	107.2	.046	1.4102	1.4078	.7198	.7157	
4,5- " -1- "	"	109.	.046	1.414	1.412	.728	.724	
5,5- " -1- "	"	101.8	.046	1.405	1.403	.709	.705	
cis-3-Ethyl-2-hexene	"	121.	.046	1.424	1.422	.737	.733	
trans-3- " -2- "	"							
cis-4- " -2- "	"	113.	.046	1.412	1.410	.725	.721	
trans-4- " -2- "	"							
2,3-Dimethyl-2-hexene	"	122.1	.046	1.4260	1.4236	.7398	.7356	-118.
2,4- " -2- "	"	110.	.045	1.411	1.409	.725	.721	
2,5- " -2- "	"	112.2	.045	1.4140	1.4115	.720	.716	

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere. [d] See footnote d of Table 9a (Part 1).

TABLE 10a (Part 4) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
cis-3,4-Dimethyl-2-hexene	C_8H_{16}	116.	0.046	1.418	1.416	0.737	0.733	
trans-3,4- " -2- "	"							
cis-3,5- " -2- "	"	112.	.045	1.416	1.414	.725	.721	
trans-3,5- " -2- "	"							
cis-4,4- " -2- "	"	106.	.046	1.413	1.411	.722	.718	
trans-4,4- " -2- "	"							
cis-4,5- " -2- "	"	110.	.046	1.413	1.411	.725	.721	
trans-4,5- " -2- "	"							
cis-5,5- " -2- "	"	107.	.045	1.410	1.408	.716	.712	
trans-5,5- " -2- "	"							
3-Ethyl-3-hexene	"	116.	.046	1.418	1.416	.729	.725	
cis-2,2-Dimethyl-3-hexene	"	105.7	.045	1.4099	1.4074	.7186	.7144	
trans-2,2- " -3- "	"							
cis-2,3- " -3- "	"	114.	.046	1.416	1.414	.728	.724	
trans-2,3- " -3- "	"							
cis-2,4- " -3- "	"	108.	.045	1.409	1.407	.714	.710	
trans-2,4- " -3- "	"							
cis-2,5- " -3- "	"	102.	.045	1.403	1.401	.710	.706	
trans-2,5- " -3- "	"							
cis-3,4- " -3- "	"	122.	.046	1.430	1.428	.747	.743	
trans-3,4- " -3- "	"							

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

[d] See footnote d of Table 9a (Part 1).

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TABLE 10a (Part 5) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
2-n-Propyl-1-pentene	C_8H_{16}	117.7	0.046	1.4136	1.4111	0.7240	0.7198	
2-Isopropyl-1- "	"	113.	.046	1.414	1.412	.725	.721	
3-Methyl-2-ethyl-1-pentene	"	112.5	.046	1.4142	1.4118	.729	.725	
4- " -2- " -1- "	"	110.3	.046	1.4105	1.4080	.7195	.7152	
2- " -3- " -1- "	"	110.	.046	1.415	1.413	.730	.726	
3- " -3- " -1- "	"	112.	.047	1.418	1.416	.7305	.7264	
4- " -3- " -1- "	"	107.	.046	1.410	1.408	.726	.722	
2,3,3-Trimethyl-1-pentene	"	108.	.047	1.418	1.416	.737	.733	-69.
2,3,4- " -1- "	"	108.	.046	1.415	1.413	.729	.725	
2,4,4- " -1- "	"	101.44	.046	1.4086	1.4060	.7150	.7108	-93.5
3,3,4- " -1- "	"	105.	.047	1.414	1.412	.729	.725	
3,4,4- " -1- "	"	104.	.046	1.412	1.410	.719	.715	
2-Methyl-3-ethyl-2-pentene	"	117.	.046	1.425	1.423	.739	.735	
cis-4-Methyl-3-ethyl-2-pentene	"	114.	.046	1.420	1.418	.738	.734	
trans-4- " -3- " -2- "	"							
2,3,4-Trimethyl-2-pentene	"	116.26	.046	1.4275	1.4249	.7434	.7391	
2,4,4- " -2- "	"	104.91	.047	1.4160	1.4135	.7212	.7170	-106.4
cis-3,4,4-Trimethyl-2-pentene	"	112.	.046	1.423	1.421	.739	.735	
trans-3,4,4- " -2- "	"							
3-Methyl-2-isopropyl-1-butene	"	104.	.046	1.409	1.407	.722	.718	
3,3-Dimethyl-2-ethyl-1-butene	"	110.	.046	1.416	1.414	.728	.724	

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 11a (Part 1) - DIOLEFINS, C_3 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[d]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Propadiene (Allene)	C_3H_4	-34.5	0.030	-	-			-136.
1,2-Butadiene	C_4H_6	10.3	0.035	-	-	0.652[c]	0.646[c]	-136.3
1,3- "	"	-4.41	.034	-	-	.6211[c]	.6149[c]	-108.915
1,2-Pentadiene	C_5H_8	44.9	0.040	1.421	1.418	0.692	0.687	
cis-1,3-Pentadiene (cis-Piperylene)	"	44.2	.040	1.4359	1.4326	.6905	.6855	
trans-1,3- " (trans- ")	"	42.3	.039	1.4299	1.4266	.6764	.6714	
1,4-Pentadiene	"	26.05	.038	1.388	1.385	.660	.655	-148.
2,3- "	"	40.	.039	1.39	1.39	.66	.66	
3-Methyl-1,2-butadiene	"	40.	.039	1.410	1.407	.680	.675	
2- " -1,3- " (Isoprene)	"	34.08	.038	1.4216	1.4180	.6808	.6756	-146.0

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [b] See footnote b of Table 1a.

[c] At saturation pressure. [d] For air-saturated hydrocarbon at one atmosphere.

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National Bureau of Standards — Washington, D. C.

TABLE 11a (Part 2) - DIOLEFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
1,2-Hexadiene	C_6H_{10}	78.	0.044	1.428	1.425	0.717	0.712	
cis-1,3-Hexadiene	"	73.	.043	1.438	1.435	.705	.700	
trans-1,3- "	"							
cis-1,4- "	"	65.0	.042	1.410	1.407	.695	.690	
trans-1,4- "	"							
1,5-Hexadiene	"	59.6	.042	1.4042	1.4010	.6914	.6869	-141.
2,3- "	"	68.0	.043	1.395	1.392	.680	.675	
cis,cis-2,4-Hexadiene	"	80.	.044	1.450	1.447	.720	.715	
cis,trans-2,4- "	"							
trans,trans-2,4- "	"							
3-Methyl-1,2-pentadiene	"	70.	.043	1.425	1.422	.715	.710	
4- " -1,2- "	"	70.	.043	1.424	1.421	.708	.703	
cis-2-Methyl-1,3-pentadiene	"	76.	.044	1.446	1.443	.719	.714	
trans-2- " -1,3- "	"							
cis-3- " -1,3- "	"	77.	.044	1.452	1.449	.735	.730	
trans-3- " -1,3- "	"							
4-Methyl-1,3-pentadiene	"	76.3	.044	1.451	1.448	.719	.714	
2- " -1,4- "	"	56.	.041	1.405	1.402	.694	.689	
3- " -1,4- "	"	55.	.041	1.405	1.402	.695	.690	
2- " -2,3- "	"	72.	.043	1.425	1.422	.711	.706	
2-Ethyl-1,3-butadiene	"	75.	.044	1.445	1.442	.730	.725	
2,3-Dimethyl-1,3-butadiene	"	68.5	.043	1.4391	1.4359	.7263	.7218	-76.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

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TABLE 12a - ACETYLENES, C_2 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Ethyne (Acetylene)	C_2H_2	-84.[e]	0.018	-	-	-	-	-81.
Propyne (Methylacetylene)	C_3H_4	-23.2	0.030	-	-	-	-	-102.7
1-Butyne (Ethylacetylene)	C_4H_6	8.7	0.036	-	-	0.65[d]	0.65[d]	-125.8
2- " (Dimethylacetylene).	"	26.99	.037	1.392	1.389	.693	.688	-32.23
1-Pentyne	C_5H_8	40.2	0.039	1.385	1.382	0.691	0.686	-106.0
2- "	"	56.07	.041	1.4039	1.4009	.7107	.7055	-109.3
3-Methyl-1-butyne	"	28.	.038	1.378	1.375	.665	.660	

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere. [d] At saturation pressure. [e] Sublimation point.

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TABLE 13a - STYRENES, C_8 and C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

September 30, 1943; June 30, 1945; May 31, 1947

Compound[d]	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
Styrene (Vinylbenzene; Phenylethylene).	C_8H_8	145.2	0.049	1.5469	1.5441	0.90600	0.90122	-30.628
α-Methylstyrene (Isopropenylbenzene; 2-Phenyl-1-propene).	C_9H_{10}	165.38	.052	1.5386	1.5358	.9106	.9062	-23.21
cis-β-Methylstyrene (cis-Propenylbenzene; cis-1-Phenyl-1-propene). . . .	"	170.	.051	1.545	1.542	.911	.907	
trans-β-Methylstyrene (trans-Propenylbenzene; trans-1-Phenyl-1-propene). . .	"							

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

[d] See footnote d of Table 9a (Part 1).

TABLE 14a - ALKYL BENZENES, C_{10}

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

January 31, 1946; May 31, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Butylbenzene (1-Phenylbutane)	$C_{10}H_{14}$	183.267	0.0534	1.48976	1.48739	0.86013	0.85607	-87.970
Isobutylbenzene (1-Phenyl-2-methylpropane)	"	172.755	.0531	1.48645	1.48399	.85321	.84907	-51.48
sec-Butylbenzene (2-Phenylbutane)	"	173.299	.0532	1.49019	1.48778	.86207	.85797	-75.470
tert- " (2-Phenyl-2-methylpropane)	"	169.113	.0527	1.49264	1.49020	.86650	.86240	-57.850
1-Methyl-2-propylbenzene	"	184.	.054	1.4993	1.4970	.8736	.8696	
1- " -3- "	"	182.	.054	1.4951	1.4928	.8623	.8583	
1- " -4- "	"	183.45	.054	1.493	1.491	.859	.855	-63.
1-Methyl-2-isopropylbenzene (o-Cymene)	"	178.3	.053	1.5006	1.4982	.8766	.8725	-71.6
1- " -3- " (m- ")	"	175.2	.053	1.4930	1.4906	.8610	.8569	-63.8
1- " -4- " (p- ")	"	177.10	.053	1.4909	1.4885	.8573	.8532	-68.0
1,2-Diethylbenzene	"	183.48	.054	1.5031	1.5008	.8805	.8765	-31.4
1,3- "	"	181.13	.054	1.4953	1.4929	.8641	.8601	-83.920
1,4- "	"	183.78	.054	1.4949	1.4926	.8619	.8579	-43.2
1,2-Dimethyl-3-ethylbenzene	"	193.91	.0554	1.5117	1.5095	.8921	.8881	-49.5
1,2- " -4- "	"	189.75	.0563	1.5031	1.5009	.8745	.8706	-67.0
1,3- " -2- "	"	190.01	.0561	1.5107	1.5085	.8904	.8864	-16.3
1,3- " -4- "	"	188.41	.0555	1.5038	1.5016	.8763	.8723	-63.0
1,3- " -5- "	"	183.75	.0542	1.4981	1.4958	.8648	.8608	-84.2
1,4- " -2- "	"	186.91	.0533	1.5043	1.5020	.8772	.8732	-53.7
1,2,3,4-Tetramethylbenzene (Prehnitene)	"	205.04	.056	1.5201	1.5181	.9053	.9015	-6.25
1,2,3,5- " (Isodurene)	"	197.93	.056	1.5125	1.5104	.8899	.8860	-24.
1,2,4,5- " (Durene)	"	196.	.056	1.512	1.510	.889	.885	+79.3

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 15a - ALKYL CYCLOPENTANES, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

February 28, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[a,b]		Density[a]		Freezing Point[c]
		760 mm Hg	760 mm Hg	20°C	25°C	20°C	25°C	In air at 1 atm
		°C	deg C/mm Hg	n_D	n_D	g/ml	g/ml	°C
n-Propylcyclopentane	C_8H_{16}	130.937	0.0489	1.42627	1.42393	0.77625	0.77223	-117.340
Isopropylcyclopentane	"	126.415	.0491	1.42586	1.42355	.77656	.77257	-111.375
1-Methyl-1-ethylcyclopentane	"	121.51	.0486	1.42717	1.42474	.78093	.77670	-143.800
cis-1-Methyl-2-ethylcyclopentane	"	128.0	.049	1.4295	1.4271	.7851	.7810	-105.95
trans-1-Methyl-2-ethylcyclopentane	"	121.2	.049	1.4219	1.4195	.7690	.7649	
cis-1-Methyl-3-ethylcyclopentane	"	120.2	.049	1.420	1.418	.772	.768	
trans-1-Methyl-3-ethylcyclopentane	"	120.8	.049	1.4186	1.4162	.7619	.7577	-108.
1,1,2-Trimethylcyclopentane	"	113.72	.0482	1.42296	1.42050	.77252	.76817	-21.64
1,1,3-Trimethylcyclopentane	"	104.89	.0471	1.41115	1.40866	.74825	.74392	-142.44
cis,cis,cis-1,2,3-Trimethylcyclopentane	"	123.0	.049	1.4263	1.4238	.7792	.7751	-116.
cis,cis,trans-1,2,3-Trimethylcyclopentane	"	117.7	.048	1.4219	1.4194	.7704	.7661	-112.
cis,trans,cis-1,2,3-Trimethylcyclopentane	"	110.4	.048	1.4144	1.4119	.7535	.7492	-112.
cis,cis,cis-1,2,4-Trimethylcyclopentane	"	118.	.048	1.422	1.420	.766	.762	
cis,cis,trans-1,2,4-Trimethylcyclopentane	"	116.73	.0483	1.41854	1.41610	.76345	.75920	-132.55
cis,trans,cis-1,2,4-Trimethylcyclopentane	"	109.28	.0473	1.41057	1.40810	.74727	.74302	-130.78

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] See footnote b of Table 1a.

[c] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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National Bureau of Standards — Washington D. C.

TABLE 1a-E - PARAFFINS, C_1 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945 .

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[f]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Methane	CH_4	-258.68	0.732	-	-	-	-	-	-	-	-	-	-296.46[g]
Ethane	C_2H_6	-127.53	1.116	-	-								-297.81[g]
Propane	C_3H_8	-43.73	1.362	-	-	31.66[e]	31.24[e]	30.76[e]	4.233[e]	4.177[e]	4.113[e]	0.5077[e]	-305.77[g]
n-Butane	C_4H_{10}	31.10	1.586	-	-	36.45[e]	36.13[e]	35.77[e]	4.872[e]	4.830[e]	4.782[e]	0.5844[e]	-216.99
2-Methylpropane (Isobutane)	"	10.89	1.541	-	-	35.12[e]	34.78[e]	34.40[e]	4.695[e]	4.650[e]	4.598[e]	.5631[e]	-255.28
n-Pentane	C_5H_{12}	96.93	1.765	1.35748	1.35475	39.363	39.094	38.791	5.2621	5.2261	5.1856	0.63116	-201.50
2-Methylbutane (Isopentane)	"	82.14	1.742	1.35373	1.35088	38.964	38.684	38.369	5.2088	5.1713	5.1291	.62476	-255.80
2,2-Dimethylpropane (Neopentane)	"	49.10	1.669	-	-								+2.1

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated.

[c] For the sodium D line, for which the wave length is taken to be 5892.6 Ångstrom units, which is the intensity-weighted mean of the wave lengths of of the D_1 and D_2 lines.

[d] The density of water at 60°F (15.556°C) is taken as 0.99904 g/ml.

[e] At saturation pressure.

[f] For air-saturated hydrocarbon at one atmosphere, unless otherwise indicated.

[g] Triple point.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2a-E (Part 1) - PARAFFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n-Hexane	C_6H_{14}	155.74	1.916	1.37486	1.37226	41.414	41.162	40.878	5.5363	5.5026	5.4646	0.66405	-139.58
2-Methylpentane	"	140.49	1.893	1.37145	1.36873	41.031	40.774	40.485	5.4851	5.4507	5.4120	.65790	-244.62
3- "	"	145.91	1.911	1.37652	1.37384	41.725	41.472	41.187	5.5778	5.5440	5.5059	.66902	
2,2-Dimethylbutane	"	121.54	1.879	1.36876	1.36595	40.787	40.525	40.231	5.4524	5.4175	5.3782	.65399	-147.51
2,3- "	"	136.38	1.907	1.37495	1.37231	41.560	41.304	41.016	5.5558	5.5215	5.4830	.66639	-199.14

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E.

[e] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 2a-E (Part 2) - PARAFFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n- Heptane	C_7H_{16}	209.17	2.048	1.38764	1.38517	42.913	42.680	42.417	5.7367	5.7055	5.6703	0.68808	-131.07
2-Methylhexane	"	194.09	2.025	1.38490	1.38230	42.605	42.366	42.097	5.6954	5.6635	5.6275	.68314	-180.89
3- "	"	197.51	2.039	1.38865	1.38615	43.12	42.89	42.62	5.764	5.733	5.698	.6914	
3-Ethylpentane	"	200.24	2.048	1.39340	1.39085	43.830	43.585	43.310	5.8592	5.8265	5.7897	.70277	-181.47
2,2-Dimethylpentane	"	174.57	2.007	1.38217	1.37956	42.305	42.067	41.798	5.6554	5.6235	5.5876	.67833	-190.82
2,3- "	"	193.62	2.048	1.39200	1.38950	43.629	43.394	43.130	5.8323	5.8009	5.7656	.69955	
2,4- "	"	176.92	1.998	1.38150	1.37888	42.243	42.001	41.727	5.6471	5.6147	5.5781	.67734	-182.61
3,3- "	"	186.93	2.062	1.39090	1.38842	43.506	43.277	43.018	5.8160	5.7852	5.7507	.69759	-210.03
2,2,3-Trimethylbutane	"	177.57	2.048	1.38946	1.38686	43.310	43.076	42.812	5.7897	5.7584	5.7231	.69445	-12.93

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E. [d] See footnote d of Table 1a-E.

[e] For air-saturated hydrocarbon at one atmosphere. See Table 2z (Part 2) for the freezing points of the metastable crystalline forms.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3a-E - PARAFFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n-Octane	C_8H_{18}	258.20	2.167	1.39745	1.39508	44.086	43.861	43.608	5.8934	5.8634	5.8296	0.70688	-70.24
2-Methylheptane	"	243.77	2.144	1.39495	1.39258	43.790	43.568	43.318	5.8538	5.8241	5.7907	.70213	-164.27
3- "	"	246.07	2.153	1.39849	1.39612	44.287	44.062	43.808	5.9203	5.8902	5.8563	.71011	-184.9
4- "	"	243.88	2.149	1.39792	1.39553	44.214	43.988	43.733	5.9106	5.8803	5.8462	.70894	-185.72
3-Ethylhexane	"	245.37	2.158	1.40162	1.39919	44.774	44.546	44.290	5.9854	5.9550	5.9208	.71791	
2,2-Dimethylhexane	"	224.32	2.126	1.39349	1.39104	43.635	43.404	43.144	5.8331	5.8023	5.7675	.69965	-186.12
2,3- "	"	240.10	2.158	1.40128	1.39880	44.687	44.463	44.210	5.9738	5.9438	5.9100	.71653	
2,4- "	"	228.98	2.131	1.39534	1.39291	43.952	43.721	43.461	5.8755	5.8447	5.8099	.70474	
2,5- "	"	228.39	2.126	1.39246	1.39005	43.529	43.296	43.034	5.8190	5.7878	5.7528	.69795	-132.16
3,3- "	"	233.55	2.167	1.40009	1.39782	44.547	44.323	44.071	5.9551	5.9251	5.8914	.71428	-194.8
3,4- "	"	243.91	2.172	1.40418	1.40184	45.130	44.903	44.649	6.0330	6.0027	5.9687	.72362	
2-Methyl-3-ethylpentane	"	240.18	2.172	1.40402	1.40170	45.131	44.904	44.648	6.0332	6.0028	5.9686	.72364	-174.93
3- " -3- "	"	244.87	2.213	1.40775	1.40550	45.624	45.410	45.169	6.0991	6.0705	6.0383	.73155	-131.57
2,2,3-Trimethylpentane	"	229.72	2.176	1.40295	1.40064	44.921	44.701	44.453	6.0051	5.9756	5.9425	.72027	-170.09
2,2,4- "	"	210.63	2.126	1.39145	1.38898	43.423	43.195	42.938	5.8049	5.7743	5.7399	.69626	-161.26
2,3,3- "	"	238.57	2.208	1.40752	1.40522	45.550	45.334	45.091	6.0892	6.0603	6.0278	.73036	-149.26
2,3,4- "	"	236.25	2.176	1.40422	1.40195	45.110	44.888	44.638	6.0303	6.0006	5.9672	.72330	-164.58
2,2,3,3-Tetramethylbutane	"	223.34	2.17										+213.24

[a] 1 atmosphere = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 4a-E (Part 1) - PARAFFINS, C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n-Nonane	C_9H_{20}	303.44	2.26	1.40549	1.40316	45.018	44.804	44.563	6.0180	5.9894	5.9572	0.72182	-64.48
2-Methyloctane	"	289.87	2.24	1.4031	1.4008	44.75	44.54	44.29	5.983	5.953	5.921	.7176	-112.7
3- "	"	291.52	2.24	1.4062	1.4039	45.21	44.99	44.75	6.044	6.014	5.982	.7249	-161.7
4- "	"	288.46	2.24	1.4061	1.4038	45.16	44.94	44.70	6.037	6.008	5.975	.7241	-171.8
3-Ethylheptane	"	289.4	2.29	1.4092	1.4069	45.6	45.4	45.1	6.10	6.07	6.03	.731	
4- "	"	286.2	2.29	1.4109	1.4086	45.8	45.6	45.3	6.12	6.09	6.06	.734	
2,2-Dimethylheptane	"	266.9	2.24	1.402	1.400	44.57	44.35	44.11	5.958	5.929	5.897	.7147	
2,3- "	"	284.9	2.29	1.4085	1.4062	45.54	45.32	45.08	6.088	6.059	6.026	.7302	
2,4- "	"	271.	2.24	1.403	1.401	44.9	44.7	44.4	6.01	5.98	5.94	.720	
2,5- "	"	277.	2.24	1.4038	1.4015	44.9	44.6	44.4	6.00	5.97	5.93	.719	
2,6- "	"	275.38	2.24	1.4007	1.3983	44.48	44.25	44.00	5.946	5.916	5.883	.7131	-153.2
3,3- "	"	279.1	2.24	1.4085	1.4062	45.5	45.3	45.0	6.08	6.05	6.02	.729	
3,4- "	"	284.9	2.29	1.4108	1.4086	45.88	45.66	45.42	6.133	6.104	6.071	.7356	
3,5- "	"	277.	2.24	1.407	1.405	45.4	45.1	44.9	6.06	6.03	6.00	.727	
4,4- "	"	280.	2.24	1.408	1.406	45.5	45.3	45.0	6.08	6.05	6.02	.729	

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 4a-E (Part 2) - Paraffins, C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point 29.921 in.Hg[a]	dt/dp 29.921 in.Hg[a]	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
				68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
2-Methyl-3-ethylhexane	C_9H_{20}	282.	2.29	1.411	1.409	45.9	45.6	45.4	6.13	6.10	6.07	0.735	
2- " -4- "	"	277.	2.24	1.407	1.405	45.4	45.1	44.9	6.06	6.03	6.00	.727	
3- " -3- "	"	289.	2.29	1.415	1.413	46.5	46.3	46.0	6.21	6.18	6.15	.745	
3- " -4- "	"	289.	2.29	1.416	1.414	46.5	46.3	46.1	6.22	6.19	6.16	.746	
2,2,3-Trimethylhexane	"	272.1	2.24	1.4105	1.4082	45.73	45.52	45.28	6.114	6.085	6.054	.7333	
2,2,4- "	"	259.77	2.24	1.4033	1.4010	44.88	44.67	44.44	6.000	5.972	5.940	.7197	-189.9
2,2,5- "	"	255.36	2.24	1.3996	1.3973	44.37	44.14	43.89	5.931	5.901	5.868	.7114	-158.40
2,3,3- "	"	280.	2.24	1.4143	1.4121	46.3	46.1	45.8	6.19	6.16	6.13	.742	
2,3,4- "	"	284.	2.29	1.415	1.413	46.5	46.3	46.0	6.21	6.18	6.15	.745	
2,3,5- "	"	268.47	2.24	1.4060	1.4036	45.29	45.07	44.82	6.054	6.024	5.991	.7262	-198.0
2,4,4- "	"	268.	2.24	1.4075	1.4052	45.5	45.3	45.0	6.08	6.05	6.02	.729	
3,3,4- "	"	282.	2.24	1.4178	1.4156	46.7	46.5	46.3	6.25	6.22	6.18	.749	
3,3-Diethylpentane	"	295.7	2.29	1.4200	1.4178	47.18	46.97	46.73	6.307	6.279	6.247	.7565	-24.
2,2-Dimethyl-3-ethylpentane	"	272.89	2.29	1.4123	1.4102	46.08	45.87	45.63	6.160	6.132	6.100	.7389	-146.6
2,3- " -3- "	"	288.	2.29	1.419	1.417	47.3	47.1	46.8	6.32	6.29	6.26	.758	
2,4- " -3- "	"	278.11	2.29	1.4137	1.4115	46.28	46.06	45.83	6.186	6.158	6.126	.7420	
2,2,3,3-Tetramethylpentane	"	284.41	2.29	1.4234	1.4212	47.44	47.23	46.99	6.342	6.314	6.282	.7607	+14.2
2,2,3,4- "	"	271.42	2.29	1.4146	1.4125	46.35	46.13	45.89	6.196	6.167	6.135	.7432	-186.9
2,2,4,4- "	"	252.10	2.24	1.4068	1.4045	45.14	44.92	44.68	6.034	6.005	5.973	.7238	-87.77
2,3,3,4- "	"	286.77	2.33	1.4220	1.4199	47.32	47.11	46.88	6.326	6.298	6.267	.7587	-151.8

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5a-E - ALKYL BENZENES, C_6 to C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945; May 31, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b]	Freezing Point[d]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in. Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Benzene	C_6H_6	176.19	1.952	1.50110	1.49790	55.172	54.875	54.541	7.3754	7.3357	7.2911	0.88464	+41.96
Methylbenzene (Toluene)	C_7H_8	231.12	2.117	1.49693	1.49413	54.379	54.121	53.831	7.2694	7.2350	7.1962	.87193	-138.98
Ethylbenzene	C_8H_{10}	277.14	2.240	1.49594	1.49330	54.368	54.125	53.852	7.2679	7.2355	7.1989	.87175	-138.96
1,2-Dimethylbenzene (o-Xylene)	"	291.95	2.272	1.50543	1.50292	55.183	54.948	54.683	7.3769	7.3455	7.3101	.88482	-13.32
1,3- " (m- ")	"	282.38	2.240	1.49721	1.49464	54.184	53.947	53.681	7.2434	7.2117	7.1761	.86880	-54.17
1,4- " (p- ")	"	281.03	2.249	1.49581	1.49325	53.995	53.752	53.480	7.2180	7.1857	7.1493	.86576	+55.87
n-Propylbenzene	C_9H_{12}	318.59	2.350	1.49202	1.48950	54.050	53.814	53.550	7.2254	7.1939	7.1585	.86664	-147.10
Isopropylbenzene (Cumene)	"	306.31	2.323	1.49146	1.48892	54.036	53.799	53.531	7.2235	7.1918	7.1561	.86642	-140.85
1-Methyl-2-ethylbenzene	"	329.27	2.359	1.50451	1.50212	55.207	54.978	54.721	7.3801	7.3496	7.3152	.88520	-113.50
1- " -3- "	"	322.34	2.327	1.49661	1.49408	54.198	53.969	53.712	7.2452	7.2146	7.1802	.86901	-139.99
1- " -4- "	"	323.57	2.350	1.49497	1.49242	53.992	53.760	53.501	7.2176	7.1867	7.1520	.86571	-80.23
1,2,3-Trimethylbenzene (Hemimellitene)	"	348.94	2.400	1.51392	1.51147	56.052	55.833	55.587	7.4930	7.4638	7.4309	.89874	-13.68
1,2,4- " (Pseudocumene)	"	336.82	2.364	1.50485	1.50238	54.897	54.674	54.424	7.3387	7.3089	7.2754	.88023	-46.84
1,3,5- " (Mesitylene)	"	328.48	2.332	1.49935	1.49684	54.236	54.010	53.756	7.2503	7.2201	7.1862	.86963	-48.50

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[c] See footnote c of Table 1a-E.

[d] For air-saturated hydrocarbon at one atmosphere. See Table 5z for the freezing points of the metastable crystalline forms.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 6a-E - ALKYL CYCLOPENTANES, C_5 to C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30,1945; February 28, 1947

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Cyclopentane	C_5H_{10}	120.67	1.829	1.40645	1.40363	46.805	46.532	46.224	6.2569	6.2204	6.1792	0.75048	-136.84
Methylcyclopentane	C_6H_{12}	161.26	1.952	1.40970	1.40700	46.996	46.735	46.442	6.2825	6.2476	6.2083	0.75354	-224.40
Ethylcyclopentane	C_7H_{14}	218.23	2.103	1.41976	1.41726	48.087	47.848	47.580	6.4282	6.3963	6.3604	0.77103	-217.18
1,1-Dimethylcyclopentane	"	190.11	2.057	1.41357	1.41092	47.353	47.100	46.814	6.3301	6.2962	6.2581	.75927	-93.51
cis-1,2-Dimethylcyclopentane	"	211.15	2.103	1.42221	1.41965	48.484	48.232	47.948	6.4813	6.4476	6.4096	.77741	-64.93
trans-1,2- "	"	197.37	2.035	1.41199	1.40939	47.164	46.910	46.624	6.3048	6.2709	6.2326	.75624	-179.63
cis-1,3- "	"	197.4	2.06	1.4111	1.4085	47.00	46.74	46.46	6.282	6.249	6.211	.7535	
trans-1,3- "	"	195.39	2.062	1.40891	1.40629	46.747	46.495	46.211	6.2491	6.2154	6.1775	.74955	-208.62

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 7a-E - ALKYL CYCLOHEXANES, C_6 to C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945; March 31, 1947

Compound	Formula	Boiling Point 29.921 in.Hg[a]	dt/dp 29.921 in.Hg[a]	Refractive Index[b,c] 68°F	77°F	Density[b] 60°F	68°F	77°F	60°F	68°F	77°F	Specific Gravity[b,d] 60°F/60°F	Freezing Point[e] In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Cyclohexane	C_6H_{12}	177.33	2.003	1.42623	1.42354	48.861	48.602	48.311	6.5317	6.4972	6.4583	0.78344	+43.80
Methylcyclohexane	C_7H_{14}	213.68	2.135	1.42312	1.42058	48.271	48.030	47.760	6.4529	6.4207	6.3846	0.77398	-195.88
Ethylcyclohexane	C_8H_{16}	269.21	2.272	1.43304	1.43073	49.410	49.187	48.936	6.6052	6.5754	6.5418	0.79225	-168.34
1,1-Dimethylcyclohexane	"	247.18	2.249	1.42895	1.42657	48.983	48.751	48.491	6.5481	6.5171	6.4823	.78540	-28.37
cis-1,2-Dimethylcyclohexane	"	265.51	2.281	1.43596	1.43360	49.933	49.708	49.456	6.6751	6.6451	6.6113	.80064	-58.00
trans-1,2- "	"	254.15	2.263	1.42695	1.42470	48.666	48.444	48.193	6.5057	6.4760	6.4425	.78032	-126.72
cis-1,3-[f] "	"	248.16	2.231	1.42294	1.42063	48.047	47.821	47.567	6.4229	6.3927	6.3587	.77039	-104.01
trans-1,3-[g] "	"	256.01	2.245	1.43085	1.42843	49.219	48.987	48.727	6.5796	6.5487	6.5139	.78919	-130.18
cis-1,4- "	"	255.78	2.249	1.42966	1.42731	49.101	48.871	48.612	6.5639	6.5331	6.4984	.78730	-125.36
trans-1,4- "	"	246.83	2.240	1.42090	1.41853	47.836	47.603	47.341	6.3948	6.3637	6.3286	.76702	-34.46

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] Formerly labeled "trans": see footnote d of Table 7a.

[g] Formerly labeled "cis": see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8a-E (Part 1) - MONOOLEFINS, C_2 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945; May 31, 1947

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[f]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Ethene (Ethylene)	C_2H_4	-154.68	1.024	-	-	-	-	-	-	-	-	-	-272.47[g]
Propene (Propylene)	C_3H_6	-53.86	1.321	-	-	32.54[e]	32.08[e]	31.54[e]	4.350[e]	4.289[e]	4.217[e]	0.5218[e]	-301.45[g]
1-Butene	C_4H_8	20.73	1.541	-	-	37.49[e]	37.15[e]	36.76[e]	5.011[e]	4.966[e]	4.914[e]	0.6011[e]	-301.63[g]
cis-2-Butene	"	38.70	1.577	-	-	39.12[e]	38.79[e]	38.42[e]	5.229[e]	5.185[e]	5.135[e]	.6272[e]	-218.04
trans-2- "	"	33.58	1.577	-	-	38.04[e]	37.72[e]	37.36[e]	5.085[e]	5.042[e]	4.993[e]	.6100[e]	-157.99
2-Methylpropene (Isobutene)	"	19.58	1.536	-	-	37.43[e]	37.09[e]	36.70[e]	5.004[e]	4.958[e]	4.907[e]	.6002[e]	-220.63
1-Pentene	C_5H_{10}	85.95	1.74	1.3714	1.3683	40.30	40.02	39.70	5.387	5.349	5.307	0.6461	-265.40
cis-2-Pentene	"	98.8	1.74	1.3830	1.3798	41.2	40.9	40.6	5.51	5.47	5.43	.661	-240.47
trans-2- "	"	97.45	1.74	1.3793	1.3761	40.75	40.46	40.15	5.447	5.409	5.367	.6533	-220.42
2-Methyl-1-butene	"	87.98	1.74	1.3778	1.3746	40.90	40.60	40.27	5.467	5.428	5.384	.6557	-215.61
3- " -1- "	"	68.11	1.69	1.3643[h]		39.45	39.15		5.273	5.234		.6325	-271.30
2- " -2- "	"	101.34	1.74	1.3874	1.3842	41.64	41.35	41.01	5.566	5.527	5.483	.6676	-208.80

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] At saturation pressure. [f] For air-saturated hydrocarbon at one atmosphere, unless otherwise indicated.

[g] Triple point. [h] n_D = 1.3671 at 60°F.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 8a-E (Part 2) - MONOOLEFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
1-Hexene	C_6H_{12}	146.39	1.87	1.3876	1.3848	42.29	42.04	41.75	5.654	5.620	5.581	0.6781	-218.
cis-2-Hexene	"	155.5	1.87	1.3954	1.3926	42.99	42.73	42.44	5.747	5.712	5.674	.6893	-221.8
trans-2- "	"	154.2	1.87	1.3935	1.3907	42.58	42.33	42.04	5.692	5.658	5.620	.6827	-207.
cis-3- "	"	153.7	1.87	1.3934	1.3907	42.69	42.43	42.13	5.706	5.671	5.632	.6845	-225.
trans-3- "	"	154.6	1.87	1.3938	1.3911	42.58	42.32	42.03	5.692	5.657	5.618	.6827	-171.
2-Methyl-1-pentene	"	144.0	1.83	1.3925	1.3897	42.84	42.57	42.28	5.727	5.691	5.651	.6869	
3- " -1- "	"	128.8	1.83	1.384	1.381	42.1	41.8	41.5	5.63	5.59	5.55	.675	
4- " -1- "	"	129.2	1.83	1.384	1.381	41.8	41.5	41.2	5.59	5.55	5.51	.670	
2- " -2- "	"	153.0	1.87	1.4004	1.3976	43.11	42.84	42.54	5.763	5.727	5.687	.6911	-211.
cis(?)-3-Methyl-2-pentene	"	158.94	1.87	1.4045	1.4018	43.86	43.61	43.34	5.863	5.830	5.793	.7032	-217.1
trans(?)-3- " -2- "	"	154.0	1.87	1.4016	1.3989	43.58	43.34	43.06	5.826	5.793	5.757	.6988	-211.5
cis(?)-4- " -2- "	"	137.1	1.83	1.389	1.386	42.2	41.9	41.6	5.64	5.61	5.57	.677	
trans(?)-4- " -2- "	"	131.	1.83	1.388	1.385	42.1	41.8	41.5	5.63	5.59	5.55	.675	
2-Ethyl-1-butene	"	148.91	1.87	1.3969	1.3941	43.30	43.04	42.74	5.788	5.753	5.714	.6943	
2,3-Dimethyl-1-butene	"	132.15	1.87	1.3904	1.3874	42.59	42.32	42.02	5.693	5.657	5.617	.6828	-220.0
3,3- " -1- "	"	106.23	1.83	1.3760	1.3730	41.03	40.76	40.45	5.485	5.449	5.407	.6579	-175.36
2,3- " -2- "	"	163.78	1.87	1.4122	1.4094	44.45	44.20	43.91	5.942	5.908	5.870	.7127	-101.65

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 9a-E (Part 1) - MONOOLEFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
1-Heptene	C_7H_{14}	199.9	2.06	1.3994	1.3968	43.74	43.50	43.23	5.847	5.815	5.779	0.7013	-182.6
cis-2-Heptene	"	209.3	2.01	1.406	1.403	44.4	44.2	43.9	5.94	5.91	5.88	.712	
trans-2- "	"	208.4	2.01	1.406	1.403	44.2	43.9	43.7	5.90	5.87	5.84	.708	
cis-3- "	"	204.4	2.01	1.404	1.401	44.0	43.8	43.5	5.88	5.85	5.82	.705	
trans-3- "	"												
2-Methyl-1-hexene	"	196.3	2.01	1.404	1.401	43.9	43.7	43.4	5.87	5.84	5.81	.704	
3- " -1- "	"	183.	2.01	1.397	1.394	43.6	43.4	43.1	5.83	5.80	5.77	.699	
4- " -1- "	"	189.1	2.01	1.399	1.396	43.7	43.5	43.3	5.85	5.82	5.78	.701	
5- " -1- "	"	186.17	2.01	1.3970	1.3942	43.47	43.22	42.95	5.811	5.778	5.742	.6970	
2- " -2- "	"	203.0	2.01	1.410	1.407	44.5	44.3	44.0	5.95	5.92	5.88	.713	
cis-3-Methyl-2-hexene	"	201.	2.01	1.410	1.407	44.7	44.4	44.2	5.97	5.94	5.91	.716	
trans-3- " -2- "	"												
cis-4- " -2- "	"	189.1	2.01	1.399	1.396	44.0	43.8	43.5	5.88	5.85	5.82	.705	
trans-4- " -2- "	"	185.7	2.01	1.399	1.396	43.8	43.6	43.3	5.85	5.82	5.79	.702	
cis-5- " -2- "	"	196.	2.01	1.400	1.397	43.9	43.7	43.4	5.87	5.84	5.81	.704	
trans-5- " -2- "	"	187.	2.01	1.400	1.397	43.9	43.7	43.4	5.87	5.84	5.81	.704	
cis-2- " -3- "	"	187.	2.01	1.399	1.396	43.5	43.3	43.1	5.82	5.79	5.76	.698	
trans-2- " -3- "	"												
cis-3- " -3- "	"	201.	2.01	1.407	1.404	44.1	43.9	43.6	5.90	5.87	5.83	.707	
trans-3- " -3- "	"												

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

[f] For completeness, all isomers are listed. However, when the data are inadequate, approximate values are given for mixtures of the cis and trans forms, as indicated by the braces.

TABLE 9a-E (Part 2) - MONOOLEFINS, C_7

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
2-Ethyl-1-pentene	C_7H_{14}	201.	2.01	1.405	1.402	44.4	44.2	43.9	5.94	5.91	5.88	0.712	
3- " -1- "	"	185.	2.01	1.398	1.395	43.9	43.6	43.4	5.86	5.83	5.80	.703	
2,3-Dimethyl-1-pentene	"	185.	2.01	1.403	1.400	44.5	44.3	44.1	5.96	5.93	5.89	.714	
2,4- " -1- "	"	178.	2.01	1.397	1.394	43.5	43.3	43.1	5.82	5.79	5.76	.698	
3,3- " -1- "	"	171.	2.01	1.399	1.396	43.7	43.4	43.2	5.84	5.81	5.78	.700	
3,4- " -1- "	"	178.	2.01	1.399	1.396	44.0	43.8	43.5	5.88	5.85	5.82	.705	
4,4- " -1- "	"	162.0	2.01	1.3918	1.3892	42.65	42.62	42.36	5.728	5.697	5.662	.6871	-213.9
3-Ethyl-2-pentene	"	203.	2.01	1.4143	1.4117	45.3	45.1	44.8	6.06	6.03	5.99	.726	
2,3-Dimethyl-2-pentene	"	207.	2.01	1.421	1.418	45.7	45.4	45.2	6.11	6.08	6.04	.732	-182.
2,4- " -2- "	"	180.3	2.01	1.403	1.400	43.65	43.42	43.15	5.836	5.804	5.768	.7000	
cis-3,4-Dimethyl-2-pentene	"	189.	2.01	1.407	1.404	44.7	44.5	44.3	5.98	5.95	5.92	.717	
trans-3,4- " -2- "	"												
cis-4,4- " -2- "	"	169.	2.01	1.399	1.396	43.2	42.9	42.7	5.77	5.74	5.71	.692	
trans-4,4- " -2- "	"												
3-Methyl-2-ethyl-1-butene	"	192.	2.01	1.410	1.407	44.9	44.6	44.4	6.00	5.97	5.93	.719	
2,3,3-Trimethyl-1-butene	"	172.17	2.06	1.4029	1.4000	44.26	44.01	43.73	5.913	5.883	5.846	.7097	-168.5

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 10a-E (Part 1) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
1-Octene	C_8H_{16}	250.29	2.10	1.4088	1.4063	44.93	44.70	44.44	6.006	5.975	5.940	0.7204	-152.3
cis-2-Octene	"	258.1	2.10	1.4150	1.4125	45.45	45.22	44.95	6.075	6.044	6.009	.7287	-148.
trans-2- "	"	257.0	2.10	1.4132	1.4107	45.17	44.94	44.68	6.039	6.008	5.973	.7243	-125.9
cis-3- "	"	253.2	2.10	1.4135	1.4111	45.2	45.0	44.8	6.05	6.02	5.98	.725	
trans-3- "	"	253.9	2.10	1.4126	1.4102	44.88	44.65	44.39	5.999	5.969	5.933	.7196	-166.
cis-4- "	"	253.0	2.10	1.4144	1.4120	45.33	45.10	44.84	6.060	6.029	5.994	.7269	-184.
trans-4- "	"	252.3	2.10	1.4118	1.4093	44.81	44.58	44.32	5.990	5.959	5.924	.7185	-136.7
2-Methyl-1-heptene	"	246.7	2.10	1.4123	1.4098	45.20	44.98	44.72	6.043	6.013	5.979	.7248	-130.
3- " -1- "	"	232.	2.06	1.406	1.404	44.6	44.4	44.1	5.96	5.93	5.90	.715	
4- " -1- "	"	235.0	2.06	1.410	1.408	45.0	44.8	44.5	6.01	5.98	5.95	.721	
5- " -1- "	"	235.9	2.06	1.4094	1.4069	44.95	44.72	44.46	6.009	5.979	5.943	.7208	
6- " -1- "	"	235.8	2.06	1.4070	1.4045	44.67	44.45	44.19	5.972	5.942	5.908	.7163	
2- " -2- "	"	252.	2.10	1.4170	1.4145	45.45	45.23	44.97	6.076	6.046	6.012	.7288	

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 10a-E (Part 2) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
cis-3-Methyl-2-heptene	C_8H_{16}	252.	2.10	1.419	1.417	45.7	45.5	45.3	6.11	6.08	6.05	0.733	
trans-3- " -2- "	"												
cis-4- " -2- "	"	237.	2.06	1.410	1.408	44.9	44.7	44.4	6.01	5.98	5.94	.720	
trans-4- " -2- "	"												
cis-5- " -2- "	"	244.	2.10	1.414	1.412	45.4	45.1	44.9	6.06	6.03	6.00	.727	
trans-5- " -2- "	"												
cis-6- " -2- "	"	243.	2.10	1.412	1.410	45.0	44.8	44.6	6.02	5.99	5.96	.722	
trans-6- " -2- "	"												
cis-2- " -3- "	"	234.	2.06	1.407	1.405	44.3	44.1	43.8	5.92	5.89	5.86	.710	
trans-2- " -3- "	"												
cis-3- " -3- "	"	250.	2.10	1.418	1.416	45.7	45.4	45.2	6.11	6.08	6.04	.732	
trans-3- " -3- "	"												
cis-4- " -3- "	"	252.	2.10	1.417	1.415	45.5	45.3	45.0	6.08	6.05	6.02	.729	
trans-4- " -3- "	"												
cis-5- " -3- "	"	234.	2.06	1.410	1.408	44.7	44.5	44.3	5.98	5.95	5.92	.717	
trans-5- " -3- "	"												
cis-6- " -3- "	"	239.	2.06	1.410	1.408	44.7	44.5	44.3	5.98	5.95	5.92	.717	
trans-6- " -3- "	"												

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 10a-E (Part 3) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
2-Ethyl-1-hexene	C_8H_{16}	248.	2.10	1.4157	1.4132	45.62	45.38	45.12	6.098	6.067	6.032	0.7314	
3- " -1- "	"	230.5	2.10	1.407	1.405	44.9	44.6	44.4	6.00	5.97	5.93	.719	
4- " -1- "	"	235.	2.10	1.412	1.410	45.5	45.3	45.1	6.09	6.06	6.03	.730	
2,3-Dimethyl-1-hexene	"	232.	2.10	1.414	1.412	45.5	45.3	45.0	6.08	6.05	6.02	.729	
2,4- " -1- "	"	232.2	2.10	1.411	1.409	45.2	44.9	44.7	6.04	6.01	5.98	.724	
2,5- " -1- "	"	232.9	2.10	1.4105	1.4080	45.01	44.77	44.50	6.017	5.985	5.949	.7217	
3,3- " -1- "	"	219.	2.10	1.4070	1.4046	44.80	44.57	44.32	5.989	5.958	5.924	.7183	
3,4- " -1- "	"	234.	2.10	1.413	1.411	45.4	45.2	44.9	6.07	6.04	6.01	.728	
3,5- " -1- "	"	219.	2.06	1.404	1.402	44.4	44.2	43.9	5.94	5.91	5.88	.712	
4,4- " -1- "	"	225.0	2.10	1.4102	1.4078	45.16	44.93	44.68	6.037	6.007	5.973	.7241	
4,5- " -1- "	"	228.	2.10	1.414	1.412	45.7	45.4	45.2	6.10	6.07	6.04	.732	
5,5- " -1- "	"	215.2	2.10	1.405	1.403	44.5	44.3	44.0	5.95	5.92	5.88	.713	
cis-3-Ethyl-2-hexene	"	250.	2.10	1.424	1.422	46.2	46.0	45.8	6.18	6.15	6.12	.741	
trans-3- " -2- "	"												
cis-4- " -2- "	"	235.	2.10	1.412	1.410	45.5	45.3	45.0	6.08	6.05	6.02	.729	
trans-4- " -2- "	"												
2,3-Dimethyl-2-hexene	"	251.8	2.10	1.4260	1.4236	46.41	46.18	45.92	6.205	6.174	6.139	.744	-180.
2,4- " -2- "	"	230.	2.06	1.411	1.409	45.5	45.3	45.0	6.08	6.05	6.02	.729	
2,5- " -2- "	"	234.0	2.06	1.4140	1.4115	45.2	44.9	44.7	6.04	6.01	5.98	.724	

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

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National Bureau of Standards — Washington, D. C.

TABLE 10a-E (Part 4) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
cis-3,4-Dimethyl-2-hexene	C_8H_{16}	241.	2.10	1.418	1.416	46.2	46.0	45.8	6.18	6.15	6.12	0.741	
trans-3,4- " -2- "	"												
cis-3,5- " -2- "	"	234.	2.06	1.416	1.414	45.5	45.3	45.0	6.08	6.05	6.02	.729	
trans-3,5- " -2- "	"												
cis-4,4- " -2- "	"	223.	2.10	1.413	1.411	45.3	45.1	44.8	6.06	6.03	5.99	.726	
trans-4,4- " -2- "	"												
cis-4,5- " -2- "	"	230..	2.10	1.413	1.411	45.5	45.3	45.0	6.08	6.05	6.02	.729	
trans-4,5- " -2- "	"												
cis-5,5- " -2- "	"	225.	2.06	1.410	1.408	44.9	44.7	44.4	6.01	5.98	5.94	.720	
trans-5,5- " -2- "	"												
3-Ethyl-3-hexene	"	241.	2.10	1.418	1.416	45.7	45.5	45.3	6.11	6.08	6.05	.733	
cis-2,2-Dimethyl-3-hexene	"	222.3	2.06	1.4099	1.4074	45.09	44.86	44.60	6.028	5.997	5.962	.7230	
trans-2,2- " -3- "	"												
cis-2,3- " -3- "	"	237.	2.10	1.416	1.414	45.7	45.4	45.2	6.11	6.08	6.04	.732	
trans-2,3- " -3- "	"												
cis-2,4- " -3- "	"	226.	2.06	1.409	1.407	44.8	44.6	44.3	5.99	5.96	5.93	.718	
trans-2,4- " -3- "	"												
cis-2,5- " -3- "	"	216.	2.06	1.403	1.401	44.5	44.3	44.1	5.96	5.93	5.89	.714	
trans-2,5- " -3- "	"												
cis-3,4- " -3- "	"	252.	2.10	1.430	1.428	46.9	46.6	46.4	6.26	6.23	6.20	.751	
trans-3,4- " -3- "	"												

[a] 1 atm = 29.921 in.Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 10a-E (Part 5) - MONOOLEFINS, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
2-n-Propyl-1-pentene	C_8H_{16}	243.9	2.10	1.4136	1.4111	45.43	45.20	44.93	6.073	6.042	6.007	0.7284	
2-Isopropyl-1- "	"	235.	2.10	1.414	1.412	45.5	45.3	45.0	6.08	6.05	6.02	.729	
3-Methyl-2-ethyl-1-pentene	"	234.5	2.10	1.4142	1.4118	45.7	45.5	45.2	6.11	6.08	6.05	.733	
4- " -2- " -1- "	"	230.5	2.10	1.4105	1.4080	45.15	44.92	44.65	6.036	6.004	5.969	.7240	
2- " -3- " -1- "	"	230.	2.10	1.415	1.413	45.8	45.6	45.3	6.12	6.09	6.06	.734	
3- " -3- " -1- "	"	234.	2.15	1.418	1.416	45.83	45.60	45.35	6.126	6.096	6.062	.7348	
4- " -3- " -1- "	"	225.	2.10	1.410	1.408	45.5	45.3	45.1	6.09	6.06	6.03	.730	
2,3,3-Trimethyl-1-pentene	"	226.	2.15	1.418	1.416	46.2	46.0	45.8	6.18	6.15	6.12	.741	-92.
2,3,4- " -1- "	"	226.	2.10	1.415	1.413	45.7	45.5	45.3	6.11	6.08	6.05	.733	
2,4,4- " -1- "	"	214.59	2.10	1.4086	1.4060	44.87	44.64	44.37	5.998	5.967	5.932	.7194	-136.3
3,3,4- " -1- "	"	221.	2.15	1.414	1.412	45.7	45.5	45.3	6.11	6.08	6.05	.733	
3,4,4- " -1- "	"	219.	2.10	1.412	1.410	45.1	44.9	44.6	6.03	6.00	5.97	.723	
2-Methyl-3-ethyl-2-pentene	"	243.	2.10	1.425	1.423	46.4	46.1	45.9	6.20	6.17	6.13	.743	
cis-4-Methyl-3-ethyl-2-pentene	"	237.	2.10	1.420	1.418	46.3	46.1	45.8	6.19	6.16	6.13	.742	
trans-4- " -3- " -2- "	"												
2,3,4-Trimethyl-2-pentene	"	241.27	2.10	1.4275	1.4249	46.65	46.41	46.14	6.236	6.204	6.168	.7479	
2,4,4- " -2- "	"	220.84	2.15	1.4160	1.4135	45.25	45.02	44.76	6.049	6.019	5.984	.7256	-159.5
cis-3,4,4-Trimethyl-2-pentene	"	234.	2.10	1.423	1.421	46.4	46.1	45.9	6.20	6.17	6.13	.743	
trans-3,4,4- " -2- "	"												
3-Methyl-2-isopropyl-1-butene	"	219.	2.10	1.409	1.407	45.3	45.1	44.8	6.06	6.03	5.99	.726	
3,3-Dimethyl-2-ethyl-1-butene	"	230.	2.10	1.416	1.414	45.7	45.4	45.2	6.11	6.08	6.04	.732	

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 11a-E (Part 1) - DIOLEFINS, C_3 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[f]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Propadiene (Allene)	C_3H_4	-30.1	1.37	-	-								-213.
1,2-Butadiene	C_4H_6	50.5	1.60	-	-	41.0[e]	40.7[e]	40.3[e]	5.49[e]	5.44[e]	5.39[e]	0.658[e]	-213.3
1,3- "	"	24.06	1.55	-	-	39.12[e]	38.77[e]	38.39[e]	5.229[e]	5.183[e]	5.131[e]	.6272[e]	-164.05
1,2-Pentadiene	C_5H_8	112.8	1.83	1.421	1.418	43.5	43.2	42.9	5.81	5.77	5.73	0.697	
cis-1,3-Pentadiene (cis-Piperylene)	"	111.6	1.83	1.4359	1.4326	43.38	43.11	42.79	5.799	5.762	5.721	.6956	
trans-1,3- " (trans- ")	"	108.1	1.78	1.4299	1.4266	42.50	42.23	41.91	5.681	5.645	5.603	.6815	
1,4-Pentadiene	"	78.89	1.74	1.388	1.385	41.5	41.2	40.9	5.54	5.51	5.47	.665	-234.
2,3- "	"	104.	1.78	1.39	1.39	41.	41.	41.	5.5	5.5	5.5	.66	
3-Methyl-1,2-butadiene	"	104.	1.78	1.410	1.407	42.7	42.5	42.1	5.71	5.67	5.63	.685	
2- " -1,3- " (Isoprene)	"	93.34	1.74	1.4216	1.4180	42.79	42.50	42.18	5.720	5.681	5.638	.6861	-230.8

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] At saturation pressure. [f] For air-saturated hydrocarbon at one atmosphere.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 11a-E (Part 2) - DIOLEFINS, C_6

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
1,2-Hexadiene	C_6H_{10}	172.	2.01	1.428	1.425	45.0	44.8	44.4	6.02	5.98	5.94	0.722	
cis-1,3-Hexadiene	"	163.	1.97	1.438	1.435	44.3	44.0	43.7	5.92	5.88	5.84	.710	
trans-1,3- "	"												
cis-1,4- "	"	149.0	1.92	1.410	1.407	43.7	43.4	43.1	5.84	5.80	5.76	.700	
trans-1,4- "	"												
1,5-Hexadiene	"	139.3	1.92	1.4042	1.4010	43.41	43.16	42.88	5.803	5.770	5.732	.6961	-222.
2,3- "	"	154.4	1.97	1.395	1.392	42.7	42.5	42.1	5.71	5.67	5.63	.685	
cis,cis-2,4-Hexadiene	"	176.	2.01	1.450	1.447	45.2	44.9	44.6	6.05	6.01	5.97	.725	
cis,trans-2,4- "	"												
trans,trans-2,4- "	"												
3-Methyl-1,2-pentadiene	"	158.	1.97	1.425	1.422	44.9	44.6	44.3	6.00	5.97	5.93	.720	
4- " -1,2- "	"	158.	1.97	1.424	1.421	44.5	44.2	43.9	5.95	5.91	5.87	.713	
cis-2-Methyl-1,3-pentadiene	"	169.	2.01	1.446	1.443	45.2	44.9	44.6	6.04	6.00	5.96	.724	
trans-2- " -1,3- "	"												
cis-3- " -1,3- "	"	171.	2.01	1.452	1.449	46.2	45.9	45.6	6.17	6.13	6.09	.740	
trans-3- " -1,3- "	"												
4-Methyl-1,3-pentadiene	"	169.3	2.01	1.451	1.448	45.2	44.9	44.6	6.04	6.00	5.96	.724	
2- " -1,4- "	"	133.	1.87	1.405	1.402	43.6	43.3	43.0	5.83	5.79	5.75	.699	
3- " -1,4- "	"	131.	1.87	1.405	1.402	43.7	43.4	43.1	5.84	5.80	5.76	.700	
2- " -2,3- "	"	162.	1.97	1.425	1.422	44.7	44.4	44.1	5.97	5.93	5.89	.716	
2-Ethyl-1,3-butadiene	"	167.	2.01	1.445	1.442	45.8	45.6	45.3	6.13	6.09	6.05	.735	
2,3-Dimethyl-1,3-butadiene	"	155.3	1.97	1.4391	1.4359	45.59	45.34	45.06	6.094	6.061	6.024	.7310	-105.

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere. [c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] See footnote f of Table 9a-E (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12a-E - ACETYLENES, C_2 to C_5

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Ethyne (Acetylene)	C_2H_2	-119.[f]	0.82	-	-								-114.
Propyne (Methylacetylene)	C_3H_4	-9.8	1.37	-	-								-152.9
1-Butyne (Ethylacetylene)	C_4H_6	47.7	1.65	-	-	41.[g]	41.[g]	41.[g]	5.4[g]	5.4[g]	5.4[g]	0.65[g]	-194.4
2- " (Dimethylacetylene)	"	80.58	1.69	1.392	1.389	43.5	43.3	42.9	5.82	5.78	5.74	.698	-26.01
1-Pentyne	C_5H_8	104.4	1.78	1.385	1.382	43.4	43.1	42.8	5.80	5.77	5.72	.696	-158.8
2- "	"	132.93	1.87	1.4039	1.4007	44.65	44.37	44.04	5.969	5.931	5.888	.7160	-164.7
3-Methyl-1-butyne	"	82.	1.74	1.378	1.375	41.8	41.5	41.2	5.59	5.55	5.51	.670	

[a] 1 atm = 29.921 in. Hg. [b] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. [c] See footnote c of Table 1a-E.
[d] See footnote d of Table 1 a-E. [e] For air-saturated hydrocarbon at one atmosphere. [f] Sublimation point. [g] At saturation pressure.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 13a-E - STYRENES, C_8 and C_9

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

June 30, 1945; May 31, 1947

Compound[f]	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[e]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
Styrene (Vinylbenzene; Phenylethylene)	C_8H_8	293.4	2.24	1.5469	1.5441	56.833	56.558	56.260	7.5975	7.5608	7.5209	0.91127	-23.13
α-Methylstyrene (Isopropenylbenzene; 2-Phenyl-1-propene)	C_9H_{10}	329.68	2.38	1.5386	1.5358	57.09	56.85	56.57	7.632	7.599	7.562	.9154	-9.78
cis-β-Methylstyrene (cis-Propenylbenzene; cis-1-Phenyl-1-propene). . . .	"	338.	2.33	1.545	1.542	57.1	56.9	56.6	7.63	7.60	7.57	.915	
trans-β-Methylstyrene (trans-Propenylbenzene; trans-1-Phenyl-1-propene). . .	"												

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E.

[e] For air-saturated hydrocarbon at one atmosphere.

[f] See footnote f of Table 9a-E (Part 1).

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TABLE 14a-E - ALKYL BENZENES, C_{10}

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

January 31, 1946; May 31, 1947

Compound	Formula	Boiling Point	dt/dp	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	60°F/60°F	In air, 1 atm
		°F	deg F/in. Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n-Butylbenzene (1-Phenylbutane)	$C_{10}H_{14}$	361.88	2.441	1.48976	1.48739	53.920	53.695	53.442	7.2081	7.1780	7.1441	0.86457	-126.35
Isobutylbenzene (1-Phenyl-2-methylpropane)	"	342.96	2.428	1.48645	1.48399	53.493	53.263	53.005	7.1509	7.1202	7.0857	.85771	-60.66
sec-Butylbenzene (2-Phenylbutane)	"	343.94	2.432	1.49019	1.48778	54.043	53.816	53.560	7.2245	7.1942	7.1599	.86654	-103.85
tert- " (2-Phenyl-2-methylpropane)	"	336.40	2.409	1.49264	1.49020	54.320	54.093	53.837	7.2615	7.2311	7.1969	.87098	-72.13
1-Methyl-2-propylbenzene	"	363.	2.47	1.4993	1.4970	54.76	54.54	54.29	7.320	7.290	7.257	.8780	
1- " -3- "	"	360.	2.47	1.4951	1.4928	54.05	53.83	53.58	7.226	7.196	7.163	.8667	
1- " -4- "	"	362.21	2.47	1.493	1.491	53.8	53.6	53.4	7.20	7.17	7.14	.863	-81.
1-Methyl-2-isopropylbenzene (o-Cymene)	"	352.9	2.42	1.5006	1.4982	54.95	54.72	54.47	7.346	7.315	7.281	.8811	-96.9
1- " -3- " (m- ")	"	347.4	2.42	1.4930	1.4906	53.98	53.75	53.49	7.216	7.185	7.151	.8655	-82.8
1- " -4- " (p- ")	"	350.78	2.42	1.4909	1.4885	53.75	53.52	53.26	7.185	7.154	7.120	.8618	-90.4
1,2-Diethylbenzene	"	362.26	2.47	1.5031	1.5008	55.19	54.97	54.72	7.378	7.348	7.315	.8849	-24.5
1,3- "	"	358.03	2.47	1.4953	1.4929	54.17	53.94	53.69	7.241	7.211	7.178	.8685	-119.06
1,4- "	"	362.80	2.47	1.4949	1.4926	54.03	53.81	53.56	7.222	7.193	7.159	.8663	-45.8
1,2-Dimethyl-3-ethylbenzene	"	381.04	2.533	1.5117	1.5095	55.91	55.69	55.44	7.474	7.445	7.411	.8965	-57.1
1,2- " -4- "	"	373.55	2.574	1.5031	1.5009	54.81	54.59	54.35	7.327	7.298	7.265	.8788	-88.6
1,3- " -2- "	"	374.02	2.565	1.5107	1.5085	55.81	55.58	55.33	7.460	7.431	7.397	.8948	+2.7
1,3- " -4- "	"	371.14	2.537	1.5038	1.5016	54.93	54.70	54.45	7.343	7.313	7.280	.8807	-81.4
1,3- " -5- "	"	362.75	2.478	1.4981	1.4958	54.21	53.99	53.74	7.247	7.217	7.184	.8692	-119.6
1,4- " -2- "	"	368.44	2.437	1.5043	1.5020	54.98	54.76	54.51	7.350	7.320	7.287	.8816	-64.7
1,2,3,4-Tetramethylbenzene (Prehnitene)	"	401.07	2.56	1.5201	1.5181	56.73	56.51	56.28	7.583	7.555	7.523	.9096	+20.75
1,2,3,5- " (Isodurene)	"	388.27	2.56	1.5125	1.5104	55.77	55.55	55.31	7.455	7.426	7.394	.8942	-11.
1,2,4,5- " (Durene)	"	385.	2.56	1.512	1.510	55.7	55.5	55.2	7.45	7.42	7.39	.893	+174.7

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E.

[e] For air-saturated hydrocarbon at one atmosphere.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 15a-E - ALKYL CYCLOPENTANES, C_8

BOILING POINT, dt/dp, REFRACTIVE INDEX, DENSITY, AND FREEZING POINT

February 28, 1947

Compound	Formula	Boiling Point	$\frac{dt}{dp}$	Refractive Index[b,c]		Density[b]						Specific Gravity[b,d]	Freezing Point[e]
		29.921 in.Hg[a]	29.921 in.Hg[a]	68°F	77°F	60°F	68°F	77°F	60°F	68°F	77°F	$\frac{60°F}{60°F}$	In air, 1 atm
		°F	deg F/ in.Hg	n_D	n_D	lb/cu ft			lb/gal				°F
n-Propylcyclopentane	C_8H_{16}	267.69	2.236	1.42627	1.42393	48.681	48.459	48.208	6.5077	6.4779	6.4444	0.78057	-179.21
Isopropylcyclopentane	"	259.55	2.245	1.42586	1.42355	48.700	48.478	48.229	6.5101	6.4805	6.4472	.78086	-168.48
1-Methyl-1-ethylcyclopentane	"	250.72	2.222	1.42717	1.42474	48.986	48.751	48.487	6.5483	6.5170	6.4817	.78544	-226.84
cis-1-Methyl-2-ethylcyclopentane	"	262.4	2.24	1.4295	1.4271	49.24	49.01	48.76	6.582	6.552	6.518	.7895	-158.71
trans-1-Methyl-2-ethylcyclopentane	"	250.1	2.24	1.4219	1.4195	48.23	48.01	47.75	6.448	6.417	6.383	.7734	
cis-1-Methyl-3-ethylcyclopentane	"	248.4	2.24	1.420	1.418	48.4	48.2	47.9	6.47	6.44	6.41	.776	
trans-1-Methyl-3-ethylcyclopentane	"	249.4	2.24	1.4186	1.4162	47.80	47.56	47.30	6.389	6.358	6.323	.7664	-162.
1,1,2-Trimethylcyclopentane	"	236.70	2.204	1.42296	1.42050	48.467	48.226	47.954	6.4791	6.4468	6.4105	.77714	-6.95
1,1,3-Trimethylcyclopentane	"	220.80	2.153	1.41115	1.40866	46.951	46.711	46.440	6.2764	6.2442	6.2081	.75282	-224.39
cis,cis,cis-1,2,3-Trimethylcyclopentane	"	253.4	2.24	1.4263	1.4238	48.87	48.64	48.39	6.533	6.503	6.468	.7836	-177.
cis,cis,trans-1,2,3-Trimethylcyclopentane	"	243.9	2.20	1.4219	1.4194	48.33	48.09	47.82	6.461	6.429	6.393	.7750	-170.
cis,trans,cis-1,2,3-Trimethylcyclopentane	"	230.7	2.20	1.4144	1.4119	47.28	47.04	46.77	6.320	6.288	6.252	.7580	-170.
cis,cis,cis-1,2,4-Trimethylcyclopentane	"	244.	2.20	1.422	1.420	48.0	47.8	47.6	6.42	6.39	6.36	.7703	
cis,cis,trans-1,2,4-Trimethylcyclopentane	"	242.11	2.208	1.41854	1.41610	47.896	47.660	47.394	6.4026	6.3711	6.3356	.76797	-206.59
cis,trans,cis-1,2,4-Trimethylcyclopentane	"	228.70	2.153	1.41057	1.40810	46.885	46.650	46.384	6.2676	6.2361	6.2006	.75177	-203.40

[a] 1 atm = 29.921 in. Hg.

[b] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[c] See footnote c of Table 1a-E.

[d] See footnote d of Table 1a-E.

[e] For air-saturated hydrocarbon at one atmosphere.

TABLE 1b - PARAFFINS, C_1 to C_5

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Methane	CH_4	-	-	-	-	-	-	-	-	-	-
Ethane	C_2H_6	-	-	-	-	-	-	-	-	-	-
Propane	C_3H_8	88.10[c]	89.48[c]	-	-	-	-	-	-	-	-
n-Butane	C_4H_{10}	100.41[c]	101.43[c]	-	-	-	-	-	-	-	-
2-Methylpropane (Isobutane)	"	104.31[c]	105.48[c]	-	-	-	-	-	-	-	-
n-Pentane	C_5H_{12}	115.205	116.104	25.266	25.288	0.35020	0.35051	1.04436	1.04406	98.0	97.9
2-Methylbutane (Isopentane)	"	116.426	117.383	25.292	25.315	.35057	.35089	1.04390	1.04357	98.7	98.6
2,2-Dimethylpropane (Neopentane)	"	-	-	-	-	-	-	-	-	-	-

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. The symbols used in defining these properties have the following meaning: M is the molecular weight in g/mole; d is the density in g/ml; n_D, n_F, and n_C are the refractive indices for the sodium D (5892.6 Å), the hydrogen F (4861.3 Å), and the hydrogen C (6562.8 Å) lines, respectively. (Å = Angstrom unit).

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 1.0 unit. The differences between any two values are believed to be uncertain by not more than 0.7 unit in most cases. The available data indicate that the specific dispersion decreases by 0.1 ± 0.1 unit from 20° to 25°C.

[c] At saturation pressure.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2b (Part 1) - PARAFFINS, C_6

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Hexane	C_6H_{14}	130.688	131.596	29.907	29.928	0.34706	0.34730	1.04517	1.04485	98.2	98.1
2-Methylpentane	"	131.933	132.875	29.946	29.962	.34751	.34770	1.04488	1.04447	98.7	98.6
3- "	"	129.713	130.609	29.801	29.816	.34583	.34600	1.04436	1.04396	97.2	97.1
2,2-Dimethylbutane	"	132.742	133.712	29.934	29.947	.34738	.34753	1.04418	1.04372	99.9	99.8
2,3- "	"	130.240	131.156	29.810	29.831	.34594	.34618	1.04413	1.04380	98.4	98.3

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] See footnote b of Table 1b.

TABLE 2b (Part 2) - PARAFFINS, C_7

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Heptane	C_7H_{16}	146.557	147.465	34.554	34.572	0.34486	0.34503	1.04580	1.04544	98.2	98.1
2-Methylhexane	"	147.643	148.587	34.592	34.604	.34523	.34535	1.04558	1.04513	98.6	98.5
3- "	"	145.85	146.75	34.467	34.481	.34399	.34413	1.04515	1.04475	97.3	97.2
3-Ethylpentane	"	143.513	144.425	34.283	34.302	.34215	.34234	1.04431	1.04397	96.3	96.2
2,2-Dimethylpentane	"	148.693	149.648	34.618	34.628	.34549	.34560	1.04524	1.04478	99.9	99.8
2,3- "	"	144.145	145.027	34.325	34.339	.34257	.34272	1.04444	1.04406	96.9	96.8
2,4- "	"	148.927	149.903	34.618	34.632	.34550	.34563	1.04510	1.04467	98.7	98.6
3,3- "	"	144.536	145.404	34.332	34.344	.34264	.34276	1.04428	1.04387	97.2	97.1
2,2,3-Trimethylbutane	"	145.210	146.106	34.380	34.387	.34312	.34319	1.04445	1.04397	98.2	98.1

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] See footnote b of Table 1b.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3b - PARAFFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Octane	C_8H_{18}	162.573	163.516	39.189	39.209	0.34309	0.34326	1.04615	1.04580	98.2	98.1
2-Methylheptane	"	163.668	164.612	39.234	39.250	.34348	.34362	1.04600	1.04563	98.6	98.5
3- "	"	161.832	162.768	39.101	39.120	.34232	.34249	1.04558	1.04524	97.6	97.5
4- "	"	162.105	163.049	39.117	39.136	.34246	.34263	1.04560	1.04525	97.6	97.5
3-Ethylhexane	"	160.072	160.997	38.944	38.960	.34094	.34108	1.04483	1.04445	96.5	96.4
2,2-Dimethylhexane	"	164.285	165.274	39.252	39.271	.34364	.34380	1.04585	1.04548	99.8	99.7
2,3- "	"	160.373	161.290	38.988	38.997	.34133	.34141	1.04516	1.04471	97.1	97.0
2,4- "	"	163.093	164.068	39.130	39.149	.34257	.34274	1.04516	1.04481	97.9	97.8
2,5- "	"	164.695	165.698	39.259	39.283	.34370	.34391	1.04568	1.04537	99.1	99.0
3,3- "	"	160.879	161.800	39.009	39.035	.34151	.34174	1.04509	1.04484	97.4	97.3
3,4- "	"	158.799	159.705	38.852	38.874	.34014	.34033	1.04453	1.04423	96.7	96.6
2-Methyl-3-ethylpentane	"	158.797	159.707	38.838	38.862	.34001	.34023	1.04436	1.04409	96.2	96.1
3- " -3- "	"	157.026	157.864	38.717	38.734	.33896	.33911	1.04404	1.04372	95.9	95.8
2,2,3-Trimethylpentane	"	159.520	160.409	38.923	38.942	.34076	.34093	1.04492	1.04460	97.3	97.2
2,2,4- "	"	165.080	166.069	39.261	39.275	.34372	.34384	1.04548	1.04507	100.6	100.5
2,3,3- "	"	157.290	158.137	38.763	38.778	.33936	.33949	1.04442	1.04406	96.2	96.1
2,3,4- "	"	158.854	159.745	38.869	38.893	.34028	.34050	1.04469	1.04443	97.0	96.9
2,2,3,3-Tetramethylbutane	"										

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] See footnote b of Table 1b.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 4b (Part 1) - PARAFFINS, C_9

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Nonane	C_9H_{20}	178.696	179.662	43.845	43.858	0.34187	0.34197	1.04664	1.04624	98.1	98.0
2-Methyloctane	"	179.77	180.76	43.88	43.90	.3421	.3423	1.0464	1.0461	98.5	98.4
3- "	"	177.95	178.92	43.73	43.75	.3410	.3411	1.0459	1.0455	97.6	97.5
4- "	"	178.15	179.12	43.77	43.79	.3413	.3414	1.0462	1.0458	97.6	97.5
3-Ethylheptane	"	176.4	177.4	43.63	43.66	.3402	.3404	1.046	1.046	96.7	96.6
4- "	"	175.7	176.7	43.6	43.6	.340	.340	1.046	1.046	96.7	96.6
2,2-Dimethylheptane	"	180.51	181.50	44.0	44.0	.343	.343	1.047	1.047	99.6	99.5
2,3- "	"	176.65	177.61	43.63	43.65	.3402	.3403	1.0455	1.0452	97.3	97.2
2,4- "	"	179.1	180.1	43.7	43.7	.341	.341	1.045	1.045	97.9	97.8
2,5- "	"	179.4	180.4	43.9	43.9	.342	.342	1.046	1.046	97.9	97.8
2,6- "	"	180.91	181.94	43.92	43.94	.3425	.3426	1.0463	1.0459	99.0	98.9
3,3- "	"	176.9	177.9	43.7	43.7	.341	.341	1.046	1.046	97.5	97.4
3,4- "	"	175.35	176.29	43.52	43.55	.3393	.3395	1.0451	1.0449	96.9	96.8
3,5- "	"	177.4	178.4	43.7	43.7	.341	.341	1.045	1.045	97.0	96.9
4,4- "	"	176.9	177.9	43.7	43.7	.340	.340	1.045	1.045	97.5	97.4

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 1.5 units. The differences between any two values are believed to be uncertain by not more than 1.5 units in most cases. The available data indicate that the specific dispersion decreases by 0.1 ± 0.1 unit from 20° to 25°C.

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National Bureau of Standards — Washington, D. C.

TABLE 4b (Part 2) - PARAFFINS, C_9

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
2-Methyl-3-ethylhexane	C_9H_{20}	175.4	176.4	43.6	43.6	0.340	0.340	1.045	1.045	96.7	96.6
2- " -4- "	"	177.4	178.4	43.7	43.7	.341	.341	1.045	1.045	97.0	96.9
3- " -3- "	"	173.1	174.0	43.4	43.4	.338	.338	1.044	1.044	96.0	95.9
3- " -4- "	"	172.8	173.8	43.4	43.4	.338	.338	1.045	1.045	95.6	95.5
2,2,3-Trimethylhexene	"	175.88	176.80	43.62	43.63	.3401	.3402	1.0459	1.0455	97.4	97.3
2,2,4- "	"	179.22	180.18	43.76	43.78	.3412	.3413	1.0455	1.0451	98.9	98.8
2,2,5- "	"	181.37	182.41	43.93	43.96	.3425	.3427	1.0461	1.0458	100.3	100.1
2,3,3- "	"	173.8	174.7	43.45	43.49	.3388	.3391	1.045	1.045	96.4	96.3
2,3,4- "	"	173.1	174.0	43.4	43.4	.338	.338	1.044	1.044	96.5	96.4
2,3,5- "	"	177.66	178.65	43.64	43.65	.3403	.3404	1.0451	1.0447	97.9	97.8
2,4,4- "	"	176.9	177.9	43.6	43.6	.340	.340	1.045	1.045	97.9	97.8
3,3,4- "	"	172.1	173.1	43.4	43.4	.338	.338	1.045	1.045	95.4	95.3
3,3-Diethylpentane	"	170.45	171.32	43.13	43.16	.3363	.3366	1.0438	1.0435	94.1	94.0
2,2-Dimethyl-3-ethylpentane	"	174.54	175.44	43.46	43.49	.3388	.3391	1.0449	1.0447	96.4	96.3
2,3- " -3- "	"	170.1	171.0	43.0	43.0	.335	.335	1.042	1.042	94.7	94.6
2,4- " -3- "	"	173.80	174.70	43.40	43.42	.3384	.3386	1.0448	1.0445	96.5	96.4
2,2,3,3-Tetramethylpentane	"	169.51	170.36	43.20	43.22	.3368	.3370	1.0451	1.0448	96.4	96.3
2,2,3,4- "	"	173.55	174.47	43.42	43.46	.3386	.3389	1.0451	1.0450	97.2	97.1
2,2,4,4- "	"	178.22	179.20	43.85	43.87	.3419	.3421	1.0470	1.0467	101.1	101.0
2,3,3,4- "	"	169.94	170.77	43.18	43.21	.3367	.3369	1.0447	1.0444	95.2	95.1

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 4b (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5b - ALKYL BENZENES, C_6 to C_9

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945; May 31, 1947

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Benzene	C_6H_6	88.857	89.401	26.183	26.201	0.33522	0.33544	1.06158	1.06106	189.8	189.6
Methylbenzene (Toluene)	C_7H_8	106.272	106.846	31.094	31.112	0.33749	0.33768	1.06345	1.06297	185.0	184.8
Ethylbenzene	C_8H_{10}	122.442	123.064	35.764	35.783	0.33689	0.33707	1.06243	1.06198	173.9	173.7
1,2-Dimethylbenzene (o-Xylene)	"	120.609	121.193	35.799	35.821	.33722	.33743	1.06533	1.06594	179.8	179.6
1,3- " (m- ")	"	122.846	123.456	35.960	35.980	.33874	.33892	1.06512	1.06569	181.1	180.9
1,4- " (p- ")	"	123.291	123.919	36.004	36.029	.33915	.33938	1.06528	1.06490	181.5	181.3
n-Propylbenzene	C_9H_{12}	139.420	140.110	40.450	40.473	0.33656	0.33675	1.06100	1.06060	165.3	165.1
Isopropylbenzene (Cumene)	"	139.461	140.157	40.423	40.446	.33633	.33653	1.06056	1.06016	164.7	164.5
1-Methyl-2-ethylbenzene	"	136.468	137.109	40.444	40.471	.33651	.33674	1.06416	1.06384	172.7	172.5
1- " -3- "	"	139.020	139.686	40.653	40.671	.33825	.33840	1.06435	1.06388	172.1	171.9
1- " -4- "	"	139.560	140.237	40.697	40.715	.33861	.33877	1.06438	1.06391	173.5	173.3
1,2,3-Trimethylbenzene (Hemimellitene)	"	134.379	134.974	40.450	40.466	.33657	.33670	1.06673	1.06625	176.3	176.1
1,2,4- " (Pseudocumene)	"	137.227	137.860	40.692	40.710	.33857	.33873	1.06694	1.06648	177.9	177.7
1,3,5- " (Mesitylene)	"	138.914	139.571	40.812	40.830	.33958	.33973	1.06676	1.06628	177.3	177.1

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 1.0 unit. The differences between any two values are believed to be uncertain by not more than 0.7 unit in most cases. The available data indicate that the specific dispersion decreases by 0.2 ± 0.2 unit from 20° to 25°C.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 6b - ALKYL CYCLOPENTANES, C_5 to C_7

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945; February 28, 1947

Compound	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Cyclopentane	C_5H_{10}	94.086	94.713	23.133	23.145	0.32986	0.33002	1.03376	1.03341	94.3	94.2
Methylcyclopentane	C_6H_{12}	112.412	113.122	27.834	27.847	0.33074	0.33089	1.03538	1.03503	96.2	96.1
Ethylcyclopentane	C_7H_{14}	128.096	128.819	32.400	32.413	0.33000	0.33013	1.03652	1.03618	95.8	95.7
1,1-Dimethylcyclopentane	"	130.132	130.925	32.489	32.502	.33090	.33104	1.03633	1.03596	97.1	97.0
cis-1,2-Dimethylcyclopentane	"	127.077	127.829	32.307	32.325	.32905	.32924	1.03590	1.03562	96.9	96.8
trans-1,2- "	"	130.658	131.460	32.510	32.528	.33112	.33130	1.03627	1.03596	96.0	95.9
cis-1,3- "	"	131.12	131.91	32.56	32.58	.3317	.3318	1.0367	1.0364		
trans-1,3- "	"	131.825	132.634	32.585	32.600	.33188	.33203	1.03652	1.03616	96.3	96.2

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 1.5 units. The differences between any two values are believed to be uncertain by not more than 1.0 unit in most cases. The available data indicate that the specific dispersion decreases by 0.1 ± 0.1 unit from 20° to 25°C.

TABLE 7b - ALKYL CYCLOHEXANES, C_6 to C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945; March 31, 1947

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Cyclohexane	C_6H_{12}	108.093	108.744	27.709	27.722	0.32926	0.32941	1.03696	1.03660	96.2	96.1
Methylcyclohexane	C_7H_{14}	127.610	128.332	32.503	32.515	0.33105	0.33117	1.03843	1.03805	97.9	97.8
Ethylcyclohexane	C_8H_{16}	142.410	143.141	37.015	37.032	0.32988	0.33003	1.03908	1.03878	97.5	97.4
1,1-Dimethylcyclohexane	"	143.683	144.455	37.038	37.056	.33008	.33024	1.03848	1.03818	98.2	98.1
cis-1,2-Dimethylcyclohexane	"	140.917	141.637	36.842	36.855	.32834	.32846	1.03783	1.03749	96.0	95.9
trans-1,2- "	"	144.596	145.347	37.121	37.142	.33083	.33101	1.03895	1.03870	98.0	97.9
cis-1,3-[c] "	"	146.480	147.262	37.296	37.316	.33238	.32256	1.03993	1.03965	99.2	99.1
trans-1,3-[d] "	"	142.991	143.755	37.002	37.017	.32976	.32990	1.03849	1.03816	97.2	97.1
cis-1,4- "	"	143.333	144.097	37.001	37.020	.32975	.32993	1.03824	1.03796	97.2	97.1
trans-1,4- "	"	147.148	147.963	37.308	37.329	.33249	.33268	1.03963	1.03936	99.2	99.1

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 6b.

[c] Formerly labeled "trans"; see footnote d of Table 7a. [d] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

Table 8b (Part 1) - MONOOLEFINS, C_2 to C_5

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945; May 31, 1947

Compound	Formula	Molecular Volume[a]		Molecular Refraction[a]		Specific Refraction[a]		Refractivity Intercept[a]		Specific Dispersion[a,b]	
		$V = M/d$		$V(n_D^2 - 1)/(n_D^2 + 2)$		$(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		$n_D - d/2$		$10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Ethene (Ethylene)	C_2H_4	-	-	-	-	-	-	-	-	-	-
Propene (Propylene)	C_3H_6	81.88[c]	83.27[c]	-	-	-	-	-	-	-	-
1-Butene	C_4H_8	94.28[c]	95.29[c]	-	-	-	-	-	-	-	-
cis-2-Butene	"	90.30[c]	91.17[c]	-	-	-	-	-	-	-	-
trans-2- "	"	92.86[c]	93.76[c]	-	-	-	-	-	-	-	-
2-Methylpropene (Isobutene)	"	94.42[c]	95.43[c]	-	-	-	-	-	-	-	-
1-Pentene	C_5H_{10}	109.41	110.28	24.83	24.84	0.3541	0.3542	1.0509	1.0503	128.	128.
cis-2-Pentene	"	106.9	107.7	24.9	24.9	.356	.356	1.055	1.054	130.	130.
trans-2 "	"	108.19	109.05	25.02	25.03	.3568	.3569	1.0552	1.0546	132.	132.
2-Methyl-1-butene	"	107.83	108.71	24.85	24.86	.3543	.3545	1.0526	1.0520	133.	133.
3- " -1- "	"	111.81		24.94		.3557		1.0507		128.	
2- " -2- "	"	105.89	106.74	24.95	24.97	.3558	.3560	1.0563	1.0557	135.	135.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 6 units. The differences between any two values are believed to be uncertain by not more than 4 units in most cases. The specific dispersion probably decreases by 0.3 ± 0.3 unit from 20° to 25°C.

[c] At saturation pressure.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8b (Part 2) - MONOOLEFINS, C_6

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
1-Hexene	C_6H_{12}	124.97	125.83	29.46	29.48	0.3501	0.3502	1.0509	1.0504	122.	122.
cis-2-Hexene	"	122.95	123.78	29.50	29.51	.3506	.3507	1.0532	1.0527	125.	125.
trans-2- "	"	124.12	124.97	29.66	29.67	.3524	.3526	1.0545	1.0540	127.	127.
cis-3- "	"	123.83	124.69	29.58	29.61	.3515	.3518	1.0536	1.0532	126.	126.
trans-3- "	"	124.14	125.01	29.68	29.71	.3527	.3530	1.0549	1.0545	128.	128.
2-Methyl-1-pentene	"	123.40	124.27	29.42	29.44	.3496	.3498	1.0515	1.0511	129.	129.
3- " -1- "	"	125.6	126.6	29.4	29.4	.349	.349	1.049	1.049	124.	124.
4- " -1- "	"	126.6	127.5	29.6	29.6	.352	.352	1.051	1.051	124.	124.
2- " -2- "	"	122.62	123.49	29.75	29.78	.3536	.3538	1.0573	1.0569	131.	131.
cis(?)-3-Methyl-2-pentene	"	120.46	121.23	29.49	29.51	.3505	.3506	1.0552	1.0547	131.	131.
trans (?)-3- " -2- "	"	121.23	122.00	29.49	29.50	.3504	.3506	1.0545	1.0540	131.	131.
cis(?)-4- " -2- "	"	125.2	126.2	29.6	29.6	.352	.352	1.053	1.053	126.	126.
trans(?)-4- " -2- "	"	125.6	126.6	29.6	29.6	.352	.352	1.053	1.053	128.	128.
2-Ethyl-1-butene	"	122.07	122.91	29.39	29.41	.3492	.3494	1.0522	1.0517	128.	128.
2,3-Dimethyl-1-butene	"	124.14	125.03	29.45	29.46	.3500	.3501	1.0515	1.0509	129.	129.
3,3- " -1- "	"	128.90	129.89	29.58	29.59	.3514	.3516	1.0495	1.0490	124.	124.
2,3- " -2- "	"	118.86	119.64	29.59	29.60	.3516	.3518	1.0582	1.0577	132.	132.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

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National Bureau of Standards — Washington, D. C.

TABLE 9b (Part 1) - MONOOLEFINS, C_7

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
1-Heptene	C_7H_{14}	140.90	141.78	34.11	34.13	0.3474	0.3476	1.0510	1.0506	118.	118.
cis-2-Heptene	"	138.7	139.5	34.0	34.0	.347	.347	1.052	1.052	122.	122.
trans-2- "	"	139.5	140.3	34.2	34.2	.349	.349	1.054	1.054	124.	124.
cis-3- "	"	140.1	140.9	34.2	34.2	.349	.349	1.053	1.053	122.	122.
trans-3- "	"									124.	124.
2-Methyl-1-hexene	"	140.3	141.1	34.3	34.3	.349	.349	1.054	1.054	125.	125.
3- " -1- "	"	141.3	142.1	34.0	34.0	.346	.346	1.049	1.049	120.	120.
4- " -1- "	"	140.9	141.7	34.1	34.1	.347	.347	1.050	1.050	120.	120.
5- " -1- "	"	141.80	142.71	34.15	34.15	.3478	.3478	1.0503	1.0502	120.	120.
2- " -2- "	"	138.5	139.3	34.3	34.3	.349	.349	1.055	1.055	127.	127.
cis-3-Methyl-2-hexene	"	137.9	138.7	34.2	34.2	.348	.348	1.054	1.054	127.	127.
trans-3- " -2- "	"										
cis-4- " -2- "	"	140.1	140.9	33.9	33.9	.345	.345	1.048	1.048	122.	122.
trans-4- " -2- "	"	140.7	141.5	34.0	34.0	.346	.346	1.050	1.050	124.	124.
cis-5- " -2- "	"	140.3	141.1	34.0	34.0	.346	.346	1.050	1.050	122.	122.
trans-5- " -2- "	"	140.3	141.1	34.0	34.0	.346	.346	1.050	1.050	124.	124.
cis-2- " -3- "	"	141.5	142.3	34.2	34.2	.348	.348	1.052	1.052	122.	122.
trans-2- " -3- "	"									124.	124.
cis-3- " -3- "	"	139.7	140.5	34.4	34.4	.350	.350	1.055	1.055	127.	127.
trans-3- " -3- "	"										

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

[c] For completeness, all isomers are listed. However, when the data are inadequate, approximate values are given for mixtures of the cis and trans forms, as indicated by the braces.

TABLE 9b (Part 2) - MONOOLEFINS, C_7

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
2-Ethyl-1-pentene	C_7H_{14}	138.7	139.5	34.0	34.0	0.346	0.346	1.051	1.051	125.	125.
3- " -1- "	"	140.5	141.3	33.9	33.9	.345	.345	1.048	1.048	121.	121.
2,3-Dimethyl-1-pentene	"	138.3	139.1	33.7	33.7	.344	.344	1.048	1.048	125.	125.
2,4- " -1- "	"	141.5	142.3	34.1	34.1	.347	.347	1.050	1.050	125.	125.
3,3- " -1- "	"	141.1	141.9	34.1	34.1	.347	.347	1.051	1.051	120.	120.
3,4- " -1- "	"	140.1	140.9	33.9	33.9	.345	.345	1.048	1.048	120.	120.
4,4- " -1- "	"	143.81	144.70	34.23	34.24	.3486	.3487	1.0504	1.0500	120.	120.
3-Ethyl-2-pentene	"	136.0	136.7	34.0	34.0	.346	.346	1.0533	1.0527	127.	127.
2,3-Dimethyl-2-pentene	"	134.9	135.6	34.2	34.2	.348	.348	1.057	1.057	130.	130.
2,4- " -2- "	"	141.17	142.05	34.4	34.4	.351	.351	1.055	1.055	128.	128.
cis-3,4-Dimethyl-2-pentene	"	137.7	138.5	33.9	33.9	.345	.345	1.050	1.050	127.	127.
trans-3,4- " -2- "	"										
cis-4,4- " -2- "	"	142.7	143.5	34.5	34.5	.351	.351	1.055	1.055	122.	122.
trans-4,4- " -2- "	"									124.	124.
3-Methyl-2-ethyl-1-butene	"	137.3	138.1	34.0	34.0	.346	.346	1.052	1.052	125.	125.
2,3,3-Trimethyl-1-butene	"	139.27	140.16	33.98	33.98	.3461	.3461	1.0504	1.0498	124.	124.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

[c] See footnote c of Table 9b (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington D. C.

TABLE 10b (Part 1) - MONOOLEFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a]		Molecular Refraction[a]		Specific Refraction[a]		Refractivity Intercept[a]		Specific Dispersion[a,b]	
		$V = M/d$		$V(n_D^2 - 1)/(n_D^2 + 2)$		$(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		$n_D - d/2$		$10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
1-Octene	C_8H_{16}	156.72	157.64	38.73	38.75	0.3451	0.3453	1.0508	1.0504	116.	116.
cis-2-Octene	"	154.92	155.82	38.79	38.81	.3457	.3459	1.0529	1.0525	118.	118.
trans-2- "	"	155.87	156.78	38.88	38.90	.3465	.3467	1.0533	1.0529	120.	120.
cis-3- "	"	155.6	156.5	38.8	38.8	.346	.346	1.053	1.053	119.	119.
trans-3- "	"	156.89	157.82	39.09	39.12	.3484	.3486	1.0550	1.0547	121.	121.
cis-4- "	"	155.31	156.21	38.84	38.87	.3462	.3464	1.0532	1.0529	120.	120.
trans-4- "	"	157.13	158.06	39.09	39.10	.3483	.3485	1.0548	1.0544	122.	122.
2-Methyl-1-heptene	"	155.74	156.63	38.78	38.79	.3456	.3457	1.0521	1.0516	122.	122.
3- " -1- "	"	157.8	158.7	38.8	38.8	.346	.346	1.051	1.051	117.	117.
4- " -1- "	"	156.5	157.4	38.8	38.8	.346	.346	1.052	1.052	117.	117.
5- " -1- "	"	156.63	157.55	38.76	38.77	.3454	.3456	1.0512	1.0508	117.	117.
6- " -1- "	"	157.60	158.51	38.79	38.81	.3457	.3459	1.0510	1.0506	117.	117.
2- " -2- "	"	154.88	155.76	38.95	38.96	.3471	.3472	1.0548	1.0543	124.	124.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

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TABLE 10b (Part 2) - MONOOLEFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
cis-3-Methyl-2-heptene	C_8H_{16}	153.9	154.8	38.9	38.9	0.347	0.347	1.055	1.055	124.	124.
trans-3- " -2- "	"										
cis-4- " -2- "	"	156.7	157.6	38.9	38.9	.346	.346	1.052	1.052	119.	119.
trans-4- " -2- "	"									121.	121.
cis-5- " -2- "	"	155.2	156.1	38.8	38.8	.346	.346	1.053	1.053	119.	119.
trans-5- " -2- "	"									121.	121.
cis-6- " -2- "	"	156.3	157.2	38.9	38.9	.347	.347	1.053	1.053	119.	119.
trans-6- " -2- "	"									121.	121.
cis-2- " -3- "	"	158.9	159.8	39.1	39.1	.349	.349	1.054	1.054	119.	119.
trans-2- " -3- "	"									121.	121.
cis-3- " -3- "	"	154.1	155.0	38.9	38.9	.346	.346	1.054	1.054	124.	124.
trans-3- " -3- "	"										
cis-4- " -3- "	"	154.8	155.6	38.9	38.9	.347	.347	1.055	1.055	124.	124.
trans-4- " -3- "	"										
cis-5- " -3- "	"	157.4	158.3	39.0	39.0	.348	.348	1.054	1.054	119.	119.
trans-5- " -3- "	"									121.	121.
cis-6- " -3- "	"	157.4	158.3	39.0	39.0	.348	.348	1.054	1.054	119.	119.
trans-6- " -3- "	"									121.	121.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

[c] See footnote c of Table 9b (Part 1).

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TABLE 10b (Part 3) - MONOOLEFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
2-Ethyl-1-hexene	C_8H_{16}	154.34	155.24	38.71	38.73	0.3450	0.3451	1.0522	1.0518	121.	121.
3- " -1- "	"	156.9	157.8	38.7	38.7	.344	.344	1.050	1.050	117.	117.
4- " -1- "	"	154.6	155.4	38.5	38.5	.343	.343	1.049	1.049	117.	117.
2,3-Dimethyl-1-hexene	"	154.8	155.6	38.7	38.7	.345	.345	1.052	1.052	122.	122.
2,4- " -1- "	"	155.8	156.7	38.7	38.7	.345	.345	1.051	1.051	122.	122.
2,5- " -1- "	"	156.45	157.40	38.80	38.83	.3458	.3460	1.0519	1.0515	122.	122.
3,3- " -1- "	"	157.15	158.06	38.68	38.71	.3448	.3450	1.0500	1.0496	117.	117.
3,4- " -1- "	"	155.0	155.8	38.7	38.7	.345	.345	1.051	1.051	117.	117.
3,5- " -1- "	"	158.5	159.4	38.8	38.8	.346	.346	1.050	1.050	117.	117.
4,4- " -1- "	"	155.89	156.78	38.64	38.66	.3444	.3445	1.0503	1.0499	117.	117.
4,5- " -1- "	"	154.1	155.0	38.5	38.5	.344	.344	1.050	1.050	117.	117.
5,5- " -1- "	"	158.3	159.2	38.8	38.8	.346	.346	1.051	1.051	117.	117.
cis-3-Ethyl-2-hexene	"	152.2	153.1	38.9	38.9	.346	.346	1.056	1.056	124.	124.
trans-3- " -2- "	"										
cis-4- " -2- "	"	154.8	155.6	38.5	38.5	.343	.343	1.050	1.050	119.	119.
trans-4- " -2- "	"									121.	121.
2,3-Dimethyl-2-hexene	"	151.67	152.54	38.86	38.89	.3463	.3466	1.0561	1.0558	127.	127.
2,4- " -2- "	"	154.8	155.6	38.5	38.5	.343	.343	1.049	1.049	124.	124.
2,5- " -2- "	"	155.8	156.7	38.9	38.9	.347	.347	1.054	1.054	124.	124.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

[c] See footnote c of Table 9b (Part 1).

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TABLE 10b (Part 4) - MONOOLEFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
cis-3,4-Dimethyl-2-hexene	C_8H_{16}	152.2	153.1	38.4	38.4	0.342	0.342	1.050	1.050	124.	124.
trans-3,4- " -2- "	"										
cis-3,5- " -2- "	"	154.8	155.6	38.9	38.9	.346	.346	1.054	1.054	124.	124.
trans-3,5- " -2- "	"										
cis-4,4- " -2- "	"	155.4	156.3	38.8	38.8	.346	.346	1.052	1.052	119.	119.
trans-4,4- " -2- "	"									121.	121.
cis-4,5- " -2- "	"	154.8	155.6	38.6	38.6	.344	.344	1.051	1.051	119.	119.
trans-4,5- " -2- "	"									121.	121.
cis-5,5- " -2- "	"	156.7	157.6	38.9	38.9	.346	.346	1.052	1.052	119.	119.
trans-5,5- " -2- "	"									121.	121.
3-Ethyl-3-hexene	"	153.9	154.8	38.8	38.8	.346	.346	1.054	1.054	124.	124.
cis-2,2-Dimethyl-3-hexene	"	156.15	157.07	38.68	38.70	.3447	.3449	1.0506	1.0502	119.	119.
trans-2,2- " -3- "	"										
cis-2,3- " -3- "	"	154.1	155.0	38.7	38.7	.345	.345	1.052	1.052	124.	124.
trans-2,3- " -3- "	"										
cis-2,4- " -3- "	"	157.2	158.0	38.9	38.9	.346	.346	1.052	1.052	124.	124.
trans-2,4- " -3- "	"										
cis-2,5- " -3- "	"	158.0	158.9	38.6	38.6	.344	.344	1.048	1.048	119.	119.
trans-2,5- " -3- "	"									121.	121.
cis-3,4- " -3- "	"	150.2	151.0	38.8	38.8	.346	.346	1.057	1.057	127.	127.
trans-3,4- " -3- "	"										

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b(Part 1).

[c] See footnote c of Table 9b (Part 1).

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TABLE 10b (Part 5) - MONOOLEFINS, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
2-n-Propyl-1-pentene	C_8H_{16}	154.98	155.89	38.69	38.71	0.3449	0.3450	1.0516	1.0512	123.	123.
2-Isopropyl-1- "	"	154.8	155.6	38.7	38.7	.345	.345	1.052	1.052	122.	122.
3-Methyl-2-ethyl-1-pentene	"	153.9	154.8	38.5	38.5	.343	.343	1.050	1.050	122.	122.
4- " -2- " -1- "	"	155.95	156.89	38.68	38.70	.3447	.3449	1.0508	1.0504	122.	122.
2- " -3- " -1- "	"	153.7	154.6	38.5	38.5	.343	.343	1.050	1.050	122.	122.
3- " -3- " -1- "	"	153.60	154.47	38.7	38.7	.345	.345	1.053	1.053	117.	117.
4- " -3- " -1- "	"	154.6	155.4	38.3	38.3	.342	.342	1.047	1.047	117.	117.
2,3,3-Trimethyl-1-pentene	"	152.2	153.1	38.4	38.4	.342	.342	1.050	1.050	122.	122.
2,3,4- " -1- "	"	153.9	154.8	38.6	38.6	.344	.344	1.051	1.051	122.	122.
2,4,4- " -1- "	"	156.93	157.86	38.76	38.78	.3455	.3456	1.0511	1.0506	122.	122.
3,3,4- " -1- "	"	153.9	154.8	38.5	38.5	.343	.343	1.050	1.050	117.	117.
3,4,4- " -1- "	"	156.1	156.9	38.9	38.9	.346	.346	1.053	1.053	117.	117.
2-Methyl-3-ethyl-2-pentene	"	151.8	152.7	38.9	38.9	.346	.346	1.056	1.056	127.	127.
cis-4-Methyl-3-ethyl-2-pentene	"	152.0	152.9	38.5	38.5	.343	.343	1.051	1.051	124.	124.
trans-4- " -3- " -2- "	"										
2,3,4-Trimethyl-2-pentene	"	150.94	151.82	38.79	38.81	.3457	.3459	1.0558	1.0554	127.	127.
2,4,4- " -2- "	"	155.59	156.50	39.04	39.07	.3480	.3481	1.0554	1.0550	125.	125.
cis-3,4,4-Trimethyl-2-pentene	"	151.8	152.7	38.7	38.7	.345	.345	1.054	1.054	124.	124.
trans-3,4,4- " -2- "	"										
3-Methyl-2-isopropyl-1-butene	"	155.4	156.3	38.4	38.4	.343	.343	1.048	1.048	122.	122.
3,3-Dimethyl-2-ethyl-1-butene	"	154.1	155.0	38.7	38.7	.345	.345	1.052	1.052	122.	122.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 8b (Part 1).

[c] See footnote c of Table 9b (Part 1).

TABLE 11b (Part 1) - DIOLEFINS, C_3 to C_5

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Propadiene (Allene)	C_3H_4	-	-	-	-	-	-	-	-	-	-
1,2-Butadiene	C_4H_6	83.0[c]	83.7[c]	-	-	-	-	-	-	-	-
1,3- "	"	87.08[c]	87.96[c]	-	-	-	-	-	-	-	-
1,2-Pentadiene	C_5H_8	98.4	99.1	25.0	25.0	0.367	0.367	1.075	1.074		
cis-1,3-Pentadiene(cis-Piperylene)	"	98.64	99.36	25.79	25.80	.3786	.3788	1.0907	1.0898	225.	225.
trans-1,3- " (trans- ")	"	100.70	101.45	26.01	26.03	.3818	.3821	1.0917	1.0909	225.	225.
1,4-Pentadiene	"	103.2	104.0	24.4	24.4	.358	.358	1.058	1.057		
2,3- "	"	103.	103.	24.	24.	.36	.36	1.06	1.06		
3-Methyl-1,2-butadiene	"	100.2	100.9	24.8	24.8	.365	.365	1.070	1.069		
2- " -1,3- " (Isoprene)	"	100.05	100.82	25.40	25.41	.3730	.3730	1.0812	1.0802	225.	225.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4(n_F-n_C)/d$, given above are believed to be uncertain by not more than 10 units, except as follows: 2-Methyl-1,3-butadiene (isoprene), ± 2 units.

[c] At saturation pressure.

TABLE 11b (Part 2) - DIOLEFINS, C_6

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound[c]	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
1,2-Hexadiene	C_6H_{10}	114.6	115.4	29.5	29.5	0.359	0.359	1.070	1.069		
cis-1,3-Hexadiene	"	116.5	117.3	30.6	30.6	.373	.373	1.086	1.085	225.	225.
trans-1,3- "	"										
cis-1,4- "	"	118.2	119.0	29.3	29.3	.357	.357	1.063	1.062		
trans-1,4- "	"										
1,5-Hexadiene	"	118.80	119.58	29.07	29.05	.3539	.3537	1.0585	1.0576		
2,3- "	"	120.8	121.7	29.0	29.0	.353	.353	1.055	1.054		
cis, cis-2,4-Hexadiene	"	114.1	114.9	30.7	30.7	.373	.373	1.090	1.089	225.	225.
cis, trans-2,4- "	"										
trans, trans-2,4- "	"										
3-Methyl-1,2-pentadiene	"	114.9	115.7	29.4	29.4	.358	.358	1.068	1.067		
4- " -1,2- "	"	116.0	116.8	29.6	29.6	.361	.361	1.070	1.069		
cis-2-Methyl-1,3-pentadiene	"	114.2	115.0	30.5	30.5	.371	.371	1.087	1.086	225.	225.
trans-2- " -1,3- "	"										
cis-3- " -1,3- "	"	111.8	112.5	30.2	30.2	.367	.367	1.085	1.084	225.	225.
trans-3- " -1,3- "	"										
4-Methyl-1,3-pentadiene	"	114.2	115.0	30.8	30.8	.375	.375	1.092	1.091	225.	225.
2- " -1,4- "	"	118.4	119.2	29.0	29.0	.353	.353	1.058	1.057		
3- " -1,4- "	"	118.2	119.0	29.0	29.0	.353	.353	1.058	1.057		
2- " -2,3- "	"	115.5	116.3	29.6	29.6	.360	.360	1.070	1.069		
2-Ethyl-1,3-butadiene	"	112.5	113.3	30.0	30.0	.365	.365	1.080	1.079	225.	225.
2,3-Dimethyl-1,3-butadiene	"	113.09	113.80	29.75	29.75	.3622	.3622	1.0759	1.0750	225.	225.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b. [b] See footnote b of Table 11b (Part 1).

[c] See footnote c of Table 9b (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 12b - ACETYLENES, C_2 to C_5

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945

Compound	Formula	Molecular Volume[a] V = M/d		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Ethyne (Acetylene)	C_2H_2	-	-	-	-	-	-	-	-	-	-
Propyne (Methylacetylene)	C_3H_4	-	-	-	-	-	-	-	-	-	-
1-Butyne (Ethylacetylene)	C_4H_6	83.[b]	83.[b]	-	-	-	-	-	-	-	-
2- " (Dimethylacetylene)	"	78.0	78.6	18.6	18.6	0.344	0.344	1.045	1.045		
1-Pentyne	C_5H_8	98.6	99.3	23.1	23.1	0.339	0.339	1.039	1.039		
2- "	"	95.84	96.55	23.43	23.45	.3440	.3443	1.0485	1.0481		
3-Methyl-1-butyne	"	102.4	103.2	23.6	23.6	.347	.347	1.045	1.045		

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere, unless otherwise indicated.

[b] At saturation pressure.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 13b - STYRENES, C_8 and C_9

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

June 30, 1945; May 31, 1947

Compound[c]	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2 - 1)/(n_D^2 + 2)$		Specific Refraction[a] $(1/d)(n_D^2 - 1)/(n_D^2 + 2)$		Refractivity Intercept[a] $n_D - d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
Styrene (Vinylbenzene; Phenylethylene).	C_8H_8	114.949	115.559	36.45	36.49	0.3500	0.3503	1.0939	1.0935	265.	265.
α-Methylstyrene (Isopropenylbenzene; 2-Phenyl-1-propene).	C_9H_{10}	129.77	130.40	40.63	40.65	.3438	.3440	1.0833	1.0827	265.	265.
cis-β-Methylstyrene (cis-Propenylbenzene; cis-1-Phenyl-1-propene).	"	129.7	130.3	41.0	41.0	.347	.347	1.090	1.089	265.	265.
trans-β-Methylstyrene (trans-Propenylbenzene; trans-1-Phenyl-1-propene). . . .	"										

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere.

[b] The absolute values of the specific dispersion, $10^4(n_F - n_C)/d$, given above are believed to be uncertain by not more than 3 units for styrene and 10 units for α-methylstyrene and β-methylstyrene.

[c] See footnote c of Table 9b (Part 1).

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TABLE 14b - ALKYL BENZENES, C_{10}

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

January 31, 1946; May 31, 1947

Compound	Formula	Molecular Volume[a] $V = M/d$		Molecular Refraction[a] $V(n_D^2-1)/(n_D^2+2)$		Specific Refraction[a] $(1/d)(n_D^2-1)/(n_D^2+2)$		Refractivity Intercept[a] $n_D-d/2$		Specific Dispersion[a,b] $10^4(n_F-n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Butylbenzene (1-Phenylbutane)	$C_{10}H_{14}$	156.037	156.777	45.094	45.121	0.33599	0.33619	1.05970	1.05936	159.	159.
Isobutylbenzene (1-Phenyl-2-methylpropane)	"	157.302	158.069	45.198	45.222	.33677	.33695	1.05984	1.05946	159.	159.
sec-Butylbenzene (2-Phenylbutane)	"	155.686	156.430	45.026	45.052	.33549	.33568	1.05916	1.05880	158.	158.
tert- " (2-Phenyl-2-methylpropane)	"	154.890	155.626	44.986	45.010	.33519	.33536	1.05939	1.05900	158.	158.
1-Methyl-2-propylbenzene	"	153.63	154.34	45.13	45.16	.3363	.3365	1.0625	1.0622	166.	166.
1- " -3- "	"	155.64	156.37	45.40	45.43	.3382	.3385	1.0639	1.0636	166.	166.
1- " -4- "	"	156.2	157.0	45.4	45.5	.338	.338	1.063	1.063	166.	166.
1-Methyl-2-isopropylbenzene (o-Cymene)	"	153.11	153.82	45.08	45.10	.3359	.3361	1.0623	1.0620	166.	166.
1- " -3- " (m- ")	"	155.88	156.63	45.30	45.33	.3375	.3377	1.0625	1.0622	166.	166.
1- " -4- " (p- ")	"	156.55	157.30	45.33	45.36	.3378	.3380	1.0622	1.0619	166.	166.
1,2-Diethylbenzene	"	152.43	153.12	45.07	45.10	.3358	.3360	1.0629	1.0626	166.	166.
1,3- "	"	155.32	156.04	45.32	45.34	.3377	.3378	1.0632	1.0628	166.	166.
1,4- "	"	155.72	156.44	45.40	45.43	.3383	.3385	1.0640	1.0636	166.	166.
1,2-Dimethyl-3-ethylbenzene	"	150.44	151.12	45.12	45.16	.3362	.3365	1.0656	1.0654	170.	170.
1,2- " -4- "	"	153.47	154.16	45.38	45.41	.3381	.3383	1.0658	1.0656	171.	171.
1,3- " -2- "	"	150.73	151.41	45.13	45.17	.3363	.3366	1.0655	1.0653	170.	170.
1,3- " -4- "	"	153.16	153.86	45.34	45.38	.3378	.3381	1.0656	1.0654	171.	171.
1,3- " -5- "	"	155.19	155.92	45.50	45.53	.3390	.3392	1.0657	1.0654	172.	172.
1,4- " -2- "	"	153.00	153.70	45.33	45.36	.3377	.3380	1.0657	1.0654	171.	171.
1,2,3,4-Tetramethylbenzene (Prehnitene)	"	148.25	148.88	45.08	45.12	.3359	.3362	1.0674	1.0673	174.	174.
1,2,3,5- " (Isodurene)	"	150.82	151.48	45.29	45.34	.3375	.3378	1.0676	1.0674	174.	174.
1,2,4,5- " (Durene)	"	151.0	151.7	45.3	45.4	.338	.338	1.067	1.067	174.	174.

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] The absolute values of the specific dispersion, $10^4 (n_F-n_C)/d$, given above are believed to be uncertain by not more than 4 units. The difference between any two values are believed to be uncertain by not more than 2 units in most cases. The specific dispersion probably decreases by 0.2 ± 0.2 unit from 20° to 25°C.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 15b - ALKYL CYCLOPENTANES, C_8

MOLECULAR VOLUME, MOLECULAR REFRACTION, SPECIFIC REFRACTION, REFRACTIVITY INTERCEPT, AND SPECIFIC DISPERSION

February 28, 1947

Compound	Formula	Molecular Volume[a] V=M/d		Molecular Refraction[a] $V(n_D^2-1)/(n_D^2+2)$		Specific Refraction[a] $(1/d)(n_D^2-1)/(n_D^2+2)$		Refractivity Intercept[a] $n_D-d/2$		Specific Dispersion[a,b] $10^4(n_F - n_C)/d$	
		20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C	20°C	25°C
		ml/mole		ml/mole		ml/g				ml/g	
n-Propylcyclopentane	C_8H_{16}	144.551	145.304	37.058	37.072	0.33026	0.33039	1.03814	1.03782	95.0	94.9
Isopropylcyclopentane	"	144.494	145.240	37.012	37.027	.32985	.32998	1.03758	1.03726	95.0	94.9
1-Methyl-1-ethylcyclopentane	"	143.685	144.468	36.904	36.920	.32889	.32904	1.03670	1.03639	96.0	95.9
cis-1-Methyl-2-ethylcyclopentane	"	142.92	143.67	36.88	36.89	.3287	.3288	1.0369	1.0366		
trans-1-Methyl-2-ethylcyclopentane	"	145.91	146.70	37.07	37.09	.3304	.3305	1.0374	1.0371		
cis-1-Methyl-3-ethylcyclopentane	"	145.3	146.1	36.8	36.8	.328	.328	1.034	1.034		
trans-1-Methyl-3-ethylcyclopentane	"	147.27	148.09	37.16	37.18	.3312	.3313	1.0376	1.0373		
1,1,2-Trimethylcyclopentane	"	145.249	146.072	36.984	37.004	.32960	.32978	1.03670	1.03642	96.9	96.8
1,1,3-Trimethylcyclopentane	"	149.961	150.833	37.246	37.263	.33194	.33209	1.03702	1.03670	98.4	98.3
cis,cis,cis-1,2,3-Trimethylcyclopentane	"	144.00	144.77	36.92	36.93	.3290	.3291	1.0367	1.0363		
cis,cis,trans-1,2,3-Trimethylcyclopentane	"	145.65	146.47	37.00	37.02	.3298	.3299	1.0367	1.0364		
cis,trans,cis-1,2,3-Trimethylcyclopentane	"	148.92	149.77	37.24	37.26	.3319	.3320	1.0376	1.0373		
cis,cis,cis-1,2,4-Trimethylcyclopentane	"	146.5	147.3	37.2	37.2	.332	.332	1.039	1.039		
cis,cis,trans-1,2,4-Trimethylcyclopentane	"	146.975	147.798	37.080	37.097	.33046	.33061	1.03682	1.03650	96.1	96.0
cis,trans,cis-1,2,4-Trimethylcyclopentane	"	150.157	151.016	37.249	37.263	.33196	.33209	1.03694	1.03659	97.3	97.2

[a] For air-saturated hydrocarbon in the liquid state at one atmosphere. See footnote a of Table 1b.

[b] See footnote b of Table 6b.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20c (Part 1) - NORMAL PARAFFINS, C_1 to C_5

VISCOSITY (ABSOLUTE)

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane	Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane
°C	Viscosity (absolute) in centipoises[b]					°C	Viscosity (absolute) in centipoises[b]				
-200						-50			0.228	0.355	0.484
-195						-45			.216	.335	.457
-190			13.8[c]			-40			.205[d]	.315	.432
-185	0.226[c]		8.78			-35				.298	.408
-180	.188		5.96			-30				.282	.385
-175	.161	0.985	4.26			-25				.267	.364
-170	.142	.805	3.18			-20				.253	.345
-165	.127	.673	2.46			-15				.241	.327
-160	.115[d]	.574	1.96			-10				.229	.309
-155		.500	1.60			-5				.219	.292
-150		.442	1.34			0				.210[d]	.2766
-145		.396	1.14			+5					.2625
-140		.359	0.984			10					.2496
-135		.328	.861			15					.2374
-130		.301	.762			20					.2259
-125		.278	.681			25					.2152
-120		.257	.614			30					.2052
-115		.238	.558			35					.1958
-110		.222	.510			40					.1868[d]
-105		.207	.469								
-100		.195	.433								
-95		.183	.402								
-90		.172	.374	0.63							
-85		.162[d]	.350	.58							
-80			.327	.536							
-75			.307	.497							
-70			.288	.462	0.62						
-65			.272	.431	.58						
-60			.256	.403	.54						
-55			.242	.378	.51						
-50			.228	.355	.484						

[a] Unless otherwise indicated.

[b] The values of absolute viscosity in this table are referred to a value of 1.005 centipoises for water at 20°C. This is the value used in the certification of standard viscosity samples by the National Bureau of Standards, and corresponds to the value for the kinematic viscosity of water at 20°C (68°F) recommended in ASTM Method D-445.

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20c (Part 2) - NORMAL PARAFFINS, C_6 to C_{10}

VISCOSITY (ABSOLUTE)

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane	Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane
°C	Viscosity (absolute) in centipoises[b]					°C	Viscosity (absolute) in centipoises[b]				
						+50	0.2295	0.3017	0.3888	0.4926	0.6148
						55	.2191	.2873	.3691	.4657	.5788
						60	.2096	.2740	.3509	.4412	.5462
						65	.2007	.2618	.3342	.4188	.5165
						70	.1923[d]	.2503	.3185	.3978	.4890
						75		.2397	.3042	.3788	.4641
-70	0.87	1.22				80		.2296	.2906	.3609	.4409
-65	.82	1.15				85		.2202	.2780	.3444	.4195
-60	.77	1.08	1.53[c]			90		.2113	.2662	.3288	.3996
-55	.72	1.02	1.44	2.04[c]		95		.2030	.2552	.3145	.3813
-50	.684	0.966	1.37	1.93		100		.1949[d]	.2446	.3007	.3638
-45	.646	.914	1.29	1.83		105			.235	.288	.348
-40	.611	.865	1.22	1.73		110			.225	.276	.333
-35	.578	.817	1.15	1.63		115			.216	.264	.318
-30	.545	.770	1.086	1.529	2.15[c]	120			.208	.254	.304
-25	.515	.725	1.020	1.430	2.00	125			.200	.243	.292
-20	.486	.682	0.955	1.332	1.852	130			.192[d]	.234	.280
-15	.459	.641	.892	1.235	1.704	135				.224	.268
-10	.432	.600	.828	1.138	1.556	140				.215	.257
-5	.406	.560	.768	1.047	1.417	145				.207	.247
0	.3827	.5251	.7142	0.9638	1.291	150				.199	.237
+5	.3616	.4928	.6651	.8896	1.180	155				.191[d]	.228
10	.3423	.4638	.6213	.8238	1.081	160					.219
15	.3243	.4370	.5816	.7649	0.9956	165					.210
20	.3077	.4127	.5458	.7129	.9204	170					.202
25	.2923	.3903	.5136	.6665	.8543	175					.194[d]
30	.2781	.3701	.4845	.6253	.7964						
35	.2648	.3512	.4578	.5878	.7444						
40	.2522	.3335	.4329	.5532	.6968						
45	.2405	.3171	.4102	.5218	.6540						
50	.2295	.3017	.3888	.4926	.6148						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c (Part 1)

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c (Part 3) - NORMAL PARAFFINS, C_{11} to C_{15}

VISCOSITY (ABSOLUTE)

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane	Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane
°C	Viscosity (absolute) in centipoises[b]					°C	Viscosity (absolute) in centipoises[b]				
						+100	0.4338	0.5110	0.5955	0.6877	0.7874
						105	.414	.486	.566	.652	.745
						110	.395	.463	.538	.619	.706
						115	.377	.442	.512	.588	.669
-30	3.02[c]					120	.360	.422	.488	.559	.636
-25	2.80					125	.345	.403	.465	.532	.605
-20	2.57					130	.330	.385	.444	.508	.576
-15	2.34					135	.316	.368	.424	.484	.549
-10	2.12	2.87[c]	3.86[c]			140	.303	.352	.405	.462	.523
-5	1.90	2.55	3.39			145	.290	.337	.388	.442	.500
0	1.717	2.268	2.975			150	.278	.323	.372	.423	.478
+5	1.551	2.023	2.621	3.372[c]	4.309[c]	155	.267	.310	.356	.405	.457
10	1.407	1.816	2.324	2.952	3.724	160	.256	.297	.341	.388	.437
15	1.283	1.639	2.074	2.605	3.248	165	.247	.286	.327	.372	.419
20	1.176	1.488	1.865	2.319	2.862	170	.237	.274	.314	.356	.401
25	1.082	1.358	1.689	2.081	2.544	175	.228	.263	.301	.342	.384
30	1.002	1.248	1.540	1.882	2.283	180	.219	.253	.289	.328	.369
35	0.9311	1.152	1.411	1.713	2.063	185	.211	.243	.278	.315	.355
40	.8668	1.066	1.298	1.566	1.873	190	.203	.234	.268	.303	.341
45	.8095	0.9902	1.199	1.437	1.710	195	.195	.226	.258	.292	.328
50	.7570	.9215	1.110	1.324	1.567	200	.188[d]	.217	.248	.281	.316
55	.7096	.8598	1.030	1.224	1.442						
60	.6668	.8046	0.9605	1.136	1.331						
65	.6284	.7551	.8980	1.058	1.235						
70	.5928	.7099	.8410	0.9870	1.149						
75	.5608	.6694	.7905	.9247	1.073						
80	.5311	.6320	.7440	.8676	1.003						
85	.5039	.5978	.7020	.8162	0.9412						
90	.4786	.5665	.6633	.7693	.8849						
95	.4556	.5379	.6284	.7271	.8345						
100	.4338	.5110	.5955	.6877	.7874						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c (Part 4) - NORMAL PARAFFINS, C_{16} to C_{20}

VISCOSITY (ABSOLUTE)

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane	Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane
°C	Viscosity (absolute) in centipoises[b]					°C	Viscosity (absolute) in centipoises[b]				
						+100	0.8952	1.011	1.134	1.267	1.408
						105	.846	0.953	1.068	1.190	1.320
						110	.800	.900	1.007	1.120	1.240
						115	.757	.850	0.950	1.055	1.166
						120	.718	.805	.898	0.997	1.101
						125	.682	.764	.851	.943	1.040
						130	.649	.726	.808	.894	0.985
						135	.617	.690	.766	.848	.933
						140	.588	.656	.729	.805	.885
						145	.561	.626	.694	.766	.841
						150	.536	.597	.662	.730	.801
						155	.512	.570	.632	.696	.764
						160	.490	.545	.603	.664	.728
+15	4.022[c]					165	.469	.521	.577	.635	.695
20	3.505	4.265[c]				170	.449	.499	.551	.606	.664
25	3.087	3.720	4.456[c]			175	.430	.477	.527	.580	.634
30	2.748	3.284	3.899	4.603[c]		180	.412	.458	.505	.555	.607
35	2.464	2.923	3.445	4.037	4.704[c]	185	.396	.439	.485	.533	.582
40	2.223	2.620	3.068	3.572	4.134	190	.380	.422	.465	.511	.558
45	2.018	2.364	2.754	3.187	3.667	195	.366	.405	.447	.491	.536
50	1.840	2.144	2.484	2.860	3.275	200	.352	.390	.430	.472	.515
55	1.685	1.954	2.253	2.581	2.943						
60	1.550	1.790	2.055	2.345	2.663						
65	1.432	1.647	1.885	2.143	2.424						
70	1.326	1.522	1.734	1.964	2.215						
75	1.234	1.411	1.603	1.811	2.036						
80	1.152	1.312	1.487	1.675	1.878						
85	1.077	1.225	1.384	1.555	1.739						
90	1.010	1.146	1.291	1.447	1.615						
95	0.9506	1.076	1.210	1.354	1.507						
100	.8952	1.011	1.134	1.267	1.408						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

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National Bureau of Standards Washington D. C.

TABLE 20c-E (Part 1) - NORMAL PARAFFINS, C_1 to C_5

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

May 31, 1947

Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane	Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane
°F	Kinematic viscosity in centistokes[b]					°F	Kinematic viscosity in centistokes[b]				
						-100			0.487	0.720	
						-90			.460	.670	0.85
						-80			.435	.626	.80
						-70			.412	.586	.75
						-60			.391	.551	.71
						-50			.372	.520	.668
						-40			.355[d]	.491	.632
						-30				.465	.598
-310			18.8[c]			-20				.441	.566
-300	0.485[c]		11.5			-10				.419	.536
-290	.405		7.62			0				.399	.508
-280	.349	1.42	5.36			+10				.382	.482
-270	.311	1.16	3.96			20				.366	.456
-260	.282	0.967	3.05			30				.353	.433
-250	.258[d]	.830	2.43			32				.350[d]	.428
-240		.728	1.99			40					.412
-230		.650	1.68			50					.392
-220		.588	1.435			60					.374
-210		.538	1.247			68					.361
-200		.496	1.099			70					.357
-190		.458	0.982			77					.346
-180		.426	.885			80					.342
-170		.397	.806			90					.327
-160		.372	.739			100					.313[d]
-150		.351	.682								
-140		.332	.633								
-130		.314	.590	0.91							
-120		.298[d]	.552	.84							
-110			.518	.78							
-100			.487	.720							

[a] Unless otherwise indicated.

[b] The values of kinematic viscosity in this table are referred to a value of 1.005 centipoises for the viscosity (absolute) of water at 20° C. This is the value used in the certification of standard viscosity samples by the National Bureau of Standards, and corresponds to the value for the kinematic viscosity of water at 20° C (68° F) recommended in ASTM Method D-445.

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20c-E (Part 2) - NORMAL PARAFFINS, C_6 to C_{10}

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

May 31, 1947

Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane	Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane
°F	Kinematic viscosity in centistokes[b]					°F	Kinematic viscosity in centistokes[b]				
						+100	0.401	0.511	0.645	0.807	1.001
						110	.383	.486	.611	.761	0.937
						120	.367	.463	.580	.718	.880
						130	.351	.442	.551	.679	.828
						140	.337	.422	.524	.643	.781
						150	.324	.405	.500	.611	.739
						160	.312[d]	.388	.478	.581	.700
-90	1.15	1.57				170		.373	.457	.554	.665
-80	1.08	1.48	2.05[c]			180		.359	.438	.529	.632
-70	1.02	1.40	1.93	2.68[c]		190		.345	.420	.506	.603
-60	0.959	1.32	1.82	2.54		200		.333	.404	.485	.576
-50	.906	1.25	1.72	2.40		210		.321[d]	.388	.465	.550
-40	.858	1.18	1.63	2.27		220			.374	.446	.527
-30	.811	1.11	1.54	2.14	2.96[c]	230			.360	.429	.505
-20	.766	1.05	1.44	2.00	2.77	240			.347	.412	.484
-10	.723	0.988	1.35	1.86	2.57	250			.334	.396	.464
0	.683	.928	1.266	1.728	2.36	260			.323[d]	.381	.446
+10	.644	.869	1.176	1.592	2.15	270				.367	.429
20	.606	.812	1.089	1.460	1.952	280				.354	.412
30	.572	.759	1.009	1.338	1.768	290				.341	.397
32	.565	.750	0.994	1.315	1.734	300				.329	.382
40	.540	.712	.937	1.230	1.607	310				.318[d]	.369
50	.512	.670	.874	1.136	1.466	320					.355
60	.486	.632	.818	1.052	1.346	330					.343
68	.467	.604	.777	0.993	1.261	340					.331
70	.462	.597	.767	.979	1.241	350					.319[d]
77	.446	.574	.735	.934	1.176						
80	.440	.566	.722	.915	1.150						
90	.420	.537	.682	.859	1.072						
100	.401	.511	.645	.807	1.001						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-E (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

TABLE 20c-E (Part 3) - NORMAL PARAFFINS, C_{11} to C_{15}

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

May 31, 1947

Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane	Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane
°F	Kinematic viscosity in centistokes[b]					°F	Kinematic viscosity in centistokes[b]				
						+200	0.676	0.788	0.910	1.042	1.187
						210	.645	749	.862	0.986	1.119
						220	.616	.713	.819	.934	1.058
						230	.588	.680	.780	.887	1.003
-20	3.84[c]					240	.563	.649	.742	.843	0.951
-10	3.53					250	.539	.620	.708	.803	.904
0	3.22					260	.517	.594	.677	.766	.861
+10	2.91	3.92[c]				270	.496	.569	.647	.731	.821
20	2.60	3.45	4.57[c]			280	.476	.545	.619	.698	.783
30	2.33	3.05	3.97			290	.457	.523	.593	.668	.748
32	2.28	2.97	3.86			300	.440	.502	.569	.640	.716
40	2.09	2.70	3.46	4.43[c]	5.63[c]	310	.424	.483	.547	.614	.686
50	1.882	2.40	3.04	3.84	4.80	320	.408	.464	.525	.590	.658
60	1.709	2.155	2.697	3.357	4.148	330	.393	.447	.505	.567	.632
68	1.588	1.987	2.465	3.040	3.724	340	.379	.431	.486	.544	.606
70	1.560	1.948	2.412	2.969	3.628	350	.366	.415	.468	.523	.582
77	1.469	1.822	2.243	2.740	3.324	360	.353	.400	.451	.504	.561
80	1.433	1.773	2.177	2.651	3.208	370	.341	.386	.435	.486	.540
90	1.325	1.626	1.980	2.391	2.868	380	.330	.373	.420	.469	.521
100	1.229	1.498	1.809	2.170	2.583	390	.319[d]	.361	.406	.453	.503
110	1.145	1.385	1.663	1.979	2.340	400		.349	.393	.438	.486
120	1.068	1.286	1.534	1.814	2.133						
130	1.000	1.196	1.419	1.670	1.954						
140	0.938	1.118	1.319	1.546	1.796						
150	.884	1.047	1.232	1.436	1.662						
160	.834	0.984	1.152	1.338	1.544						
170	.789	.928	1.082	1.252	1.438						
180	.748	.877	1.019	1.174	1.344						
190	.711	.830	0.962	1.105	1.261						
200	.676	.788	.910	1.042	1.187						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-E (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c-E (Part 4) - NORMAL PARAFFINS, C_{16} to C_{20}

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

May 31, 1947

Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane	Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane
°F	Kinematic viscosity in centistokes[b]					°F	Kinematic viscosity in centistokes[b]				
						+200	1.342	1.510	1.688	1.879	2.082
						210	1.263	1.417	1.580	1.755	1.941
						220	1.191	1.333	1.483	1.645	1.815
						230	1.126	1.257	1.396	1.546	1.702
						240	1.065	1.188	1.317	1.456	1.600
						250	1.011	1.126	1.246	1.374	1.508
						260	0.962	1.069	1.182	1.300	1.425
						270	.915	1.016	1.122	1.232	1.349
						280	.872	0.966	1.065	1.170	1.279
						290	.832	.921	1.014	1.113	1.215
						300	.796	.880	0.968	1.060	1.157
						310	.762	.841	.925	1.013	1.103
						320	.729	.805	.884	0.966	1.053
+60	5.10[c]					330	.700	.772	.847	.925	1.006
68	4.53					340	.671	.740	.811	.885	0.963
70	4.41	5.32[c]				350	.644	.709	.777	.848	.922
77	4.01	4.80				360	.620	.682	.747	.814	.885
80	3.86	4.61	5.47[c]	6.46[c]		370	.597	.656	.718	.783	.850
90	3.42	4.05	4.76	5.58	6.50[c]	380	.575	.632	.692	.753	.817
100	3.05	3.59	4.19	4.87	5.62	390	.555	.610	.667	.726	.787
110	2.748	3.21	3.72	4.29	4.92	400	.536	.589	.642	.701	.758
120	2.489	2.886	3.33	3.82	4.36						
130	2.267	2.614	3.00	3.42	3.88						
140	2.077	2.383	2.720	3.09	3.49						
150	1.912	2.183	2.484	2.808	3.16						
160	1.766	2.012	2.277	2.564	2.875						
170	1.641	1.862	2.100	2.358	2.634						
180	1.530	1.730	1.946	2.177	2.425						
190	1.430	1.613	1.808	2.017	2.241						
200	1.342	1.510	1.688	1.879	2.082						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-E (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

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TABLE 20c-K (Part 1) - NORMAL PARAFFINS, C_1 to C_5

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane	Temperature	Methane	Ethane	Propane	n-Butane	n-Pentane
°C	Kinematic viscosity in centistokes[b]					°C	Kinematic viscosity in centistokes[b]				
-200						-50			0.387	0.545	0.698
-195						-45			.370	.517	.664
-190			18.8[c]			-40			.355[d]	.491	.632
-185	0.495[c]		12.1			-35				.468	.601
-180	.418		8.24			-30				.446	.572
-175	.364	1.52	5.93			-25				.426	.545
-170	.325	1.25	4.45			-20				.407	.519
-165	.295	1.05	3.46			-15				.390	.495
-160	.272[d]	0.907	2.78			-10				.375	.471
-155		.796	2.28			-5				.362	.449
-150		.711	1.92			0				.350[d]	.4284
-145		.643	1.65			+5					.4096
-140		.588	1.435			10					.3924
-135		.542	1.264			15					.3762
-130		.504	1.126			20					.3607
-125		.469	1.015			25					.3464
-120		.438	0.922			30					.3330
-115		.411	.844			35					.3203
-110		.387	.778			40					.3081[d]
-105		.365	.721								
-100		.348	.671								
-95		.330	.628								
-90		.314	.590	.91							
-85		.299[d]	.555	.85							
-80			.524	.79							
-75			.496	.736							
-70			.470	.689	0.87						
-65			.447	.647	.82						
-60			.425	.609	.78						
-55			.406	.576	.74						
-50			.387	.545	.698						

[a] Unless otherwise indicated.

[b] The values of kinematic viscosity in this table are referred to a value of 1.005 centipoises for the viscosity (absolute) of water at 20°C. This is the value used in the certification of standard viscosity samples by the National Bureau of Standards, and corresponds to the value for the kinematic viscosity of water at 20°C (68°F) recommended in ASTM Method D-445.

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c-K (Part 2) - NORMAL PARAFFINS, C_6 to C_{10}
KINEMATIC VISCOSITY
FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]
MARCH 31, 1947

Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane	Temperature	n-Hexane	n-Heptane	n-Octane	n-Nonane	n-Decane
°C	Kinematic viscosity in centistokes[b]					°C	Kinematic viscosity in centistokes[b]				
						+50	0.3635	0.4589	0.5735	0.7096	0.8693
						55	.3497	.4400	.5479	.6748	.8229
						60	.3370	.4225	.5242	.6431	.7808
						65	.3252	.4065	.5024	.6141	.7426
						70	.3141[d]	.3914	.4819	.5868	.7071
						75		.3775	.4633	.5622	.6750
-70	1.18	1.61				80		.3643	.4456	.5390	.6450
-65	1.11	1.53				85		.3519	.4291	.5175	.6173
-60	1.05	1.45	2.00[c]			90		.3402	.4137	.4972	.5916
-55	0.998	1.37	1.90	2.64[c]		95		.3293	.3994	.4787	.5679
-50	0.948	1.30	1.80	2.51		100		.3186[d]	.3854	.4606	.5452
-45	.901	1.24	1.71	2.39		105			.372	.444	.524
-40	.858	1.18	1.63	2.27		110			.360	.429	.505
-35	.816	1.12	1.55	2.15		115			.348	.413	.486
-30	.774	1.062	1.464	2.026	2.81[c]	120			.337	.399	.468
-25	.736	1.006	1.381	1.904	2.63	125			.326	.386	.451
-20	.699	0.952	1.301	1.782	2.441	130			.316[d]	.373	.436
-15	.664	.899	1.221	1.660	2.256	135				.360	.420
-10	.629	.846	1.140	1.538	2.070	140				.348	.406
-5	.596	.795	1.064	1.422	1.895	145				.337	.392
0	.5649	.7495	.9939	1.315	1.734	150				.327	.379
+5	.5373	.7076	.9307	1.220	1.592	155				.317[d]	.367
10	.5120	.6700	.8742	1.136	1.466	160					.355
15	.4885	.6353	.8230	1.060	1.357	165					.344
20	.4666	.6037	.7768	0.9933	1.261	170					.333
25	.4464	.5745	.7352	.9336	1.176	175					.323[d]
30	.4277	.5483	.6976	.8807	1.102						
35	.4102	.5236	.6631	.8326	1.036						
40	.3936	.5005	.6309	.7879	0.9747						
45	.3781	.4791	.6014	.7474	.9197						
50	.3635	.4589	.5735	.7096	.8693						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-K (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c-K (Part 3) - NORMAL PARAFFINS, C_{11} to C_{15}

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane	Temperature	n-Undecane	n-Dodecane	n-Tridecane	n-Tetradecane	n-Pentadecane
°C	Kinematic viscosity in centistokes[b]					°C	Kinematic viscosity in centistokes[b]				
						+100	0.6386	0.7412	0.8533	0.975	1.106
						105	.613	.710	.815	.929	1.052
						110	.588	.680	.780	.887	1.003
						115	.565	.652	.746	.847	0.956
-30	3.90[c]					120	.544	.626	.715	.810	.913
-25	3.63					125	.523	.601	.686	.776	.873
-20	3.34					130	.504	.579	.659	.745	.836
-15	3.06					135	.486	.557	.633	.714	.801
-10	2.78	3.72[c]	4.97[c]			140	.468	.536	.608	.686	.768
-5	2.51	3.33	4.38			145	.452	.517	.586	.660	.738
0	2.276	2.973	3.863			150	.437	.498	.565	.635	.710
+5	2.065	2.664	3.418	4.362[c]	5.535[c]	155	.422	.481	.544	.612	.683
10	1.882	2.402	3.045	3.835	4.803	160	.408	.464	.525	.590	.658
15	1.725	2.178	2.729	3.400	4.207	165	.395	.449	.507	.569	.634
20	1.588	1.987	2.465	3.040	3.724	170	.382	.434	.490	.549	.611
25	1.469	1.822	2.243	2.740	3.324	175	.370	.419	.473	.530	.589
30	1.367	1.682	2.055	2.489	2.996	180	.358	.406	.457	.512	.569
35	1.276	1.560	1.891	2.276	2.720	185	.347	.393	.443	.495	.550
40	1.194	1.451	1.748	2.090	2.481	190	.336	.381	.429	.479	.532
45	1.121	1.354	1.623	1.927	2.275	195	.327	.370	.416	.464	.516
50	1.054	1.267	1.510	1.784	2.095	200	.317[d]	.359	.403	.450	.500
55	0.9933	1.188	1.408	1.657	1.937						
60	.9384	1.118	1.319	1.546	1.796						
65	.8891	1.054	1.240	1.447	1.675						
70	.8432	0.9964	1.167	1.356	1.566						
75	.8022	.9444	1.103	1.277	1.469						
80	.7640	.8966	1.043	1.204	1.380						
85	.7290	.8527	0.9896	1.139	1.302						
90	.6963	.8125	.9401	1.079	1.230						
95	.6668	.7759	.8954	1.025	1.166						
100	.6386	.7412	.8533	0.975	1.106						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-K (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

[d] For the liquid above the normal boiling point, at saturation pressure.

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TABLE 20c-K (Part 4) - NORMAL PARAFFINS, C_{16} to C_{20}

KINEMATIC VISCOSITY

FOR THE NORMAL LIQUID RANGE, AT ATMOSPHERIC PRESSURE[a]

March 31, 1947

Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane	Temperature	n-Hexadecane	n-Heptadecane	n-Octadecane	n-Nonadecane	n-Eicosane
°C	Kinematic viscosity in centistokes[b]					°C	Kinematic viscosity in centistokes[b]				
						+100	1.248	1.399	1.559	1.731	1.914
						105	1.184	1.326	1.476	1.634	1.803
						110	1.126	1.258	1.398	1.546	1.702
						115	1.071	1.195	1.325	1.463	1.608
						120	1.022	1.138	1.260	1.390	1.526
						125	0.976	1.085	1.200	1.321	1.449
						130	.934	1.037	1.146	1.259	1.379
						135	.893	0.990	1.093	1.200	1.313
						140	.856	.948	1.044	1.146	1.253
						145	.821	.909	1.000	1.097	1.197
						150	.789	.872	0.959	1.050	1.146
						155	.758	.838	.921	1.008	1.098
						160	.729	.805	.884	0.966	1.053
+15	5.177[c]					165	.703	.775	.851	.929	1.011
20	4.531	5.481[c]				170	.677	.746	.818	.893	0.971
25	4.008	4.801	5.721[c]			175	.652	.718	.787	.859	.934
30	3.583	4.257	5.027	5.906[c]		180	.630	.693	.759	.827	.899
35	3.227	3.805	4.461	5.202	6.035[c]	185	.608	.669	.733	.798	.867
40	2.924	3.425	3.990	4.622	5.325	190	.588	.646	.707	.770	.836
45	2.666	3.104	3.597	4.141	4.743	195	.569	.625	.684	.744	.808
50	2.442	2.828	3.258	3.732	4.254	200	.551	.606	.662	.721	.781
55	2.247	2.589	2.968	3.383	3.840						
60	2.077	2.383	2.720	3.087	3.489						
65	1.928	2.202	2.506	2.834	3.190						
70	1.793	2.045	2.316	2.609	2.928						
75	1.677	1.905	2.151	2.417	2.703						
80	1.573	1.780	2.005	2.246	2.505						
85	1.478	1.670	1.875	2.095	2.330						
90	1.393	1.570	1.757	1.958	2.174						
95	1.318	1.481	1.655	1.841	2.039						
100	1.248	1.399	1.559	1.731	1.914						

[a] Unless otherwise indicated.

[b] See footnote b of Table 20c-K (Part 1).

[c] Extrapolated value for the undercooled liquid below the normal melting point.

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TABLE 1k - PARAFFINS, C_1 to C_5

VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg

June 30, 1944

Pressure	Methane	Ethane	Propane	n-Butane	2-Methyl-propane (Isobutane)	n-Pentane	2-Methyl-butane (Isopentane)	2,2-Dimethyl-propane (Neopentane)
mm Hg	Temperature in °C							
10	-195.51	-142.88	-108.51	-77.76	-86.42	-50.1	-57.0	
20	-191.77	-136.69	-100.91	-68.93	-77.93	-40.2	-47.3	
30	-189.41	-132.74	-96.07	-63.30	-72.52	-33.93	-41.15	
40	-187.66 (solid)	-129.78	-92.44	-59.08	-68.45	-29.22	-36.52	
50	-186.25	-127.39	-89.51	-55.66	-65.16	-25.41	-32.77	
60	-185.06	-125.36	-87.02	-52.77	-62.37	-22.18	-29.60	
80	-183.12 [a]	-122.03	-82.94	-48.02	-57.79	-16.89	-24.39	
100	-181.45	-119.33	-79.63	-44.17	-54.07	-12.59	-20.16	
150	-178.09	-114.12	-73.26	-36.76	-46.91	-4.33	-12.02	
200	-175.55	-110.19	-68.43	-31.16	-41.49	+1.92	-5.86	
250	-173.47	-106.98	-64.51	-26.59	-37.06	7.01	-0.84	[b]
300	-171.69	-104.25	-61.17	-22.71	-33.30	11.34	+3.42	-13.85
400	-168.76	-99.74	-55.65	-16.29	-27.07	18.49	10.48	-7.11
500	-166.35	-96.05	-51.14	-11.04	-21.98	24.337	16.25	-1.59
600	-164.29	-92.90	-47.29	-6.57	-17.63	29.319	21.176	+3.11
700	-162.48	-90.14	-43.92	-2.65	-13.81	33.685	25.492	7.24
710	-162.31	-89.88	-43.60	-2.28	-13.46	34.094	25.896	7.63
720	-162.14	-89.63	-43.29	-1.92	-13.10	34.499	26.296	8.01
730	-161.98	-89.37	-42.98	-1.56	-12.75	34.899	26.692	8.39
740	-161.81	-89.12	-42.67	-1.20	-12.41	35.295	27.083	8.77
750	-161.65	-88.88	-42.37	-0.85	-12.06	35.687	27.471	9.14
760	-161.49	-88.63	-42.07	-0.50	-11.73	36.074	27.854	9.50
770	-161.33	-88.39	-41.77	-0.16	-11.39	36.458	28.234	9.87
780	-161.17	-88.15	-41.48	+0.19	-11.06	36.838	28.609	10.23
790	-161.02	-87.91	-41.19	0.52	-10.73	37.214	28.981	10.58
800	-160.86	-87.67	-40.90	0.86	-10.40	37.587	29.352	10.94
900	-159.39	-85.44	-38.17	4.04	-7.31	41.12	32.85	14.29
1000	-158.04	-83.38	-35.66	6.95	-4.47	44.37	36.06	17.36
1200	-155.6	-79.71	-31.2	12.2	+0.6	50.17	41.80	22.9
1500	-152.5	-75.00	-25.4	18.9	7.1	57.6	49.2	29.9

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C+t) \quad ; \quad t = B/(A-\log_{10} P) - C$$

(P in mm Hg ; t in °C)

Constants of the Antoine equation								
A	6.61184 7.69540(solid)	6.80266	6.82973	6.83029	6.74808	6.85221	6.80380	6.73812
B	389.93 532.20(solid)	656.40	813.20	945.90	882.80	1064.63	1027.25	950.84
C	266.00 275.00(solid)	256.00	248.00	240.00	240.00	232.000	234.000	237.00

[a] At the triple point, - 182.48 °C, the pressure is 87.7 mm Hg.

[b] At the triple point, - 16.6 °C, the pressure is 265.4 mm Hg.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2k (Part 1) - PARAFFINS, C_6
VAPOR PRESSURES AND BOILING POINTS, AT 10 TO 1500 mm Hg
March 31, 1944

Pressure	n-Hexane	2-Methyl-pentane	3-Methyl-pentane	2,2-Dimethyl-butane	2,3-Dimethyl-butane
mm Hg	Temperature in °C				
10	-25.0	-32.1	-30.1	-41.5	-34.9
20	-14.3	-21.6	-19.4	-31.1	-24.3
30	- 7.4	-14.8	-12.6	-24.5	-17.5
40	- 2.3	- 9.8	- 7.5	-19.5	-12.5
50	+ 1.85	- 5.7	- 3.4	-15.5	- 8.4
60	5.36	- 2.2	+ 0.13	-12.1	- 4.9
80	11.13	+ 3.46	5.87	- 6.5	+ 0.82
100	15.81	8.06	10.53	- 2.0	5.45
150	24.809	16.92	19.49	+ 6.79	14.36
200	31.611	23.626	26.261	13.41	21.099
250	37.148	29.086	31.778	18.81	26.590
300	41.854	33.727	36.467	23.405	31.259
400	49.633	41.402	44.222	31.009	38.984
500	55.988	47.675	50.559	37.230	45.299
600	61.402	53.022	55.960	42.538	50.685
700	66.147	57.709	60.694	47.194	55.406
710	66.591	58.148	61.137	47.630	55.848
720	67.030	58.582	61.576	48.062	56.285
730	67.465	59.012	62.010	48.489	56.718
740	67.895	59.437	62.439	48.911	57.147
750	68.321	59.858	62.864	49.329	57.571
760	68.742	60.274	63.284	49.743	57.990
770	69.159	60.686	63.700	50.153	58.405
780	69.572	61.094	64.112	50.558	58.816
790	69.981	61.498	64.520	50.960	59.223
800	70.385	61.897	64.924	51.357	59.626
900	74.23	65.70	68.76	55.14	63.45
1000	77.75	69.18	72.28	58.60	66.97
1200	84.05	75.41	78.57	64.80	73.24
1500	92.1	83.4	86.6	72.8	81.3

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C+t); \qquad t = B/(A-\log_{10} P) - C$$

(P in mm Hg; t in °C)

Constants of the Antoine equation					
A	6.87773	6.83907	6.84884	6.75480	6.80980
B	1171.530	1135.410	1152.368	1081.176	1127.187
C	224.366	226.572	227.129	229.343	228.900

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 2k (Part 2) PARAFFINS, C_7

VAPOR PRESSURES AND BOILING POINTS, AT 10 TO 1500 mm Hg

May 31, 1944

Pressure	n-Heptane	2-Methyl-hexane	3-Methyl-hexane	3-Ethyl-pentane	2,2-Dimethyl-pentane	2,3-Dimethyl-pentane	2,4-Dimethyl-pentane	3,3-Dimethyl-pentane	2,2,3-Trimethyl-butane
mm Hg	Temperature in °C								
10	-2.1	-9.1	-7.8	-6.8	-18.7	-10.3	-17.1	-14.4	-18.8
20	+9.49	+2.3	+3.6	+4.71	-7.5	+1.1	-5.9	-2.9	-7.5
30	16.84	9.5	10.9	12.03	-0.4	8.5	+1.2	+4.40	-0.2
40	22.351	14.9	16.4	17.52	+4.99	13.9	6.5	9.89	+5.22
50	26.807	19.3	20.8	21.960	9.31	18.4	10.8	14.33	9.63
60	30.573	23.0	24.5	25.714	12.97	22.1	14.5	18.08	13.35
80	36.758	29.1	30.6	31.880	18.98	28.3	20.5	24.253	19.47
100	41.773	34.1	35.6	36.882	23.860	33.3	25.4	29.260	24.443
150	51.411	43.60	45.19	46.497	33.244	42.88	34.73	38.893	34.004
200	58.696	50.79	52.42	53.768	40.346	50.12	41.81	46.184	41.242
250	64.625	56.65	58.32	59.688	46.131	56.03	47.57	52.123	47.140
300	69.663	61.62	63.32	64.719	51.049	61.06	52.48	57.172	52.154
400	77.988	69.85	71.60	73.036	59.187	69.37	60.58	65.524	60.452
500	84.787	76.57	78.37	79.830	65.839	76.16	67.21	72.352	67.236
600	90.579	82.29	84.13	85.620	71.511	81.94	72.85	78.174	73.021
700	95.653	87.31	89.19	90.692	76.483	87.02	77.80	83.278	78.094
710	96.128	87.78	89.66	91.168	76.949	87.49	78.27	83.756	78.570
720	96.598	88.24	90.13	91.637	77.410	87.96	78.72	84.228	79.039
730	97.063	88.70	90.59	92.102	77.866	88.42	79.18	84.696	79.505
740	97.523	89.15	91.05	92.563	78.317	88.88	79.63	85.159	79.965
750	97.978	89.60	91.50	93.018	78.763	89.34	80.07	85.617	80.420
760	98.428	90.05	91.95	93.468	79.205	89.79	80.51	86.071	80.871
770	98.874	90.49	92.39	93.914	79.642	90.24	80.95	86.520	81.317
780	99.315	90.93	92.83	94.355	80.075	90.68	81.38	86.964	81.758
790	99.752	91.36	93.27	94.793	80.504	91.11	81.80	87.404	82.196
800	100.185	91.79	93.70	95.225	80.928	91.55	82.22	87.839	82.629
900	104.29	95.85	97.79	99.334	84.96	95.65	86.23	91.98	86.74
1000	108.06	99.57	101.55	103.102	88.66	99.42	89.91	95.77	90.52
1200	114.79	106.2	108.3	109.84	95.27	106.2	96.5	102.56	97.27
1500	123.41	114.8	116.9	118.47	103.8	114.8	104.9	111.3	105.93

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C + t) \quad ; \quad t = B/(A - \log_{10} P) - C$$

(P in mm Hg ; t in °C)

Constants of the Antoine equation

A	6.90319	6.88017	6.86216	6.87306	6.81506	6.85785	6.84773	6.81810	6.79968
B	1268.586	1240.	1238.	1249.825	1190.298	1240.	1204.	1223.543	1204.997
C	216.954	220.	219.	219.595	223.343	222.	223.	224.687	226.615

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3k (Part 1) - PARAFFINS, C_8

VAPOR PRESSURES AND BOILING POINTS, AT 10 TO 1500 mm Hg

April 30, 1944

Pressure	n-Octane	2-Methyl-heptane	3-Methyl-heptane	4-Methyl-heptane	3-Ethyl-hexane	2,2-Dimethyl-hexane	2,3-Dimethyl-hexane	2,4-Dimethyl-hexane	2,5-Dimethyl-hexane
mm Hg	Temperature in °C								
10	19.2	12.3	13.3	12.4	12.8	3.1	9.9	5.2	5.3
20	31.5	24.4	25.4	24.5	25.0	15.0	22.1	17.2	17.2
30	39.28	32.16	33.15	32.23	32.68	22.54	29.78	24.77	24.74
40	45.13	37.93	38.94	38.00	38.48	28.21	35.56	30.47	30.42
50	49.849	42.607	43.627	42.671	43.162	32.798	40.242	35.087	35.020
60	53.840	46.556	47.586	46.616	47.123	36.678	44.198	38.985	38.906
80	60.393	53.041	54.088	53.096	53.628	43.052	50.696	45.391	45.291
100	65.706	56.298	59.359	58.349	58.903	48.224	55.967	50.586	50.470
150	75.914	68.399	69.491	68.447	69.043	58.171	66.100	60.578	60.429
200	83.628	76.034	77.150	76.080	76.709	65.697	73.764	68.136	67.961
250	89.905	82.247	83.384	82.293	82.949	71 826	80.003	74.290	74.094
300	95.237	87.524	88.680	87.571	88.251	77.037	85.306	79.521	79.306
400	104.048	96.245	97.434	96.295	97.015	85.654	94.072	88.171	87.925
500	111.240	103.366	104.583	103.418	104.173	92.697	101.233	95.239	94.967
600	117.367	109.431	110.673	109.488	110.271	98.701	107.336	101.263	100.969
700	122.732	114.743	116.009	114.804	115.614	103.963	112.684	106.543	106.228
710	123.235	115.241	116.508	115.302	116.114	104.456	113.185	107.037	106.721
720	123.732	115.733	117.002	115.794	116.609	104.944	113.680	107.526	107.208
730	124.223	116.219	117.491	116.282	117.099	105.426	114.170	108.010	107.690
740	124.710	116.701	117.975	116.764	117.583	105.903	114.655	108.489	108.167
750	125.191	117.178	118.454	117.241	118.062	106.375	115.135	108.963	108.639
760	125.667	117.649	118.927	117.712	118.537	106.843	115.610	109.432	109.106
770	126.139	118.116	119.396	118.180	119.006	107.305	116.080	109.896	109.568
780	126.605	118.577	119.860	118.642	119.471	107.763	116.545	110.355	110.026
790	127.067	119.035	120.320	119.100	119.931	108.217	117.006	110.810	110.479
800	127.525	119.488	120.774	119.553	120.387	108.666	117.462	111.260	110.927
900	131.87	123.79	125.09	123.86	124.71	112.93	121.79	115.54	115.19
1000	135.85	127.73	129.05	127.80	128.68	116.84	125.77	119.46	119.10
1200	142.96	134.77	136.13	134.86	135.77	123.84	132.87	126.47	126.08
1500	152.1	143.8	145.2	143.9	144.9	132.8	142.0	135.5	135.0

Above values calculated from the constants below and the Antoine equation:

$$\log_{10}P = A - B/(C + t) \quad ; \quad t = B/(A-\log_{10}P) - C$$

(P in mm Hg ; t in °C)

	Constants of the Antoine equation								
A	6.92374	6.91733	6.89942	6.90061	6.89095	6.83712	6.87000	6.85302	6.85980
B	1355.126	1337.468	1331.530	1327.661	1327.884	1273.594	1315.503	1287.876	1287.274
C	209.517	213.693	212.414	212.568	212.595	215.072	214.157	214.790	214.412

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 3k (Part 2) - PARAFFINS, C_8

VAPOR PRESSURES AND BOILING POINTS, AT 10 TO 1500 mm Hg

April 30, 1944

Pressure	3,3-Dimethylhexane	3,4-Dimethylhexane	2-Methyl-3-ethylpentane	3-Methyl-3-ethylpentane	2,2,3-Trimethylpentane	2,2,4-Trimethylpentane	2,3,3-Trimethylpentane	2,3,4-Trimethylpentane	2,2,3,3-Tetramethylbutane
mm Hg	Temperature in °C								
10	6.1	11.3	9.5	9.9	3.9	-4.3	6.9	7.1	13.5
20	18.2	23.5	21.7	22.3	16.0	+7.5	19.2	19.3	24.6
30	25.93	31.32	29.41	30.26	23.69	15.05	27.10	27.06	31.6
40	31.72	37.14	35.22	36.19	29.48	20.69	33.00	32.88	36.8
50	36.410	41.858	39.918	40.984	34.167	25.267	37.773	37.585	40.95
60	40.372	45.843	43.891	45.039	38.130	29.139	41.808	41.565	44.47
80	46.882	52.388	50.420	51.702	44.641	35.502	48.438	48.103	50.21
100	52.162	57.695	55.715	57.105	49.925	40.665	53.817	53.406	54.83
150	62.316	67.899	65.896	67.495	60.088	50.598	64.162	63.605	63.65
200	69.998	75.614	73.596	75.353	67.779	58.115	71.988	71.320	70.24
250	76.253	81.895	79.866	81.750	74.043	64.237	78.361	77.602	75.56
300	81.570	87.232	85.194	87.187	79.369	69.443	83.778	82.941	80.25
400	90.362	96.056	94.004	96.176	88.178	78.055	92.738	91.770	87.43
500	97.546	103.263	101.202	103.519	95.379	85.094	100.059	98.984	93.40
600	103.669	109.404	107.336	109.778	101.518	91.096	106.300	105.133	98.45 a
700	109.035	114.784	112.712	115.262	106.899	96.357	111.770	110.522	103.35
710	109.538	115.288	113.215	115.776	107.404	96.850	112.283	111.027	103.86
720	110.035	115.787	113.713	116.283	107.902	97.338	112.789	111.526	104.35
730	110.527	116.280	114.206	116.786	108.395	97.820	113.291	112.019	104.85
740	111.014	116.768	114.693	117.283	108.884	98.297	113.787	112.508	105.34
750	111.495	117.251	115.176	117.775	109.367	98.770	114.278	112.992	105.82
760	111.972	117.728	115.653	118.262	109.844	99.237	114.763	113.470	106.30
770	112.444	118.201	116.126	118.744	110.318	99.700	115.244	113.944	106.77
780	112.910	118.669	116.593	119.221	110.786	100.157	115.720	114.413	107.24
790	113.373	119.133	117.057	119.694	111.250	100.611	116.192	114.877	107.70
800	113.831	119.591	117.515	120.162	111.709	101.060	116.658	115.337	108.16
900	118.18	123.95	121.87	124.60	116.07	105.33	121.09	119.70	112.52
1000	122.17	127.95	125.86	128.68	120.07	109.24	125.16	123.71	116.51
1200	129.30	135.09	133.00	135.96	127.23	116.23	132.42	130.86	123.7
1500	138.4	144.2	142.2	145.3	136.4	125.21	141.7	140.0	132.8

(solid)

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C+t) \quad ; \quad t = B/(A-\log_{10} P) - C$$

(P in mm Hg ; t in °C)

Constants of the Antoine equation

A	6.85118	6.87982	6.86354	6.86727	6.82542	6.81984	6.84349	6.85392	6.87665 7.78882(solid)
B	1307.882	1330.035	1318.120	1347.209	1294.875	1262.490	1328.046	1315.084	1327.8 1625.7(solid)
C	217.439	214.863	215.306	219.684	218.420	221.271	220.375	217.526	226. 226.(solid)

[a] At the triple point , 100.58°C, the pressure is 647.0 mm Hg.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5k (Part 1) - ALKYL BENZENES, C_6 to C_8
VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg
June 30, 1944

Pressure	Benzene	Methyl-benzene (Toluene)	Ethyl-benzene	1,2-Dimethyl-benzene (o-Xylene)	1,3-Dimethyl-benzene (m-Xylene)	1,4-Dimethyl-benzene (p-Xylene)
mm Hg	Temperature in °C					
10	-11.5 (Solid)	6.37	25.90	32.11	28.26	27.30
20	- 2.8 (Solid)	18.39	38.62	45.11	41.09	40.14
30	+ 3.01 a	26.04	46.71	53.36	49,24	48.30
40	7.57	31.77	52.77	59.55	55.35	54.42
50	11.82	36.399	57.668	64.547	60.281	59.356
60	15.41	40.313	61.808	68.769	64.448	63.529
80	21.305	46.737	68.604	75.697	71.287	70.378
100	26.085	51.944	74.112	81.309	76.826	75.926
150	35.272	61.944	84.692	92.083	87.460	86.579
200	42.217	69.499	92.684	100.217	95.488	94.623
250	47.870	75.845	99.185	106.831	102.015	101.163
300	52.672	80.864	104.706	112.444	107.554	106.716
400	60.611	89.485	113.826	121.712	116.701	115.885
500	67.093	96.520	121.268	129.272	124.161	123.364
600	72.616	102.511	127.606	135.706	130.510	129.730
700	77.454	107.757	133.155	141.338	136.067	135.303
710	77.908	108.248	133.674	141.865	136.587	135.825
720	78.356	108.733	134.188	142.386	137.101	136.341
730	78.799	109.214	134.696	142.902	137.610	136.851
740	79.238	109.689	135.199	143.412	138.113	137.356
750	79.672	110.160	135.697	143.917	138.612	137.856
760	80.101	110.625	136.189	144.416	139.104	138.350
770	80.526	111.088	136.677	144.911	139.592	138.839
780	80.947	111.542	137.159	145.400	140.075	139.323
790	81.364	111.994	137.637	145.885	140.553	139.803
800	81.776	112.440	138.109	146.364	141.026	140.278
900	85.694	116.68	142.60	150.92	145.52	144.78
1000	89.286	120.57	146.71	155.09	149.63	148.91
1200	95.705	127.52	154.06	162.54	156.98	156.29
1500	103.93	136.42	163.48	172.07	166.39	165.73

Above values calculated from the constante below and the Antoine equation:

$$\log_{10} P = A - B/(C + t) \quad ; \quad t = B/(A - \log_{10} P) - C$$

(P in mm Hg ; t in °C)

Conetante of the Antoine equation						
A	6.89745 9.0963 (solid)	6.95334	6.95366	7.00289	7.00659	6.99099
B	1206.350 1882.0 (solid)	1343.943	1421.914	1477.519	1460.498	1453.840
C	220.237 244.0 (solid)	219.377	212.931	214.024	214.889	215.367

[a] At the triple point, 5.53°C, the preeeure is 35.8 mm Hg.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 5k (Part 2) - ALKYL BENZENES, C_9

VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg

June 30, 1944

Pressure	n-Propyl-benzene	Isopropyl-benzene	1-Methyl-2-ethyl-benzene	1-Methyl-3-ethyl-benzene	1-Methyl-4-ethyl-benzene	1,2,3-Trimethyl-benzene	1,2,4-Trimethyl-benzene	1,3,5-Trimethyl-benzene
mm Hg	Temperature in °C							
10	43.44	38.33	47.6	44.7	44.9	55.9	50.7	47.4
20	56.79	51.46	61.2	58.2	58.5	69.9	64.5	61.0
30	65.28	59.81	69.9	66.8	67.1	78.8	73.2	69.7
40	71.64	66.08	76.4	73.3	73.6	85.4	79.8	76.1
50	76.783	71.140	81.6	78.5	78.8	90.8	85.1	81.4
60	81.129	75.419	86.0	82.9	83.2	95.3	89.5	85.8
80	88.263	82.444	93.3	90.1	90.5	102.8	96.9	93.0
100	94.045	88.139	99.2	95.9	96.3	108.8	102.8	98.9
150	105.152	99.080	110.4	107.1	107.6	120.3	114.2	110.1
200	113.542	107.348	119.0	115.5	116.1	129.0	122.7	118.6
250	120.367	114.075	125.9	122.4	123.0	136.1	129.7	125.5
300	126.163	119.789	131.7	128.2	128.8	142.1	135.6	131.4
400	135.738	129.231	141.4	137.8	138.4	152.0	145.4	141.0
500	143.552	136.938	149.3	145.6	146.3	160.0	153.3	148.9
600	150.206	143.502	156.1	152.3	153.0	166.9	160.1	155.6
700	156.032	149.251	161.93	158.12	158.85	172.88	166.02	161.49
710	156.578	149.789	162.49	158.66	159.40	173.44	166.57	162.04
720	157.117	150.322	163.03	159.20	159.94	173.99	167.12	162.59
730	157.651	150.848	163.57	159.73	160.48	174.54	167.66	163.12
740	158.179	151.369	164.10	160.26	161.01	175.08	168.20	163.65
750	158.701	151.885	164.63	160.78	161.53	175.62	168.73	164.18
760	159.218	152.395	165.15	161.30	162.05	176.15	169.25	164.70
770	159.730	152.900	165.67	161.81	162.56	176.68	169.77	165.21
780	160.236	153.400	166.18	162.32	163.07	177.20	170.28	165.72
790	160.738	153.895	166.68	162.82	163.57	177.71	170.79	166.23
800	161.234	154.385	167.18	163.31	164.07	178.22	171.29	166.73
900	165.95	159.04	171.9	168.0	168.8	183.1	176.1	171.5
1000	170.27	163.30	176.3	172.3	173.1	187,5	180.4	175.8
1200	177.99	170.92	184.1	180.0	180.9	195.4	188.3	183.6
1500	187.87	180.69	194.0	189.9	190.7	205.5	198.2	193.5

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C + t) \quad ; \quad t = B/(A - \log_{10} P) - C$$

(P in mm Hg ; t in °C)

	Constants of the Antoine equation							
A	6.95175	6.92926	7.03460	7.05428	7.06730	7.10175	7.07938	7.04089
B	1491.548	1455.811	1566.60	1566.30	1582.70	1646.80	1609.10	1567.10
C	207.171	207.202	212.00	214.00	216.00	214.00	214.00	212.00

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TABLE 6k (Part 1) - ALKYL CYCLOPENTANES, C_5 to C_7
VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg
August 31, 1944

Pressure	Cyclopentane	Methyl-cyclopentane	Ethyl-cyclopentane
mm Hg	Temperature in °C		
10	-40.4	-23.7	-0.1
20	-30.1	-12.8	+11.7
30	-23.6	-5.8	19.3
40	-18.6	-0.6	25.0
50	-14.7	+3.64	29.6
60	-11.3	7.22	33.4
80	-5.8	13.10	39.8
100	-1.3	17.86	45.0
150	+7.28	27.027	54.9
200	13.78	33.958	62.4
250	19.08	39.601	68.5
300	23.574	44.397	73.7
400	31.007	52.327	82.3
500	37.079	58.806	89.4
600	42.252	64.328	95.3
700	46.785	69.166	100.58
710	47.209	69.620	101.07
720	47.629	70.068	101.56
730	48.044	70.511	102.04
740	48.455	70.950	102.51
750	48.862	71.384	102.98
760	49.264	71.814	103.45
770	49.663	72.239	103.91
780	50.057	72.660	104.37
790	50.447	73.077	104.82
800	50.834	73.490	105.27
900	54.50	77.41	109.5
1000	57.87	81.00	113.4
1200	63.88	87.43	120.4
1500	71.6	95.7	129.3

Above values calculated from the constants below and the Antoine equation

$\log_{10} P = A - B/(C + t)$; $t = B/(A - \log_{10} P) - C$

(P in mm Hg ; t in °C)

Constants of the Antoine equation			
A	6.88673	6.86280	6.86472
B	1124.162	1186.059	1286.60
C	231.361	226.042	219.50

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TABLE 7k (Part 1) - ALKYL CYCLOHEXANES, C_6 to C_8
VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg
August 31, 1944; March 31, 1947

Pressure	Cyclohexane	Methyl-cyclohexane	Ethyl-cyclohexane	1,1-Dimethyl-cyclohexane
mm Hg	Temperature in °C			
10		-3.2	20.6	10.1
20		+8.7	33.4	22.6
30	———a	16.30	41.50	30.55
40	6.69	21.99	47.58	36.53
50	11.01	26.592	52.503	41.361
60	14.67	30.485	56.665	45.449
80	20.672	36.882	63.501	52.169
100	25.543	42.072	69.044	57.622
150	34.912	52.057	79.704	68.115
200	42.000	59.612	87.766	76.058
250	47.772	65.766	94.329	82.530
300	52.678	70.998	99.907	88.033
400	60.792	79.652	109.128	97.138
500	67.422	86.725	116.661	104.582
600	73.074	92.756	123.081	110.930
700	78.028	98.042	128.706	116.496
710	78.492	98.537	129.233	117.018
720	78.950	99.027	129.754	117.533
730	79.405	99.511	130.270	118.044
740	79.854	99.990	130.780	118.549
750	80.299	100.465	131.284	119.048
760	80.738	100.934	131.784	119.543
770	81.174	101.400	132.278	120.032
780	81.604	101.859	132.767	120.516
790	82.032	102.315	133.253	120.997
800	82.454	102.766	133.732	121.472
900	86.47	107.05	138.29	125.98
1000	90.15	110.98	142.47	130.12
1200	96.73	118.01	149.94	137.53
1500	105.2	127.0	159.5	147.0

Above values calculated from the constants below and the Antoine equation:

$$\log_{10} P = A - B/(C + t) \quad ; \quad t = B/(A - \log_{10} P) - C$$

(P in mm Hg ; t in °C)

Constants of the Antoine equation				
A	6.84498	6.82689	6.87041	6.80225
B	1203.526	1272.864	1384.036	1323.861
C	222.863	221.630	215.128	218.053

[a] At the triple point, 6.56 °C, the pressure is 39.7 mm Hg.

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TABLE 7k (Part 2) - ALKYL CYCLOHEXANES, C_8

VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg

August 31, 1944; March 31, 1947 (Corrected)

Pressure	cis-1,2-Dimethyl-cyclohexane	trans-1,2-Dimethyl-cyclohexane	cis-1,3-Dimethyl-cyclohexane[a]	trans-1,3-Dimethyl-cyclohexane[b]	cis-1,4-Dimethyl-cyclohexane	trans-1,4-Dimethyl-cyclohexane
mm Hg	Temperature in °C					
10	18.4	13.0	11.2	14.9	14.5	10.1
20	31.1	25.6	23.6	27.4	27.1	22.6
30	39.25	33.66	31.57	35.42	35.10	30.54
40	45.34	39.70	37.53	41.41	41.10	36.51
50	50.266	44.580	42.347	46.258	45.958	41.341
60	54.430	48.711	46.421	50.355	50.063	45.425
80	61.273	55.498	53.116	57.087	56.810	52.136
100	66.824	61.005	58.547	62.549	62.283	57.581
150	77.500	71.596	68.992	73.054	72.810	68.057
200	85.577	79.609	76.895	81.002	80.775	75.985
250	92.155	86.136	83.330	87.474	87.262	82.442
300	97.746	91.683	88.800	92.976	92.776	87.932
400	106.933	100.859	97.847	102.077	101.897	97.014
500	114.550	108.357	105.240	109.513	109.350	104.437
600	120.992	114.750	111.542	115.853	115.704	110.766
700	126.638	120.353	117.066	121.410	121.274	116.315
710	127.167	120.878	117.583	121.931	121.795	116.835
720	127.690	121.396	118.094	122.445	122.311	117.349
730	128.208	121.910	118.601	122.954	122.822	117.857
740	128.720	122.419	119.102	123.459	123.327	118.360
750	129.227	122.921	119.598	123.957	123.827	118.859
760	129.728	123.419	120.088	124.450	124.321	119.351
770	130.224	123.912	120.574	124.939	124.811	119.839
780	130.715	124.399	121.054	125.422	125.295	120.321
790	131.202	124.882	121.530	125.901	125.776	120.800
800	131.683	125.360	122.001	126.375	126.250	121.273
900	136.26	129.90	126.48	130.88	130.77	125.77
1000	140.46	134.07	130.59	135.01	134.91	129.90
1200	147.96	141.51	137.92	142.40	142.31	137.28
1500	157.6	151.1	147.3	151.9	151.8	146.7

Above values calculated from the constants below and the Antoine equation:

$$\log_{10}P = A - B/(C + t) \quad ; \quad t = B/(A - \log_{10}P) - C$$

(P in mm Hg ; t in °C)

Constants of the Antoine equation

A	6.84164	6.83722	6.84293	6.83866	6.83699	6.82180
B	1369.525	1356.100	1340.658	1345.859	1347.794	1332.613
C	216.040	219.342	218.281	215.596	216.360	218.791

[a] Formerly labeled "trans"; see footnote d of Table 7a.

[b] Formerly labeled "cis"; see footnote e of Table 7a.

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TABLE 8k (Part 1) - MONOOLEFINS, C_2 to C_4
VAPOR PRESSURES AND BOILING POINTS, AT 10 to 1500 mm Hg
July 31, 1944; revised March 31, 1945

Pressure	Ethene (Ethylene)	Propene (Propylene)	1-Butene	cis-2-Butene	trans-2-Butene	2-Methyl-propene (Isobutene)
mm Hg	Temperature in °C					
10	-153.22	-112.11	-81.50	-73.42	-76.31	-81.95
20	-147.59	-104.75	-72.89	-64.58	-67.46	-73.37
30	-144.00	-100.06	-67.41	-58.94	-61.82	-67.90
40	-141.31	-96.55	-63.29	-54.72	-57.60	-63.79
50	-139.13	-93.70	-59.96	-51.305	-54.18	-60.472
60	-137.28	-91.29	-57.15	-48.416	-51.29	-57.664
80	-134.24	-87.33	-52.52	-43.672	-46.54	-53.051
100	-131.78	-84.12	-48.77	-39.824	-42.69	-49.309
150	-127.03	-77.95	-41.56	-32.426	-35.29	-42.111
200	-123.44	-73.27	-36.10	-26.831	-29.69	-36.666
250	-120.51	-69.46	-31.65	-22.276	-25.13	-32.231
300	-118.01	-66.23	-27.87	-18.405	-21.26	-28.462
400	-113.88	-60.87	-21.62	-12.005	-14.85	-22.227
500	-110.51	-56.50	-16.52	-6.776	-9.62	-17.133
600	-107.62	-52.76	-12.16	-2.321	-5.16	-12.789
700	-105.09	-49.49	-8.35	+1.584	-1.26	-8.983
710	-104.86	-49.18	-7.99	1.950	-0.89	-8.626
720	-104.62	-48.88	-7.64	2.311	-0.53	-8.274
730	-104.39	-48.58	-7.29	2.669	-0.17	-7.925
740	-104.16	-48.28	-6.94	3.023	+0.18	-7.580
750	-103.93	-47.99	-6.60	3.374	0.53	-7.238
760	-103.71	-47.70	-6.26	3.720	0.88	-6.900
770	-103.49	-47.41	-5.93	4.063	1.22	-6.565
780	-103.27	-47.13	-5.59	4.403	1.56	-6.234
790	-103.05	-46.85	-5.26	4.740	1.90	-5.906
800	-102.83	-46.57	-4.94	5.072	2.23	-5.581
900	-100.78	-43.91	-1.85	8.235	5.40	-2.497
1000	-98.90	-41.48	+0.99	11.135	8.30	+0.333
1200	-95.53	-37.13	6.06	16.319	13.49	5.391
1500	-91.20	-31.55	12.56	22.97	20.14	11.88

Above values calculated from the constants below and the Antoine equation:

$\log_{10}P = A - B/(C + t)$; $t = B/(A-\log_{10}P) - C$

(P in mm Hg ; t in °C)

	Constants of the Antoine equation					
A	6.74756	6.81960	6.84290	6.86926	6.86952	6.84134
B	585.00	785.00	926.10	960.10	960.80	923.20
C	255.00	247.00	240.00	237.000	240.00	240.000

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TABLE 1m - PARAFFINS, C_1 TO C_5
HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT
March 31, 1944; May 31, 1947

Compound	Formula	Normal Boiling Point	Heat of Vaporization ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn. press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
Methane	CH_4	-161.49	-	-	-	1.955	121.87	219.22	17.51
Ethane	C_2H_6	- 88.63				3.517	116.97	210.41	19.06
Propane	C_3H_8	- 42.07	3.605	81.76	147.07	4.487	101.76	183.05	19.42
n-Butane	C_4H_{10}	- 0.50	5.035	86.63	155.83	5.352	92.09	165.64	19.63
2-Methylpropane (Isobutane)	"	- 11.73	4.570	78.63	141.44	5.089	87.56	157.50	19.47
n-Pentane	C_5H_{12}	36.074	6.316	87.54	157.48	6.160	85.38	153.59	19.92
2-Methylbutane (Isopentane)	"	27.854	5.878	81.47	146.56	5.842	80.97	145.66	19.41
2,2-Dimethylpropane (Neopentane)	"	9.50	5.205	72.15	129.78	5.438	75.37	135.59	19.24

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature.

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National Bureau of Standards Washington, D. C.

TABLE 2m - PARAFFINS, C_6 AND C_7
HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT
March 31, 1944; May 31, 1947

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn. press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg-mole
n-Hexane	C_6H_{14}	68.742	7.540	87.50	157.40	6.896	80.03	143.96	20.17
2-Methylpentane	"	60.274	7.138	82.83	149.00	6.643	77.09	138.67	19.92
3- "	"	63.284	7.235	83.96	151.03	6.711	77.88	140.09	19.95
2,2-Dimethylbutane	"	49.743	6.617	76.79	138.13	6.287	72.96	131.24	19.47
2,3- "	"	57.990	6.960	80.77	145.29	6.519	75.65	136.08	19.68
n-Heptane	C_7H_{16}	98.428	8.735	87.18	156.82	7.575	75.60	135.99	20.38
2-Methylhexane	"	90.05	8.318	83.02	149.33	7.329	73.14	131.56	20.18
3- "	"	91.95	8.385	83.68	150.53	7.358	73.43	132.09	20.15
3-Ethylpentane	"	93.468	8.419	84.02	151.14	7.398	73.83	132.81	20.18
2,2-Dimethylpentane	"	79.205	7.751	77.36	139.15	6.969	69.55	125.11	19.78
2,3- "	"	89.79	8.184	81.68	146.92	7.262	72.48	130.38	20.01
2,4- "	"	80.51	7.860	78.44	141.11	7.050	70.36	126.56	19.93
3,3- "	"	86.071	7.892	78.76	141.68	7.085	70.71	127.19	19.72
2,2,3-Trimethylbutane	"	80.871	7.657	76.42	137.46	6.918	69.04	124.19	19.54

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature.

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TABLE 3m - PARAFFINS, C_8

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

March 31, 1944

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn.press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg. mole
n-Octane	C_8H_{18}	125.66	9.915	86.80	156.14	8.360	73.19	131.65	20.96
2-Methylheptane	"	117.64	9.483	83.02	149.34	8.03	70.3	126.5	20.55
3- "	"	118.92	9.520	83.35	149.92	8.14	71.3	128.2	20.76
4- "	"	117.71	9.482	83.01	149.32	8.100	70.91	127.56	20.72
3-Ethylhexane	"	118.53	9.475	82.95	149.21	8.19	71.7	129.0	20.91
2,2-Dimethylhexane	"	106.84	8.912	78.02	140.35	7.73	67.7	121.7	20.34
2,3- "	"	115.60	9.271	81.17	146.00	8.02	70.2	126.3	20.63
2,4- "	"	109.43	9.026	79.02	142.14	7.82	68.5	123.2	20.44
2,5- "	"	109.10	9.048	79.21	142.49	7.84	68.6	123.5	20.51
3,3- "	"	111.97	8.971	78.54	141.28	7.82	68.5	123.2	20.30
3,4- "	"	117.72	9.315	81.55	146.69	8.02	70.2	126.3	20.52
2-Methyl-3-ethylpentane	"	115.65	9.207	80.60	144.99	7.96	69.7	125.4	20.47
3- " -3- "	"	118.26	9.080	79.49	142.99	7.91	69.3	124.6	20.21
2,2,3-Trimethylpentane	"	109.84	8.823	77.24	138.95	7.69	67.3	121.1	20.08
2,2,4- "	"	99.24	8.396	73.50	132.22	7.410	64.87	116.69	19.90
2,3,3- "	"	114.76	8.895	77.87	140.08	7.78	68.1	122.5	20.06
2,3,4- "	"	113.47	9.012	78.90	141.92	7.810	68.37	122.99	20.20
2,2,3,3-Tetramethylbutane	"	106.30	10.24[b]	89.6[b]	161.3[b]	7.56	66.2	119.1	19.92

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature, unless otherwise indicated.

[b] Heat of sublimation, for the process, C_mH_n (solid) = C_mH_n (gas), at saturation pressure at the indicated temperature.

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TABLE 4m - PARAFFINS, C_9

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

March 31, 1945

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy at Vaporization, ΔSv, at satn.press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
n-Nonane	C_9H_{20}	150.80	11.099	86.54	155.67	9.030	70.41	126.65	21.30
2-Methyloctane	"	143.26	10.67	83.2	149.7	8.76	68.3	122.9	21.03
3- "	"	144.18	10.69	83.4	149.9	8.79	68.5	123.3	21.06
4- "	"	142.48	10.69	83.4	149.9	8.75	68.2	122.7	21.06
3-Ethylheptane	"	143.	10.71	83.5	150.2	8.78	68.5	123.1	21.10
4- "	"	142.	10.71	83.5	150.2	8.76	68.3	122.9	21.10
2,2-Dimethylheptane	"	130.5	10.10	78.8	141.7	8.31	64.8	116.6	20.58
2,3- "	"	140.7	10.46	81.6	146.7	8.63	67.3	121.0	20.84
2,4- "	"	133.	10.25	79.9	143.8	8.45	65.9	118.5	20.80
2,5- "	"	136.	10.25	79.9	143.8	8.51	66.4	119.3	20.80
2,6- "	"	135.21	10.24	79.8	143.6	8.49	66.2	119.1	20.80
3,3- "	"	137.3	10.19	79.5	142.9	8.44	65.8	118.4	20.55
3,4- "	"	143.	10.48	81.7	147.0	8.69	67.8	121.9	20.87
3,5- "	"	136.	10.27	80.1	144.0	8.52	66.4	119.5	20.83
4,4- "	"	138.	10.19	79.5	142.9	8.45	65.9	118.5	20.55
2-Methyl-3-ethylhexane	"	139.	10.48	81.7	147.0	8.60	67.1	120.6	20.87
2- " -4- "	"	136.	10.27	80.1	144.0	8.52	66.4	119.5	20.83
3- " -3- "	"	143.	10.28	80.2	144.2	8.54	66.6	119.8	20.53
3- " -4- "	"	143.	10.50	81.9	147.3	8.70	67.8	122.0	20.90
2,3,3-Trimethylhexane	"	134.	10.02	78.1	140.5	8.31	64.8	116.6	20.40
2,2,4- "	"	126.54	9.69	75.6	135.9	8.13	63.4	114.0	20.34
2,2,5- "	"	124.09	9.601	74.86	134.66	8.07	62.9	113.2	20.31
2,3,3- "	"	138.	10.09	78.7	141.5	8.36	65.2	117.3	20.34
2,3,4- "	"	140.	10.26	80.0	143.9	8.53	66.5	119.6	20.64
2,3,5- "	"	131.37	9.900	77.19	138.86	8.32	64.9	116.7	20.57
2,4,4- "	"	131.	9.76	76.1	136.9	8.20	63.9	115.0	20.29
3,3,4- "	"	139.	10.11	78.8	141.8	8.40	65.5	117.8	20.37
3,3-Diethylpentane	"	146.5	10.36	80.8	145.3	8.60	67.1	120.6	20.50
2,2-Dimethyl-3-ethylpentane	"	133.83	10.04	78.3	140.8	8.32	64.9	116.7	20.43
2,3- " -3- "	"	142.	10.17	79.3	142.6	8.44	65.8	118.4	20.32
2,4- " -3- "	"	136.73	10.26	80.0	143.9	8.46	66.0	118.7	20.64
2,2,3,3-Tetramethylpentane	"	140.23	9.80	76.4	137.4	8.43	65.7	118.2	20.38
2,2,3,4- "	"	133.01	9.80	76.4	137.4	8.19	63.9	114.9	20.17
2,2,4,4- "	"	122.28	9.11	71.0	127.8	7.85	61.2	110.1	19.86
2,3,3,4- "	"	141.54	9.98	77.8	140.0	8.35	65.1	117.1	20.13

[a] For the process, C_mH_n(liq.) = C_mH_n(gas), at saturation pressure at the indicated temperature.

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TABLE 5m - ALKYL BENZENES, C_6 TO C_9

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

June 30, 1944; revised March 31, 1945

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn. press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
Benzene	C_6H_6	80.10	8.090	103.57	186.31	7.353	94.14	169.34	20.81
Methylbenzene (Toluene)	C_7H_8	110.62	9.080	98.55	177.28	8.00	86.8	156.2	20.85
Ethylbenzene	C_8H_{10}	136.19	10.097	95.11	171.09	8.60	81.0	145.7	21.01
1,2-Dimethylbenzene (o-Xylene)	"	144.42	10.381	97.79	175.90	8.80	82.9	149.1	21.07
1,3- " (m- ")	"	139.10	10.195	96.03	172.75	8.70	82.0	147.4	21.10
1,4- " (p- ")	"	138.35	10.128	95.40	171.61	8.62	81.2	146.1	20.95
n-Propylbenzene	C_9H_{12}	159.22	11.049	91.93	165.37	9.14	76.0	136.8	21.14
Isopropylbenzene (Cumene)	"	152.40	10.789	89.77	161.48	8.97	74.6	134.3	21.08
1-Methyl-2-ethylbenzene	"	165.15	11.40	94.9	170.7	9.29	77.3	139.0	21.2
1- " -3- "	"	161.30	11.21	93.3	167.8	9.21	76.6	137.8	21.2
1- " -4- "	"	162.05	11.14	92.7	166.7	9.18	76.4	137.4	21.1
1,2,3-Trimethylbenzene (Hemimellitene)	"	176.15	11.725	97.56	175.49	9.57	79.6	143.2	21.3
1,2,4- " (Pseudocumene)	"	169.25	11.457	95.33	171.48	9.38	78.0	140.4	21.2
1,3,5- " (Mesitylene)	"	164.70	11.346	94.40	169.82	9.33	77.6	139.6	21.3

[a] For the process, C_mH_n(liq.) = C_mH_n(gas), at saturation pressure at the indicated temperature.

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TABLE 6m - ALKYL CYCLOPENTANES, C_5 to C_7

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

March 31, 1945

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn.press.[a]
		At 1 atm.	At 25° C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
Cyclopentane	C_5H_{10}	49.26	6.81	97.1	174.7	6.53	93.1	167.5	20.26
Methylcyclopentane	C_6H_{12}	71.81	7.560	89.83	161.59	7.00	83.2	149.6	20.30
Ethylcyclopentane	C_7H_{14}	103.45	8.70	88.6	159.4	7.69	78.3	140.9	20.42
1,1-Dimethylcyclopentane	"	87.5	8.10	82.5	148.4	7.32	74.6	134.1	20.3
cis-1,2-Dimethylcyclopentane	"	99.3	8.48	86.4	155.4	7.56	77.0	138.5	20.3
trans-1,2- "	"	91.9	8.24	83.9	151.0	7.41	75.5	135.8	20.3
cis-1,3- "	"								
trans-1,3- "	"	90.8	8.21	83.6	150.4	7.39	75.3	135.4	20.3

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature.

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TABLE 7m - ALKYL CYCLOHEXANES, C_6 to C_8

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

March 31, 1945; March 31, 1947

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn. pressure[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
Cyclohexane	C_6H_{12}	80.74	7.895	93.81	168.75	7.19	85.4	153.7	20.30
Methylcyclohexane	C_7H_{14}	100.94	8.451	86.07	154.83	7.58	77.2	138.9	20.26
Ethylcyclohexane	C_8H_{16}	131.79	9.673	86.21	155.07	8.29	73.9	132.9	20.47
1,1-Dimethylcyclohexane	"	119.54	9.043	80.59	144.97	7.88	70.2	126.3	20.06
cis-1,2-Dimethylcyclohexane	"	129.73	9.492	84.59	152.17	8.18	72.9	131.1	20.29
trans-1,2- "	"	123.42	9.167	81.70	146.96	7.98	71.1	127.9	20.13
cis-1,3-[b] "	"	120.09	9.136	81.42	146.46	7.96	70.9	127.6	20.25
trans-1,3-[c] "	"	124.45	9.368	83.49	150.18	8.09	72.1	129.7	20.35
cis-1,4- "	"	124.32	9.328	83.13	149.54	8.07	71.9	129.4	20.30
trans-1,4- "	"	119.35	9.052	80.67	145.11	7.90	70.4	126.6	20.12

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature.

[b] Formerly labeled "trans"; see footnote d of Table 7a.

[c] Formerly labeled "cis"; see footnote e of Table 7a.

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TABLE 8m (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT AND ENTROPY OF VAPORIZATION, AT 25°C AND THE NORMAL BOILING POINT

March 31, 1945

Compound	Formula	Normal Boiling Point	Heat of Vaporization, ΔHv, at saturation pressure[a]						Entropy of Vaporization, ΔSv, at satn.press.[a]
		At 1 atm.	At 25°C			At Normal Boiling Point			At Normal Boiling Point
		°C	kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb	cal/deg mole
Ethene (Ethylene)	C_2H_4	-103.71	-	-	-	3.237	115.39	207.56	19.10
Propene (Propylene)	C_3H_6	-47.70	-	-	-	4.402	104.62	118.19	19.52
1-Butene	C_4H_8	-6.25	4.87	86.8	156.1	5.238	93.36	167.93	19.62
cis-2-Butene	"	3.72	5.30	94.5	169.9	5.580	99.46	178.91	20.15
trans-2- "	"	0.88	5.15	91.8	165.1	5.439	96.94	174.37	19.85
2-Methylpropene (Isobutene)	"	-6.90	4.92	87.7	157.7	5.286	94.22	169.48	19.85

[a] For the process, C_mH_n (liq.) = C_mH_n (gas), at saturation pressure at the indicated temperature.

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TABLE On - H_2, C , CO

HEATS OF COMBUSTION, AT 25°C [a]

April 30, 1945; May 31, 1945

Compound	Formula	State	Reaction	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure [b]		
				kcal/mole	cal/g	BTU/lb
Hydrogen.	H_2	gas	$H_2(gas) + \frac{1}{2} O_2(gas) = H_2O$ (liq.[c])	68.3174	33887.6	60957.7
Hydrogen.	H_2	gas	$H_2(gas) + \frac{1}{2} O_2(gas) = H_2O$ (gas)	57.7979	28669.6	51571.4
Carbon.	C	solid, graphite	$C(solid, graphite) + O_2(gas) = CO_2(gas)$	94.0518	7831.1	14086.8
Carbon monoxide	CO	gas	$CO(gas) + \frac{1}{2} O_2(gas) = CO_2(gas)$	67.6361	2414.7	4343.6

[a] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values, in order to retain the significance of certain differences.

[b] $-\Delta Hc^\circ$ represents the heat evolved in the combustion of the given compound in the state indicated, in gaseous oxygen to form the products indicated, at 25°C and constant pressure, with all the reactants and products in their appropriate standard reference states.

[c] liq. = liquid.

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TABLE 1n - PARAFFINS, C_1 TO C_5

HEATS OF COMBUSTION, AT 25°C [a]

March 31, 1944; April 30, 1945

Compound	Formula	State[b]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[c]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Methane	CH_4	gas	212.798	13265.1	23861.	191.759	11953.6	21502.
Ethane	C_2H_6	gas	372.820	12399.2	22304.	341.261	11349.6	20416.
Propane	C_3H_8	gas	530.605	12033.5	21646.	488.527	11079.2	19929.
"	"	liq.[d]	526.782	11946.8	21490.	484.704	10992.5	19774.
n-Butane	C_4H_{10}	gas	687.982	11837.3	21293.	635.384	10932.3	19665.
"	"	liq.[d]	682.844	11748.9	21134.	630.246	10843.9	19506.
2-Methylpropane (Isobutane)	"	gas	686.342	11809.1	21242.	633.744	10904.1	19614.
"	"	liq.[d]	681.625	11727.9	21096.	629.027	10822.9	19468.
n-Pentane	C_5H_{12}	gas	845.16	11714.6	21072.	782.04	10839.7	19499.
"	"	liq.	838.80	11626.4	20914.	775.68	10751.5	19340.
2-Methylbutane (Isopentane)	"	gas	843.24	11688.0	21025.	780.12	10813.1	19451.
"	"	liq.	837.31	11605.6	20877.	774.19	10730.9	19303.
2,2-Dimethylpropane (Neopentane)	"	gas	840.49	11649.8	20956.	777.37	10775.0	19382.
"	"	liq.[d]	835.18	11576.2	20824.	772.06	10701.4	19250.

[a] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the significance of the small differences between the liquid and gaseous states and, to a lesser extent, between isomers.

[b] liq. = liquid.

[c] $-\Delta Hc^o$ represents the heat evolved in the combustion of the given hydrocarbon, in the state indicated, in gaseous oxygen to form gaseous carbon dioxide and gaseous or liquid water, as indicated, at 25°C and constant pressure, with all the reactants and products in their appropriate standard reference states, unless otherwise indicated.

[d] At saturation pressure.

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TABLE 2n - PARAFFINS, C_6 AND C_7
HEATS OF COMBUSTION, AT 25°C [a]
March 31, 1944; April 30, 1945

Compound	Formula	State [b]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form [c]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
n-Hexane	C_6H_{14}	gas	1002.57	11634.5	20928.	928.93	10780.0	19391.
"	"	liq.	995.01	11546.8	20771.	921.37	10692.2	19233.
2-Methylpentane	"	gas	1000.87	11614.8	20893.	927.23	10760.2	19356.
"	"	liq.	993.71	11531.7	20743.	920.07	10677.1	19206.
3-Methylpentane	"	gas	1001.51	11622.2	20906.	927.87	10767.6	19369.
"	"	liq.	994.25	11538.0	20755.	920.61	10683.4	19218.
2,2-Dimethylbutane	"	gas	998.17	11583.5	20837.	924.53	10728.9	19299.
"	"	liq.	991.52	11506.3	20698.	917.88	10651.7	19161.
2,3-Dimethylbutane	"	gas	1000.04	11605.2	20876.	926.40	10750.6	19338.
"	"	liq.	993.05	11524.0	20730.	919.41	10669.5	19192.
n-Heptane	C_7H_{16}	gas	1160.01	11577.2	20825.	1075.85	10737.2	19314.
"	"	liq.	1151.27	11489.9	20668.	1067.11	10650.0	19157.
2-Methylhexane	"	gas	1158.30	11560.1	20795.	1074.14	10720.2	19284.
"	"	liq.	1149.97	11477.0	20645.	1065.81	10637.0	19134.
3-Methylhexane	"	gas	1158.94	11566.5	20806.	1074.78	10726.6	19295.
"	"	liq.	1150.55	11482.8	20655.	1066.39	10642.8	19145.
3-Ethylpentane	"	gas	1159.56	11572.7	20817.	1075.40	10732.7	19306.
"	"	liq.	1151.13	11488.6	20666.	1066.97	10648.6	19155.
2,2-Dimethylpentane	"	gas	1155.61	11533.3	20746.	1071.45	10693.3	19235.
"	"	liq.	1147.85	11455.8	20607.	1063.69	10615.9	19096.
2,3-Dimethylpentane	"	gas	1157.28	11549.9	20776.	1073.12	10710.0	19265.
"	"	liq.	1149.09	11468.2	20629.	1064.93	10628.3	19118.
2,4-Dimethylpentane	"	gas	1156.60	11543.1	20764.	1072.44	10703.2	19253.
"	"	liq.	1148.73	11464.6	20623.	1064.57	10624.7	19112.
3,3-Dimethylpentane	"	gas	1156.73	11544.4	20766.	1072.57	10704.5	19255.
"	"	liq.	1148.83	11465.6	20625.	1064.67	10625.7	19114
2,2,3-Trimethylbutane	"	gas	1155.94	11536.6	20752.	1071.78	10696.6	19241.
"	"	liq.	1148.27	11460.0	20614.	1064.11	10620.1	19104.

[a] See footnote a of Table 1n. [b] liq. = liquid. [c] See footnote c of Table 1n.

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TABLE 3n - PARAFFINS, C_8

HEATS OF COMBUSTION, AT 25°C [a]

March 31, 1944; April 30, 1945

Compound	Formula	State [b]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form [c]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
n-Octane	C_8H_{18}	gas	1317.45	11533.9	20747.	1222.77	10705.0	19256.
"	"	liq.	1307.53	11447.1	20591.	1212.85	10618.2	19100.
2-Methylheptane	"	gas	1315.76	11519.1	20721.	1221.08	10690.2	19230.
"	"	liq.	1306.28	11436.1	20572.	1211.60	10607.2	19080.
3-Methylheptane	"	gas	1316.44	11525.1	20732.	1221.76	10696.2	19240.
"	"	liq.	1306.92	11441.7	20582.	1212.24	10612.8	19091.
4-Methylheptane	"	gas	1316.57	11526.2	20734.	1221.89	10697.3	19243.
"	"	liq.	1307.09	11443.2	20584.	1212.41	10614.3	19093.
3-Ethylhexane	"	gas	1316.87	11528.8	20738.	1222.19	10699.9	19247.
"	"	liq.	1307.39	11445.8	20589.	1212.71	10616.9	19098.
2,2-Dimethylhexane	"	gas	1313.56	11499.9	20686.	1218.88	10671.0	19195.
"	"	liq.	1304.64	11421.8	20546.	1209.96	10592.9	19055.
2,3-Dimethylhexane	"	gas	1316.13	11522.4	20727.	1221.45	10693.5	19236.
"	"	liq.	1306.86	11441.2	20581.	1212.18	10612.3	19090.
2,4-Dimethylhexane	"	gas	1314.83	11511.0	20706.	1220.15	10682.1	19215.
"	"	liq.	1305.80	11431.9	20564.	1211.12	10603.0	19073.
2,5-Dimethylhexane	"	gas	1314.05	11504.2	20694.	1219.37	10675.3	19203.
"	"	liq.	1305.00	11424.9	20551.	1210.32	10596.0	19060.
3,3-Dimethylhexane	"	gas	1314.65	11509.4	20703.	1219.97	10680.5	19212.
"	"	liq.	1305.68	11430.9	20562.	1211.00	10602.0	19071.
3,4-Dimethylhexane	"	gas	1316.36	11524.4	20730.	1221.68	10695.5	19239.
"	"	liq.	1307.04	11442.8	20583.	1212.36	10613.9	19092.
2-Methyl-3-ethylpentane	"	gas	1316.79	11528.1	20737.	1222.11	10699.2	19246.
"	"	liq.	1307.58	11447.5	20592.	1212.90	10618.6	19101.
3-Methyl-3-ethylpentane	"	gas	1315.88	11520.2	20723.	1221.20	10691.3	19232.
"	"	liq.	1306.80	11440.7	20580.	1212.12	10611.8	19089.
2,2,3-Trimethylpentane	"	gas	1314.66	11509.5	20703.	1219.98	10680.6	19212.
"	"	liq.	1305.83	11432.2	20564.	1211.15	10603.3	19073.
2,2,4-Trimethylpentane	"	gas	1313.69	11501.0	20688.	1219.01	10672.1	19197.
"	"	liq.	1305.29	11427.5	20556.	1210.61	10598.6	19065.
2,3,3-Trimethylpentane	"	gas	1315.54	11517.2	20717.	1220.86	10688.3	19226.
"	"	liq.	1306.64	11439.3	20577.	1211.96	10610.4	19086.
2,3,4-Trimethylpentane	"	gas	1315.29	11515.0	20713.	1220.61	10686.1	19222.
"	"	liq.	1306.28	11436.1	20572.	1211.60	10607.2	19080.
2,2,3,3-Tetramethylbutane	"	gas	1313.27	11497.3	20682.	1218.59	10668.4	19191.
"	"	solid	1303.03	11407.7	20520.	1208.35	10578.8	19029.

[a] See footnote a of Table 1n. [b] liq. = liquid; solid = crystalline solid. [c] See footnote c of Table 1n.

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TABLE 5n - ALKYL BENZENES, C_6 to C_9
HEATS OF COMBUSTION, AT 25°C
March 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]: H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Benzene	C_6H_6	gas	789.08	10102.4	18172.	757.52	9698.4	17446.
"	"	liq.	780.98	9998.7	17986.	749.42	9594.7	17259.
Methylbenzene (Toluene)	C_7H_8	gas	943.58	10241.4	18422.	901.50	9784.7	17601.
"	"	liq.	934.50	10142.8	18245.	892.42	9686.1	17424.
Ethylbenzene	C_8H_{10}	gas	1101.13	10372.4	18658.	1048.53	9876.9	17767.
"	"	liq.	1091.03	10277.2	18487.	1038.43	9781.7	17596.
1,2-Dimethylbenzene (o-Xylene)	"	gas	1098.54	10348.0	18614.	1045.94	9852.5	17723.
"	"	liq.	1088.16	10250.2	18438.	1035.56	9754.7	17547.
1,3-Dimethylbenzene (m-Xylene)	"	gas	1098.12	10344.0	18607.	1045.52	9848.5	17716.
"	"	liq.	1087.92	10247.9	18434.	1035.32	9752.4	17543.
1,4-Dimethylbenzene (p-Xylene)	"	gas	1098.29	10345.6	18610.	1045.69	9850.1	17719.
"	"	liq.	1088.16	10250.2	18438.	1035.56	9754.7	17547.
n-Propylbenzene	C_9H_{12}	gas	1258.24	10469.1	18832.	1195.12	9943.9	17887.
"	"	liq.	1247.19	10377.2	18667.	1184.07	9852.0	17722.
Isopropylbenzene (Cumene)	"	gas	1257.31	10461.4	18818.	1194.19	9936.2	17873.
"	"	liq.	1246.52	10371.6	18657.	1183.40	9846.4	17712.
1-Methyl-2-ethylbenzene	"	gas	1256.66	10456.0	18808.	1193.54	9930.8	17864.
"	"	liq.	1245.26	10361.1	18638.	1182.14	9835.9	17693.
1-Methyl-3-ethylbenzene	"	gas	1255.92	10449.8	18797.	1192.80	9924.6	17853.
"	"	liq.	1244.71	10356.5	18630.	1181.59	9831.3	17685.
1-Methyl-4-ethylbenzene	"	gas	1255.59	10447.1	18792.	1192.47	9921.9	17848.
"	"	liq.	1244.45	10354.4	18626.	1181.33	9829.2	17681.
1,2,3-Trimethylbenzene (Hemimellitene)	"	gas	1254.08	10434.5	18770.	1190.96	9909.3	17825.
"	"	liq.	1242.36	10337.0	18594.	1179.24	9811.8	17650.
1,2,4-Trimethylbenzene (Pseudocumene)	"	gas	1253.04	10425.8	18754.	1189.92	9900.7	17809.
"	"	liq.	1241.58	10330.5	18583.	1178.46	9805.3	17638.
1,3,5-Trimethylbenzene (Mesitylene)	"	gas	1252.53	10421.6	18747.	1189.41	9896.4	17802.
"	"	liq.	1241.19	10327.2	18577.	1178.07	9802.1	17632.

[a] liq. = liquid

[b] See footnote c of Table 1n.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 9n (Part 1) - MONOOLEFINS, C_2 to C_5

HEAT OF COMBUSTION, AT 25°C

October 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Ethene (Ethylene)	C_2H_4	gas	337.234	12021.7	21625.	316.195	11271.7	20276.
Propene (Propylene)	C_3H_6	gas	491.987	11692.3	21032.	460.428	10942.3	19683.
1-Butene	C_4H_8	gas	649.757	11581.3	20833.	607.679	10831.3	19484.
"	"	liq.						
cis-2-Butene	"	gas	648.115	11552.0	20780.	606.037	10802.0	19431.
"	"	liq.						
trans-2-Butene	"	gas	647.072	11533.4	20747.	604.994	10783.4	19397.
"	"	liq.						
2-Methylpropene (Isobutene)	"	gas	646.134	11516.7	20716.	604.056	10766.7	19367.
"	"	liq.						
1-Pentene	C_5H_{10}	gas	806.85	11505.1	20696.	754.25	10755.1	19346.
"	"	liq.						
cis-2-Pentene	"	gas	805.34	11483.5	20657.	752.74	10733.5	19308.
"	"	liq.						
trans-2- Pentene	"	gas.	804.26	11468.1	20629.	751.66	10718.1	19280.
"	"	liq.						
2-Methyl-1-butene	"	gas.	803.17	11452.6	20601.	750.57	10702.6	19252.
"	"	liq.						
3-Methyl-1-butene	"	gas	804.93	11477.7	20646.	752.33	10727.7	19297.
"	"	liq.						
2-Methyl-2-butene	"	gas	801.68	11431.3	20563.	749.08	10681.3	19214.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8n (Part 2) - MONOOLEFINS, C_6

HEAT OF COMBUSTION, AT 25° C.

October 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^{\circ}$, at 25°C and constant pressure, to form[b]: H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
1-Hexene	C_6H_{12}	gas	964.26	11458.0	20611.	901.14	10708.0	19262.
"	"	liq.						
cis-2-Hexene	"	gas	962.66	11439.0	20577.	899.54	10689.0	19228.
"	"	liq.						
trans-2-Hexene	"	gas	961.66	11427.1	20555.	898.54	10677.1	19206.
"	"	liq.						
cis-3-Hexene	"	gas	962.66	11439.0	20577.	899.54	10689.0	19228.
"	"	liq.						
trans-3-Hexene	"	gas	961.66	11427.1	20555.	898.54	10677.1	19206.
"	"	liq.						
2-Methyl-1-pentene	"	gas	960.66	11415.2	20534.	897.54	10665.2	19185.
"	"	liq.						
3-Methyl-1-pentene	"	gas	963.20	11445.4	20588.	900.08	10695.4	19239.
"	"	liq.						
4-Methyl-1-pentene	"	gas	962.56	11437.8	20575.	899.44	10687.8	19225.
"	"	liq.						
2-Methyl-2-pentene	"	gas	959.26	11398.6	20504.	896.14	10648.6	19155.
"	"	liq.						
cis (?)-3-Methyl-2-pentene	"	gas	959.90	11406.2	20518.	896.78	10656.2	19169.
"	"	liq.						
trans (?)-3-Methyl-2-pentene	"	gas	959.90	11406.2	20518.	896.78	10656.2	19169.
"	"	liq.						
cis(?)-4-Methyl-2-pentene	"	gas	960.96	11418.8	20540.	897.84	10668.8	19191.
"	"	liq.						
trans (?)-4-Methyl-2-pentene	"	gas	959.96	11406.9	20519.	896.84	10656.9	19170.
"	"	liq.						
2-Ethyl-1-butene	"	gas	961.30	11422.8	20548.	898.18	10672.8	19198.
"	"	liq.						
2,3-Dimethyl-1-butene	"	gas	959.44	11400.7	20508.	896.32	10650.7	19159.
"	"	liq.						
3-3-Dimethyl-1-butene	"	gas	959.97	11407.0	20519.	896.85	10657.0	19170.
"	"	liq.						
2,3-Dimethyl-2-butene	"	gas	958.31	11387.3	20484.	895.19	10637.3	19135.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 9n (Part 1) - MONOOLEFINS, C_7

HEAT OF COMBUSTION, AT 25°C

October 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
1-Heptene	C_7H_{14}	gas	1121.69	11424.6	20551.	1048.05	10674.6	19202.
"	"	liq.						
cis-2-Heptene	"	gas	1120.09	11408.3	20522.	1046.45	10658.3	19172.
"	"	liq.						
trans-2-Heptene	"	gas	1119.09	11398.1	20503.	1045.45	10648.1	19154.
"	"	liq.						
cis-3-Heptene	"	gas	1120.09	11408.3	20522.	1046.45	10658.3	19172.
"	"	liq.						
trans-3-Heptene	"	gas	1119.09	11398.1	20503.	1045.45	10648.1	19154.
"	"	liq.						
2-Methyl-1-hexene	"	gas	1118.08	11387.8	20485.	1044.44	10637.8	19136.
"	"	liq.						
3-Methyl-1-hexene	"	gas	1120.62	11413.7	20531.	1046.98	10663.7	19182.
"	"	liq.						
4-Methyl-1-hexene	"	gas	1120.62	11413.7	20531.	1046.98	10663.7	19182.
"	"	liq.						
5-Methyl-1-hexene	"	gas	1119.98	11407.2	20520.	1046.34	10657.2	19170.
"	"	liq.						
2-Methyl-2-hexene	"	gas	1116.68	11373.6	20459.	1043.04	10623.6	19110.
"	"	liq.						
cis-3-Methyl-2-hexene	"	gas	1117.32	11380.1	20471.	1043.68	10630.1	19122.
"	"	liq.						
trans-3-Methyl-2-hexene	"	gas	1117.32	11380.1	20471.	1043.68	10630.1	19122.
"	"	liq.						
cis-4-Methyl-2-hexene	"	gas	1119.02	11397.4	20502.	1045.38	10647.4	19153.
"	"	liq.						
trans-4-Methyl-2-hexene	"	gas	1118.02	11387.2	20484.	1044.38	10637.2	19134.
"	"	liq.						
cis-5-Methyl-2-hexene	"	gas	1118.38	11390.9	20490.	1044.74	10640.9	19141.
"	"	liq.						
trans-5-Methyl-2-hexene	"	gas	1117.38	11380.7	20472.	1043.74	10630.7	19123.
"	"	liq.						
cis-2-Methyl-3-hexene	"	gas	1118.38	11390.9	20490.	1044.74	10640.9	19141.
"	"	liq.						
trans-2-Methyl-3-hexene	"	gas	1117.38	11380.7	20472.	1043.74	10630.7	19123.
"	"	liq.						
cis-3-Methyl-3-hexene	"	gas	1117.32	11380.1	20471.	1043.68	10630.1	19122.
"	"	liq.						
trans-3-Methyl-3-hexene	"	gas	1117.32	11380.1	20471.	1043.68	10630.1	19122.
"	"	liq.						

[a] liq. = liquid.

[b] See footnote c of Table 1n.

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National Bureau of Standards, Washington, D. C.

TABLE 9n (Part 2) - MONOOLEFINS, C_7

HEAT OF COMBUSTION AT 25°C

October 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
2-Ethyl-1-pentene	C_7H_{14}	gas	1118.72	11394.3	20496.	1045.08	10644.4	19147.
"	"	liq.						
3-Ethyl-1-pentene	"	gas	1121.24	11420.0	20542.	1047.60	10670.0	19193.
"	"	liq.						
2,3-Dimethyl-1-pentene	"	gas	1117.06	11377.4	20466.	1043.42	10627.4	19117.
"	"	liq.						
2,4-Dimethyl-1-pentene	"	gas	1116.38	11370.5	20454.	1042.74	10620.5	19104.
"	"	liq.						
3,3-Dimethyl-1-pentene	"	gas	1118.41	11391.2	20491.	1044.77	10641.2	19142.
"	"	liq.						
3,4-Dimethyl-1-pentene	"	gas	1118.96	11396.8	20501.	1045.32	10646.8	19152.
"	"	liq.						
4,4-Dimethyl-1-pentene	"	gas	1117.29	11379.8	20470.	1043.65	10629.8	19121.
"	"	liq.						
3-Ethyl-2-pentene	"	gas	1117.94	11386.4	20482.	1044.30	10636.4	19133.
"	"	liq.						
2,3-Dimethyl-2-pentene	"	gas	1115.46	11361.1	20437.	1041.82	10611.2	19088.
"	"	liq.						
2,4-Dimethyl-2-pentene	"	gas	1114.98	11356.3	20428.	1041.34	10606.3	19079.
"	"	liq.						
cis-3,4-Dimethyl-2-pentene	"	gas	1115.66	11363.2	20440.	1042.02	10613.2	19091.
"	"	liq.						
trans-3,4-Dimethyl-2-pentene	"	gas	1115.66	11363.2	20440.	1042.02	10613.2	19091.
"	"	liq.						
cis-4,4-Dimethyl-2-pentene	"	gas	1115.69	11363.5	20441.	1042.05	10613.5	19092.
"	"	liq.						
trans-4,4-Dimethyl-2-pentene	"	gas	1114.69	11353.3	20422.	1041.05	10603.3	19073.
"	"	liq.						
3-Methyl-2-ethyl-1-butene	"	gas	1117.06	11377.4	20466.	1043.42	10627.4	19117.
"	"	liq.						
2,3,3-Trimethyl-1-butene	"	gas	1115.72	11363.8	20441.	1042.08	10613.8	19092.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 12n - ACETYLENES, C_2 to C_5
HEAT OF COMBUSTION, AT 25°C
March 31, 1946

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Ethyne (Acetylene)	C_2H_2	gas	310.615	11930.2	21460.	300.096	11526.2	20734.
"	"	liq.						
Propyne (Methylacetylene). . .	C_3H_4	gas.	463.109	11559.8	20794.	442.070	11034.6	19849.
" . . .	"	liq.						
1-Butyne (Ethylacetylene). . .	C_4H_6	gas	620.86	11478.7	20648.	589.302	10895.2	19599.
" . . .	"	liq.						
2-Butyne (Dimethylacetylene) .	"	gas	616.533	11398.7	20504.	584.974	10815.2	19455.
" .	"	liq.						
1-Pentyne.	C_5H_8	gas	778.03	11422.5	20547.	735.95	10804.7	19436.
"	"	liq.						
2-Pentyne.	"	gas	774.33	11368.2	20449.	732.25	10750.4	19338.
"	"	liq.						
3-Methyl-1-butyne.	"	gas	776.13	11394.6	20497.	734.05	10776.8	19386.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20n - NORMAL PARAFFINS, C_1 to C_{20}
HEAT OF COMBUSTION, AT 25°C
December 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Methane	CH_4	gas	212.798	13265.1	23861.	191.759	11953.6	21502.
"	"	liq.						
Ethane	C_2H_6	gas	372.820	12399.2	22304.	341.261	11349.6	20416.
"	"	liq.						
Propane	C_3H_8	gas	530.605	12033.5	21646.	488.527	11079.2	19929.
"	"	liq.[c]	526.782	11946.8	21490.	484.704	10992.5	19774.
n-Butane	C_4H_{10}	gas	687.982	11837.3	21293.	635.384	10932.3	19665.
"	"	liq.[c]	682.844	11748.9	21134.	630.246	10843.9	19506.
n-Pentane	C_5H_{12}	gas	845.16	11714.6	21072.	782.04	10839.7	19499.
"	"	liq.	838.80	11626.4	20914.	775.68	10751.5	19340.
n-Hexane	C_6H_{14}	gas	1002.57	11634.5	20928.	928.93	10780.0	19391.
"	"	liq.	995.01	11546.8	20771.	921.37	10692.2	19233.
n-Heptane	C_7H_{16}	gas	1160.01	11577.2	20825.	1075.85	10737.2	19314.
"	"	liq.	1151.27	11489.9	20668.	1067.11	10650.0	19157.
n-Octane	C_8H_{18}	gas	1317.45	11533.9	20747.	1222.77	10705.0	19256.
"	"	liq.	1307.53	11447.1	20591.	1212.85	10618.2	19100.
n-Nonane	C_9H_{20}	gas	1474.90	11500.2	20687.	1369.70	10680.0	19211.
"	"	liq.	1463.80	11413.6	20531.	1358.60	10593.4	19056.
n-Decane	$C_{10}H_{22}$	gas	1632.34	11473.0	20638.	1516.63	10659.7	19175.
"	"	liq.	1620.06	11386.7	20483.	1504.35	10573.4	19020.
n-Undecane	$C_{11}H_{24}$	gas	1789.78	11450.8	20598.	1663.55	10643.2	19145.
"	"	liq.	1776.32	11364.7	20443.	1650.09	10557.0	18990.
n-Dodecane	$C_{12}H_{26}$	gas	1947.23	11432.2	20564.	1810.48	10629.4	19120.
"	"	liq.	1932.59	11346.3	20410.	1795.84	10543.4	18966.
n-Tridecane	$C_{13}H_{28}$	gas	2104.67	11416.5	20536.	1957.40	10617.6	19099.
"	"	liq.	2088.85	11330.6	20382.	1941.58	10531.8	18945.
n-Tetradecane	$C_{14}H_{30}$	gas	2262.11	11402.9	20512.	2104.32	10607.5	19081.
"	"	liq.	2245.11	11317.2	20358.	2087.32	10521.8	18927.
n-Pentadecane	$C_{15}H_{32}$	gas	2419.55	11391.2	20491.	2251.24	10598.7	19065.
"	"	liq.	2401.37	11305.6	20337.	2233.06	10513.2	18911.
n-Hexadecane	$C_{16}H_{34}$	gas	2577.00	11380.9	20472.	2398.17	10591.1	19052.
"	"	liq.	2557.64	11295.4	20318.	2378.81	10505.6	18898.
n-Heptadecane	$C_{17}H_{36}$	gas	2734.44	11371.8	20456.	2545.09	10584.3	19039.
"	"	liq.	2713.90	11286.4	20302.	2524.55	10498.9	18886.
n-Octadecane	$C_{18}H_{38}$	gas	2891.88	11363.7	20441.	2692.01	10578.3	19028.
"	"	liq.	2870.16	11278.4	20288.	2670.29	10493.0	18875.
n-Nonadecane	$C_{19}H_{40}$	gas	3049.33	11356.5	20428.	2838.94	10572.9	19019.
"	"	liq.	3026.43	11271.2	20275.	2816.04	10487.7	18865.
n-Eicosane	$C_{20}H_{42}$	gas	3206.77	11350.0	20416.	2985.86	10568.1	19010.
"	"	liq.	3182.69	11264.7	20263.	2961.78	10482.8	18857.

[a] liq.- liquid

[b] See footnote c of Table 1n.

[c] At saturation pressure.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

TABLE 21n - NORMAL ALKYL BENZENES, C_6 to C_{22}

HEAT OF COMBUSTION, AT 25°C

December 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Benzene	C_6H_6	gas	789.08	10102.4	18172.	757.52	9698.4	17446.
"	"	liq.	780.98	9998.7	17986.	749.42	9594.7	17259.
Methylbenzene (Toluene)	C_7H_8	gas	943.58	10241.4	18422.	901.50	9784.7	17601.
"	"	liq.	934.50	10142.8	18245.	892.42	9686.1	17424.
Ethylbenzene	C_8H_{10}	gas	1101.13	10372.4	18658.	1048.53	9876.9	17767.
"	"	liq.	1091.03	10277.2	18487.	1038.43	9781.7	17596.
n-Propylbenzene	C_9H_{12}	gas	1258.24	10469.1	18832.	1195.12	9943.9	17887.
"	"	liq.	1247.19	10377.2	18667.	1184.07	9852.0	17722.
n-Butylbenzene	$C_{10}H_{14}$	gas	1415.44	10546.3	18971.	1341.80	9997.6	17984.
"	"	liq.	1403.46	10457.0	18810.	1329.82	9908.4	17823.
n-Amylbenzene	$C_{11}H_{16}$	gas	1572.88	10610.5	19086.	1488.72	10042.8	18065.
"	"	liq.						
n-Hexylbenzene	$C_{12}H_{18}$	gas	1730.33	10663.7	19182.	1635.65	10080.2	18132.
"	"	liq.						
n-Heptylbenzene	$C_{13}H_{20}$	gas	1887.77	10708.3	19262.	1782.58	10111.6	18189.
"	"	liq.						
n-Octylbenzene	$C_{14}H_{22}$	gas	2045.21	10746.4	19331.	1929.50	10138.4	18237.
"	"	liq.						
n-Nonylbenzene	$C_{15}H_{24}$	gas	2202.66	10779.3	19390.	2076.43	10161.5	18279.
"	"	liq.						
n-Decylbenzene	$C_{16}H_{26}$	gas	2360.10	10807.9	19441.	2223.35	10181.7	18315.
"	"	liq.						
n-Undecylbenzene	$C_{17}H_{28}$	gas	2517.54	10833.1	19487.	2370.27	10199.4	18347.
"	"	liq.						
n-Dodecylbenzene	$C_{18}H_{30}$	gas	2674.98	10855.4	19527.	2517.19	10215.0	18375.
"	"	liq.						
n-Tridecylbenzene	$C_{19}H_{32}$	gas	2832.43	10875.3	19563.	2664.12	10229.1	18400.
"	"	liq.						
n-Tetradecylbenzene	$C_{20}H_{34}$	gas	2989.87	10893.2	19595.	2811.04	10241.6	18423.
"	"	liq.						
n-Pentadecylbenzene	$C_{21}H_{36}$	gas	3147.31	10909.3	19624.	2957.96	10253.0	18443.
"	"	liq.						
n-Hexadecylbenzene	$C_{22}H_{38}$	gas	3304.76	10924.0	19650.	3104.89	10263.3	18462.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

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TABLE 22n - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}
HEAT OF COMBUSTION, AT 25°C
March 31, 1946

Compound	Formula	State	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Cyclopentane	C_5H_{10}	gas	793.39	11313.1	20350.	740.79	10563.1	19001.
"	"	liq.	786.54	11215.5	20175.	733.94	10465.4	18825.
Methylcyclopentane	C_6H_{12}	gas	948.72	11273.4	20279.	885.60	10523.3	18930.
"	"	liq.	941.14	11183.3	20117.	878.02	10433.2	18768.
Ethylcyclopentane	C_7H_{14}	gas	1106.21	11266.9	20267.	1032.57	10516.9	18918.
"	"	liq.	1097.50	11178.2	20108.	1023.86	10428.2	18758.
n-Propylcyclopentane	C_8H_{16}	gas	1263.56	11260.9	20256.	1179.40	10510.8	18907.
"	"	liq.	1253.74	11173.4	20099.	1169.58	10423.3	18750.
n-Butylcyclopentane	C_9H_{18}	gas	1421.10	11257.7	20250.	1326.42	10507.6	18901.
"	"	liq.	1410.10	11170.5	20094.	1315.42	10420.5	18745.
n-Pentylcyclopentane	$C_{10}H_{20}$	gas	1578.54	11254.4	20245.	1473.34	10504.4	18895.
"	"	liq.						
n-Hexylcyclopentane	$C_{11}H_{22}$	gas	1735.99	11251.8	20240.	1620.28	10501.8	18891.
"	"	liq.						
n-Heptylcyclopentane	$C_{12}H_{24}$	gas	1893.43	11249.5	20236.	1767.20	10499.6	18887.
"	"	liq.						
n-Octylcyclopentane	$C_{13}H_{26}$	gas	2050.87	11247.6	20232.	1914.12	10497.6	18883.
"	"	liq.						
n-Nonylcyclopentane	$C_{14}H_{28}$	gas	2208.32	11246.0	20230.	2061.05	10496.1	18880.
"	"	liq.						
n-Decylcyclopentane	$C_{15}H_{30}$	gas	2365.76	11244.6	20227.	2207.97	10494.6	18878.
"	"	liq.						
n-Undecylcyclopentane	$C_{16}H_{32}$	gas	2523.20	11243.4	20225.	2354.89	10493.4	18876.
"	"	liq.						
n-Dodecylcyclopentane	$C_{17}H_{34}$	gas	2680.65	11242.4	20223.	2501.82	10492.4	18874.
"	"	liq.						
n-Tridecylcyclopentane	$C_{18}H_{36}$	gas	2838.09	11241.4	20221.	2648.74	10491.4	18872.
"	"	liq.						
n-Tetradecylcyclopentane	$C_{19}H_{38}$	gas	2995.53	11240.5	20220.	2795.66	10490.5	18870.
"	"	liq.						
n-Pentadecylcyclopentane	$C_{20}H_{40}$	gas	3152.97	11239.7	20218.	2942.58	10489.7	18869.
"	"	liq.						
n-Hexadecylcyclopentane	$C_{21}H_{42}$	gas	3310.42	11239.1	20217.	3089.51	10489.1	18868.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n

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TABLE 23n - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

HEAT OF COMBUSTION, AT 25°C

March 31, 1946

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^o$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Cyclohexane	C_6H_{12}	gas	944.79	11226.7	20195.	881.67	10476.7	18846.
"	"	liq.	936.88	11132.7	20026.	873.76	10382.7	18676.
Methylcyclohexane	C_7H_{14}	gas	1099.59	11199.5	20146.	1025.95	10449.5	18797.
"	"	liq.	1091.13	11113.3	19991.	1017.49	10363.3	18642.
Ethylcyclohexane	C_8H_{16}	gas	1257.90	11210.4	20166.	1173.74	10460.4	18816.
"	"	liq.	1248.23	11124.3	20011.	1164.07	10374.3	18661.
n-Propylcyclohexane	C_9H_{18}	gas	1415.12	11210.3	20165.	1320.44	10460.3	18816.
"	"	liq.	1404.34	11124.9	20012.	1309.66	10374.9	18663.
n-Butylcyclohexane	$C_{10}H_{20}$	gas	1572.74	11213.0	20170.	1467.54	10463.0	18821.
"	"	liq.	1560.78	11127.8	20017.	1455.58	10377.8	18668.
n-Pentylcyclohexane	$C_{11}H_{22}$	gas	1730.18	11214.1	20172.	1614.47	10464.1	18823.
"	"	liq.						
n-Hexylcyclohexane	$C_{12}H_{24}$	gas	1887.63	11215.1	20174.	1761.40	10465.1	18825.
"	"	liq.						
n-Heptylcyclohexane	$C_{13}H_{26}$	gas	2045.07	11215.8	20175.	1908.32	10465.8	18826.
"	"	liq.						
n-Octylcyclohexane	$C_{14}H_{28}$	gas	2202.51	11216.5	20176.	2055.24	10466.5	18827.
"	"	liq.						
n-Nonylcyclohexane	$C_{15}H_{30}$	gas	2359.96	11217.1	20178.	2202.17	10467.1	18828.
"	"	liq.						
n-Decylcyclohexane	$C_{16}H_{32}$	gas	2517.40	11217.6	20178.	2349.09	10467.6	18829.
"	"	liq.						
n-Undecylcyclohexane	$C_{17}H_{34}$	gas	2674.84	11218.0	20179.	2496.01	10468.0	18830.
"	"	liq.						
n-Dodecylcyclohexane	$C_{18}H_{36}$	gas	2832.28	11218.4	20180.	2642.93	10468.4	18831.
"	"	liq.						
n-Tridecylcyclohexane	$C_{19}H_{38}$	gas	2989.73	11218.8	20181.	2789.86	10468.8	18831.
"	"	liq.						
n-Tetradecylcyclohexane	$C_{20}H_{40}$	gas	3147.17	11219.1	20181.	2936.78	10469.1	18832.
"	"	liq.						
n-Pentadecylcyclohexane	$C_{21}H_{42}$	gas	3304.61	11219.3	20182.	3083.70	10469.3	18832.
"	"	liq.						
n-Hexadecylcyclohexane	$C_{22}H_{44}$	gas	3462.06	11219.6	20182.	3230.63	10469.6	18833.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n

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TABLE 24n - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}
HEAT OF COMBUSTION, AT 25°C
December 31, 1945

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Ethene (Ethylene)	C_2H_4	gas	337.234	12021.7	21625.	316.195	11271.7	20276.
"	"	liq.						
Propene (Propylene)	C_3H_6	gas	491.987	11692.3	21032.	460.428	10942.3	19683.
"	"	liq.						
1-Butene	C_4H_8	gas	649.757	11581.3	20833.	607.679	10831.3	19484.
"	"	liq.						
1-Pentene	C_5H_{10}	gas	806.85	11505.1	20696.	754.25	10755.1	19346.
"	"	liq.						
1-Hexene	C_6H_{12}	gas	964.26	11458.0	20611.	901.14	10708.0	19262.
"	"	liq.						
1-Heptene	C_7H_{14}	gas	1121.69	11424.6	20551.	1048.05	10674.6	19202.
"	"	liq.						
1-Octene	C_8H_{16}	gas	1279.13	11399.6	20506.	1194.97	10649.6	19157.
"	"	liq.						
1-Nonene	C_9H_{18}	gas	1436.58	11380.3	20471.	1341.90	10630.3	19122.
"	"	liq.						
1-Decene	$C_{10}H_{20}$	gas	1594.02	11364.8	20443.	1488.82	10614.7	19094.
"	"	liq.						
1-Undecene	$C_{11}H_{22}$	gas	1751.46	11352.0	20420.	1635.75	10602.1	19071.
"	"	liq.						
1-Dodecene	$C_{12}H_{24}$	gas	1908.91	11341.5	20401.	1782.68	10591.5	19052.
"	"	liq.						
1-Tridecene	$C_{13}H_{26}$	gas	2066.35	11332.5	20385.	1929.60	10582.5	19036.
"	"	liq.						
1-Tetradecene	$C_{14}H_{28}$	gas	2223.79	11324.8	20371.	2076.52	10574.9	19022.
"	"	liq.						
1-Pentadecene	$C_{15}H_{30}$	gas	2381.23	11318.2	20359.	2223.44	10568.2	19010.
"	"	liq.						
1-Hexadecene	$C_{16}H_{32}$	gas	2538.68	11312.4	20349.	2370.37	10562.4	19000.
"	"	liq.						
1-Heptadecene	$C_{17}H_{34}$	gas	2696.13	11307.3	20340.	2517.30	10557.3	18991.
"	"	liq.						
1-Octadecene	$C_{18}H_{36}$	gas	2853.57	11302.7	20332.	2664.22	10552.7	18982.
"	"	liq.						
1-Nonadecene	$C_{19}H_{38}$	gas	3011.01	11298.6	20324.	2811.14	10548.6	18975.
"	"	liq.						
1-Eicosene	$C_{20}H_{40}$	gas	3168.45	11294.9	20318.	2958.06	10544.9	18968.
"	"	liq.						

[a] liq. = liquid.

[b] See footnote c of Table 1n.

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TABLE 25n - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

HEAT OF COMBUSTION, AT 25°C

March 31, 1946

Compound	Formula	State[a]	Heat of Combustion, $-\Delta Hc^\circ$, at 25°C and constant pressure, to form[b]:					
			H_2O (liq.) and CO_2 (gas)			H_2O (gas) and CO_2 (gas)		
			kcal/mole	cal/g	BTU/lb	kcal/mole	cal/g	BTU/lb
Ethyne (Acetylene)	C_2H_2	gas	310.615	11930.2	21460.	300.096	11526.2	20734.
"	"	liq.						
Propyne (Methylacetylene)	C_3H_4	gas	463.109	11559.8	20794.	442.070	11034.6	19849.
"	"	liq.						
1-Butyne (Ethylacetylene)	C_4H_6	gas	620.86	11478.7	20648.	589.30	10895.2	19599.
"	"	liq.						
1-Pentyne	C_5H_8	gas	778.03	11422.5	20547.	735.95	10804.7	19436.
"	"	liq.						
1-Hexyne	C_6H_{10}	gas	935.45	11388.5	20486.	882.85	10748.1	19334.
"	"	liq.						
1-Heptyne	C_7H_{12}	gas	1092.89	11364.6	20443.	1029.77	10708.2	19262.
"	"	liq.						
1-Octyne	C_8H_{14}	gas	1250.34	11346.9	20411.	1176.70	10678.6	19209.
"	"	liq.						
1-Nonyne	C_9H_{16}	gas	1407.78	11333.1	20386.	1323.62	10655.6	19168.
"	"	liq.						
1-Decyne	$C_{10}H_{18}$	gas	1565.22	11322.2	20366.	1470.54	10637.3	19134.
"	"	liq.						
1-Undecyne	$C_{11}H_{20}$	gas	1722.67	11313.3	20350.	1617.48	10622.4	19108.
"	"	liq.						
1-Dodecyne	$C_{12}H_{22}$	gas	1880.11	11305.8	20337.	1764.40	10610.0	19086.
"	"	liq.						
1-Tridecyne	$C_{13}H_{24}$	gas	2037.55	11299.5	20326.	1911.32	10599.5	19066.
"	"	liq.						
1-Tetradecyne	$C_{14}H_{26}$	gas	2194.99	11294.1	20316.	2058.24	10590.5	19050.
"	"	liq.						
1-Pentadecyne	$C_{15}H_{28}$	gas	2352.44	11289.5	20308.	2205.17	10582.8	19036.
"	"	liq.						
1-Hexadecyne	$C_{16}H_{30}$	gas	2509.88	11285.4	20300.	2352.09	10575.9	19024.
"	"	liq.						
1-Heptadecyne	$C_{17}H_{32}$	gas	2667.32	11281.8	20294.	2499.01	10570.0	19013.
"	"	liq.						
1-Octadecyne	$C_{18}H_{34}$	gae	2824.77	11278.7	20288.	2645.94	10564.7	19004.
"	"	liq.						
1-Nonadecyne	$C_{19}H_{36}$	gae	2982.21	11275.8	20283.	2792.86	10559.9	18995.
"	"	liq.						
1-Eicosyne	$C_{20}H_{38}$	gae	3139.65	11273.3	20279.	2939.78	10555.6	18988.
"	"	liq.						

[a] liq. = liquid

[b] See footnote c of Table 1n.

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TABLE Op - O_2, H_2, H_2O, N_2, C, CO, CO_2

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C [a]

April 30, 1945

Compound	Formula	State[b]	Heat of Formation [c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation [c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Oxygen	O_2	gas	0	49.003	0
Hydrogen	H_2	gas	0	31.211	0
Water	H_2O	gas	-57.7979	45.106	-54.6351
"	"	liq.	-68.3174	16.716	-56.6899
Nitrogen	N_2	gas	0	45.767	0
Carbon	C	solid, graphite	0	1.3609	0
Carbon monoxide	CO	gas	-26.4157	47.300	-32.8077
Carbon dioxide	CO_2	gas	-94.0518	51.061	-94.2598

[a] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values, in order to retain the significance of certain differences.

[b] liq. = liquid.

[c] ΔHf^o and ΔFf^o represent the increments in heat content and free energy, respectively, for the reaction of forming the given compound from the elements, with all the reactants and products in their appropriate standard reference states.

[d] S^o represents the entropy (exclusive of nuclear spin) of the given compound in its appropriate standard reference state.

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TABLE 1p - PARAFFINS, C_1 TO C_5
HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C [a]
April 30, 1944; April 30, 1945

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Methane	CH_4	gas	-17.889	44.50	-12.140
Ethane	C_2H_6	gas	-20.236	54.85	-7.860
Propane	C_3H_8	gas	-24.820	64.51	-5.614
"	"	liq.[e]	-28.643		
n-Butane	C_4H_{10}	gas	-29.812	74.10	-3.754
"	"	liq.[e]	-34.950		
2-Methylpropane (Isobutane)	"	gas	-31.452	70.42	-4.296
"	"	liq.[e]	-36.169		
n-Pentane	C_5H_{12}	gas	-35.00	83.27	-1.96
"	"	liq.	-41.36	62.79	-2.21
2-Methylbutane (Isopentane)	"	gas	-36.92	81.98	-3.50
"	"	liq.	-42.85	62.38	-3.59
2,2-Dimethylpropane (Neopentane)	"	gas	-39.67	73.23	-3.64
"	"	liq.[e]	-44.98		

[a] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the significance of the small differences between the liquid and gaseous states and, to a lesser extent, between isomers.

[b] liq. = liquid.

[c] ΔHf^o and ΔFf^o represent the increments in heat content and free energy, respectively, for the reaction of forming the given hydrocarbon in the state indicated from the elements carbon (crystalline graphite) and hydrogen (gaseous), with all the reactants and products in their appropriate standard reference states, unless otherwise indicated.

[d] S^o represents the entropy (exclusive of nuclear spin) of the given hydrocarbon in its appropriate standard reference state.

[e] At saturation pressure.

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TABLE 2p - PARAFFINS, C_6 AND C_7

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C [a]

April 30, 1944; April 30, 1945; November 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
n-Hexane	C_6H_{14}	gas	-39.96	92.45	+0.05
"	"	liq.	-47.52	70.34[e]	-0.91
2-Methylpentane	"	gas	-41.66	90.65	-1.11
"	"	liq.	-48.82	69.21	-1.88
3-Methylpentane	"	gas	-41.02	90.77	-0.51
"	"	liq.	-48.28	69.22	-1.34
2,2-Dimethylbutane	"	gas	-44.35	85.72	-2.33
"	"	liq.	-51.00	65.18	-2.86
2,3-Dimethylbutane	"	gas	-42.49	87.33	-0.95
"	"	liq.	-49.48	66.27	-1.66
n-Heptane	C_7H_{16}	gas	-44.89	101.64	+2.09
"	"	liq.	-53.63	77.92	+0.42
2-Methylhexane	"	gas	-46.60	99.64	+0.98
"	"	liq.	-54.93	76.58	-0.47
3-Methylhexane	"	gas	-45.96	101.37	+1.10
"	"	liq.	-54.35	78.23	-0.39
3-Ethylpentane	"	gas	-45.34	98.47	+2.59
"	"	liq.	-53.77	75.33	+1.06
2,2-Dimethylpentane	"	gas	-49.29	93.60	+0.09
"	"	liq.	-57.05	71.50	-1.08
2,3-Dimethylpentane	"	gas	-47.62	98.96	+0.16
"	"	liq.	-55.81	76.27	-1.27
2,4-Dimethylpentane	"	gas	-48.30	94.80	+0.72
"	"	liq.	-56.17	72.47	-0.49
3,3-Dimethylpentane	"	gas	-48.17	95.53	+0.63
"	"	liq.	-56.07	73.44	-0.69
2,2,3-Trimethylbutane	"	gas	-48.96	92.46	+0.76
"	"	liq.	-56.63	70.73	-0.43

[a] See footnote a of Table 1p. [b] liq. = liquid. [c] See footnote c of Table 1p.

[d] See footnote d of Table 1p.

[e] A more accurate value for the entropy of n-hexane (liquid) at 25°C, namely, 70.76 ±0.14 cal/deg mole, has recently become available (Douslin and Huffman[1]). However, the value 70.34 cal/deg mole is retained in order to preserve, in the framework of the tables, the consistency of the increment per CH_2 group, and its temperature coefficient, for the entropy and related thermodynamic properties. It is planned to make the change when more accurate data become available on the normal paraffins above hexane.

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TABLE 3p - PARAFFINS, C_8

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C [a]

April 30, 1944; April 30, 1945

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
n-Octane	C_8H_{18}	gas	-49.82	110.82	4.14
"	"	liq.	-59.74	85.50	1.77
2-Methylheptane	"	gas	-51.50	108.81	3.06
"	"	liq.	-60.98	84.16	0.92
3-Methylheptane	"	gas	-50.82	110.32	3.29
"	"	liq.	-60.34	85.66	1.12
4-Methylheptane	"	gas	-50.69	108.35	4.00
"	"	liq.	-60.17	83.72	1.86
3-Ethylhexane	"	gas	-50.40	109.51	3.95
"	"	liq.	-59.88	84.95	1.80
2,2-Dimethylhexane	"	gas	-53.71	103.06	2.56
"	"	liq.	-62.63	79.33	0.72
2,3-Dimethylhexane	"	gas	-51.13	106.11	4.23
"	"	liq.	-60.40	81.92	2.17
2,4-Dimethylhexane	"	gas	-52.44	106.51	2.80
"	"	liq.	-61.47	82.62	0.89
2,5-Dimethylhexane	"	gas	-53.21	104.93	2.50
"	"	liq.	-62.26	80.96	0.59
3,3-Dimethylhexane	"	gas	-52.61	104.70	3.17
"	"	liq.	-61.58	81.12	1.23
3,4-Dimethylhexane	"	gas	-50.91	104.38	4.97
"	"	liq.	-60.23	80.20	2.86
2-Methyl-3-ethylpentane	"	gas	-50.48	105.43	5.08
"	"	liq.	-59.69	81.41	3.03
3-Methyl-3-ethylpentane	"	gas	-51.38	103.48	4.76
"	"	liq.	-60.46	79.97	2.69
2,2,3-Trimethylpentane	"	gas	-52.61	101.62	4.09
"	"	liq.	-61.44	78.30	2.22
2,2,4-Trimethylpentane	"	gas	-53.57	101.62	3.13
"	"	liq.	-61.97	78.87	1.51
2,3,3-Trimethylpentane	"	gas	-51.73	103.14	4.52
"	"	liq.	-60.63	79.93	2.54
2,3,4-Trimethylpentane	"	gas	-51.97	102.99	4.32
"	"	liq.	-60.98	79.39	2.34
2,2,3,3-Tetramethylbutane	"	gas	-53.99	94.34	4.88
"	"	solid	-64.23	67.17	2.74

[a] See footnote a of Table 1p. [b] liq = liquid; solid = crystalline solid. [c] See footnote c of Table 1p.

[d] See footnote d of Table 1p.

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TABLE 5p - ALKYL BENZENES, C_6 To C_9
HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]
November 30, 1945

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Benzene	C_6H_6	gas	19.820	64.34	30.989
"	"	liq.	11.718	41.30	29.756
Methylbenzene (Toluene)	C_7H_8	gas	11.950	76.42	29.228
"	"	liq.	2.867	52.48	27.282
Ethylbenzene	C_8H_{10}	gas	7.120	86.15	31.208
"	"	liq.	-2.977	60.99	28.614
1,2-Dimethylbenzene (o-Xylene)	"	gas	4.540	84.31	29.177
"	"	liq.	-5.841	58.91	26.370
1,3-Dimethylbenzene (m-Xylene)	"	gas	4.120	85.49	28.405
"	"	liq.	-6.075	60.27	25.730
1,4-Dimethylbenzene (p-Xylene)	"	gas	4.290	84.23	28.952
"	"	liq.	-5.838	59.12	26.310
n-Propylbenzene	C_9H_{12}	gas	1.870	95.74	32.810
"	"	liq.	-9.178	69.44	29.600
Isopropylbenzene (Cumene)	"	gas	0.940	92.87	32.738
"	"	liq.	-9.848	66.87	29.708
1-Methyl-2-ethylbenzene	"	gas	0.290	95.42	31.323
"	"	liq.	-11.110	68.42	27.973
1-Methyl-3-ethylbenzene	"	gas	-0.460	96.60	30.217
"	"	liq.	-11.670	69.90	26.977
1-Methyl-4-ethylbenzene	"	gas	-0.780	95.34	30.281
"	"	liq.	-11.920	68.84	27.041
1,2,3-Trimethylbenzene (Hemimellitene)	"	gas	-2.290	93.50	29.319
"	"	liq.	-14.013	66.40	25.679
1,2,4-Trimethylbenzene (Pseudocumene)	"	gas	-3.330	94.73	27.912
"	"	liq.	-14.785	67.93	24.462
1,3,5-Trimethylbenzene (Mesitylene)	"	gas	-3.840	92.15	28.172
"	"	liq.	-15.184	65.35	24.832

[a] See footnote a of Table 1p. [b] liq. = liquid. [c] See footnote c of Table 1p.
[d] See footnote d of Table 1p.

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TABLE 8p (Part 1) - MONOOLEFINS, C_2 to C_5

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C

November 30, 1945; May 31, 1947

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Ethene (Ethylene)	C_2H_4	gas	12.496	52.45	16.282
"	"	liq.			
Propene (Propylene)	C_3H_6	gas	4.879	63.80	14.990
"	"	liq.			
1-Butene	C_4H_8	gas	0.280	73.48	17.217
"	"	liq.			
cis-2-Butene	"	gas	-1.362	71.90	16.046
"	"	liq.			
trans-2-Butene	"	gas	-2.405	70.86	15.315
"	"	liq.			
2-Methyl-2-propene (Isobutene)	"	gas	-3.343	70.17	14.582
"	"	liq.			
1-Pentene	C_5H_{10}	gas	-5.000	83.08	18.787
"	"	liq.			
cis-2-Pentene	"	gas	-6.710	82.76	17.173
"	"	liq.			
trans-2-Pentene	"	gas	-7.590	81.81	16.575
"	"	liq.			
2-Methyl-1-butene	"	gas	-8.680	81.73	15.509
"	"	liq.			
3-Methyl-1-butene	"	gas	-6.920	79.70	17.874
"	"	liq.			
2-Methyl-2-butene	"	gas	-10.170	80.90	14.267
"	"	liq.			

[a] See footnote a of Table 1p. [b] liq. = liquid. [c] See footnote c of Table 1p.

[d] See footnote d of Table 1p.

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TABLE 8p (Part 2) - MONOOLEFINS, C_6

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C

November 30, 1945

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
1-Hexene	C_6H_{12}	gas	-9.96	92.25	20.80
"	"	liq.			
cis-2-Hexene	"	gas	-11.56	92.35	19.18
"	"	liq.			
trans-2-Hexene	"	gas	-12.56	91.40	18.46
"	"	liq.			
cis-3-Hexene	"	gas	-11.56	90.73	19.66
"	"	liq.			
trans-3-Hexene	"	gas	-12.56	90.04	18.86
"	"	liq.			
2-Methyl-1-pentene	"	gas	-13.56	91.32	17.48
"	"	liq.			
3-Methyl-1-pentene	"	gas	-11.02	90.45	20.28
"	"	liq.			
4-Methyl-1-pentene	"	gas	-11.66	89.58	19.90
"	"	liq.			
2-Methyl-2-pentene	"	gas	-14.96	90.45	16.34
"	"	liq.			
cis (?)-3-Methyl-2-pentene	"	gas	-14.32	90.45	16.98
"	"	liq.			
trans (?)-3-Methyl-2-pentene	"	gas	-14.32	91.26	16.74
"	"	liq.			
cis (?)-4-Methyl-2-pentene	"	gas	-13.26	89.23	18.40
"	"	liq.			
trans(?)-4-Methyl-2-pentene	"	gas	-14.26	88.02	17.77
"	"	liq.			
2-Ethyl-1-butene	"	gas	-12.92	90.01	18.51
"	"	liq.			
2,3-Dimethyl-1-butene	"	gas	-14.78	87.39	17.43
"	"	liq.			
3,3-Dimethyl-1-butene	"	gas	-14.25	83.79	19.04
"	"	liq.			
2,3-Dimethyl-2-butene	"	gas	-15.91	86.67	16.52
"	"	liq.			

[a] See footnote a of Table 1p. [b] liq. = liquid. [c] See footnote c of Table 1p.

[d] See footnote d of Table 1p.

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TABLE 12p - ACETYLENES, C_2 to C_5

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]

June 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Ethyne (Acetylene)	C_2H_2	gas	54.194	47.997	50.000
"	"	liq.			
Propyne (Methylacetylene)	C_3H_4	gas	44.319	59.30	46.313
"	"	liq.			
1-Butyne (Ethylacetylene)	C_4H_6	gas	39.70	69.51	48.52
"	"	liq.			
2-Butyne (Dimethylacetylene)	"	gas	35.374	67.71	44.725
"	"	liq.			
1-Pentyne	C_5H_8	gas	34.50	79.10	50.17
"	"	liq.			
2-Pentyne	"	gas	30.80	79.30	46.41
"	"	liq.			
3-Methyl-1-butyne	"	gas	32.60	76.23	49.12
"	"	liq.			

[a] See footnote a of Table 1p. [b] liq.=liquid [c] See footnote c of Table 1p. [d] See footnote d of Table 1p.

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TABLE 20p - NORMAL PARAFFINS, C_1 to C_{20}
HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]
June 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf°	Entropy[d] S°	Free Energy of Formation[c] ΔFf°
			At 25°C	At 25°C	At 25°C
			kcal/mols	cal/deg mols	kcal/mols
Methane	CH_4	gas	-17.889	44.50	-12.140
"	"	liq.			
Ethane	C_2H_6	gas	-20.236	54.85	-7.860
"	"	liq.			
Propane	C_3H_8	gas	-24.820	64.51	-5.614
"	"	liq.			
n-Butane	C_4H_{10}	gas	-29.812	74.10	-3.754
"	"	liq.			
n-Pentane	C_5H_{12}	gas	-35.00	83.27	-1.96
"	"	liq.			
n-Hexane	C_6H_{14}	gas	-39.96	92.45	+0.05
"	"	liq.			
n-Heptane	C_7H_{16}	gas	-44.89	101.64	2.09
"	"	liq.			
n-Octane	C_8H_{18}	gas	-49.82	110.82	4.14
"	"	liq.			
n-Nonane	C_9H_{20}	gas	-54.74	120.00	6.18
"	"	liq.			
n-Decane	$C_{10}H_{22}$	gas	-59.67	129.19	8.23
"	"	liq.			
n-Undecane	$C_{11}H_{24}$	gas	-65.60	138.37	10.28
"	"	liq.			
n-Dodecane	$C_{12}H_{26}$	gas	-69.52	147.55	12.33
"	"	liq.			
n-Tridecane	$C_{13}H_{28}$	gas	-74.45	156.74	14.37
"	"	liq.			
n-Tetradecane	$C_{14}H_{30}$	gas	-79.38	165.92	16.42
"	"	liq.			
n-Pentadecane	$C_{15}H_{32}$	gas	-84.31	175.10	18.47
"	"	liq.			
n-Hexadecane	$C_{16}H_{34}$	gas	-89.23	184.28	20.52
"	"	liq.			
n-Heptadecane	$C_{17}H_{36}$	gas	-94.15	193.47	22.56
"	"	liq.			
n-Octadecane	$C_{18}H_{38}$	gas	-99.08	202.65	24.61
"	"	solid			
n-Nonadecane	$C_{19}H_{40}$	gas	-104.00	211.83	26.66
"	"	solid			
n-Eicosane	$C_{20}H_{42}$	gas	-108.93	221.02	28.71
"	"	solid			

[a] See footnote a of Table 1p. [b] liq.=liquid [c] See footnote c of Table 1p. [d] See footnote d of Table 1p.

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TABLE 21p - NORMAL ALKYL BENZENES, C_6 to C_{22}
HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]
June 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Benzene	C_6H_6	gas	19.820	64.34	30.989
"	"	liq.			
Methylbenzene (Toluene)	C_7H_8	gas	11.950	76.42	29.228
"	"	liq.			
Ethylbenzene	C_8H_{10}	gas	7.120	86.15	31.208
"	"	liq.			
n-Propylbenzene	C_9H_{12}	gas	1.870	95.74	32.810
"	"	liq.			
n-Butylbenzene	$C_{10}H_{14}$	gas	-3.30	104.91	34.62
"	"	liq.			
n-Amylbenzene	$C_{11}H_{16}$	gas	-8.23	114.09	36.67
"	"	liq.			
n-Hexylbenzene	$C_{12}H_{18}$	gas	-13.15	123.28	38.72
"	"	liq.			
n-Heptylbenzene	$C_{13}H_{20}$	gas	-18.08	132.46	40.76
"	"	liq.			
n-Octylbenzene	$C_{14}H_{22}$	gas	-23.00	141.64	42.81
"	"	liq.			
n-Nonylbenzene	$C_{15}H_{24}$	gas	-27.93	150.82	44.86
"	"	liq.			
n-Decylbenzene	$C_{16}H_{26}$	gas	-32.86	160.01	46.91
"	"	liq.			
n-Undecylbenzene	$C_{17}H_{28}$	gas	-37.78	169.19	48.96
"	"	liq.			
n-Dodecylbenzene	$C_{18}H_{30}$	gas	42.71	178.37	51.00
"	"	liq.			
n-Tridecylbenzene	$C_{19}H_{32}$	gas	-47.63	187.56	53.05
"	"	liq.			
n-Tetradecylbenzene	$C_{20}H_{34}$	gas	-52.56	196.74	55.10
"	"	liq.			
n-Pentadecylbenzene	$C_{21}H_{36}$	gas	-57.49	205.92	57.15
"	"	liq.			
n-Hexadecylbenzene	$C_{22}H_{38}$	gas	-62.41	215.11	59.20
"	"	liq.			

[a] See footnote a of Table 1p. [b] liq.=liquid [c] See footnote c of Table 1p. [d] See footnote d of Table 1p.

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TABLE 24p - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}
HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]
June 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Ethene (Ethylene)	C_2H_4	gas	12.496	52.45	16.282
"	"	liq.			
Propene (Propylene)	C_3H_6	gas	4.879	63.80	14.990
"	"	liq.			
1-Butene	C_4H_8	gas	0.280	73.48	17.217
"	"	liq.			
1-Pentene	C_5H_{10}	gas	-5.000	83.08	18.787
"	"	liq.			
1-Hexene	C_6H_{12}	gas	-9.96	92.25	20.80
"	"	liq.			
1-Heptene	C_7H_{14}	gas	-14.89	101.43	22.84
"	"	liq.			
1-Octene	C_8H_{16}	gas	-19.82	110.61	24.89
"	"	liq.			
1-Nonene	C_9H_{18}	gas	-24.74	119.80	26.94
"	"	liq.			
1-Decene	$C_{10}H_{20}$	gas	-29.67	128.98	28.99
"	"	liq.			
1-Undecene	$C_{11}H_{22}$	gas	-34.60	138.16	31.03
"	"	liq.			
1-Dodecene	$C_{12}H_{24}$	gas	-39.52	147.34	33.08
"	"	liq.			
1 Tridecene	$C_{13}H_{26}$	gas	-44.45	156.53	35.13
"	"	liq.			
1-Tetradecene	$C_{14}H_{28}$	gas	-49.38	165.71	37.18
"	"	liq.			
1-Pentadecene	$C_{15}H_{30}$	gas	-54.31	174.89	39.23
"	"	liq.			
1-Hexadecene	$C_{16}H_{32}$	gas	-59.23	184.08	41.27
"	"	liq.			
1-Heptadecene	$C_{17}H_{34}$	gas	-64.15	193.26	43.32
"	"	liq.			
1-Octadecene	$C_{18}H_{36}$	gas	-69.08	202.44	45.37
"	"	liq.			
1-Nonadecene	$C_{19}H_{38}$	gas	-74.00	211.63	47.42
"	"	liq.			
1-Eicosene	$C_{20}H_{40}$	gas	-78.93	220.81	49.47
"	"	solid			

[a] See footnote a of Table 1p. [b] liq.=liquid [c] See footnote c of Table 1p. [d] See footnote d of Table 1p.

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TABLE 25p - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

HEAT OF FORMATION, ENTROPY, AND FREE ENERGY OF FORMATION, AT 25°C[a]

June 30, 1946

Compound	Formula	State[b]	Heat of Formation[c] ΔHf^o	Entropy[d] S^o	Free Energy of Formation[c] ΔFf^o
			At 25°C	At 25°C	At 25°C
			kcal/mole	cal/deg mole	kcal/mole
Ethyne (Acetylene)	C_2H_2	gas	54.194	47.997	50.000
"	"	liq.			
Propyne (Methylacetylene)	C_3H_4	gas	44.319	59.30	46.313
"	"	liq.			
1-Butyne (Ethylacetylene)	C_4H_6	gas	39.70	69.51	48.52
"	"	liq.			
1-Pentyne	C_5H_8	gas	34.50	79.10	50.17
"	"	liq.			
1-Hexyne	C_6H_{10}	gas	29.55	88.27	52.19
"	"	liq.			
1-Heptyne	C_7H_{12}	gas	24.62	97.45	54.24
"	"	liq.			
1-Octyne	C_8H_{14}	gas	19.70	106.63	56.29
"	"	liq.			
1-Nonyne	C_9H_{16}	gas	14.77	115.82	58.34
"	"	liq.			
1-Decyne	$C_{10}H_{18}$	gas	9.85	125.00	60.39
"	"	liq.			
1-Undecyne	$C_{11}H_{20}$	gas	4.92	134.18	62.43
"	"	liq.			
1-Dodecyne	$C_{12}H_{22}$	gas	-0.01	143.36	64.48
"	"	liq.			
1-Tridecyne	$C_{13}H_{24}$	gas	-4.93	152.55	66.53
"	"	liq.			
1-Tetradecyne	$C_{14}H_{26}$	gas	-9.86	161.73	68.58
"	"	liq.			
1-Pentadecyne	$C_{15}H_{28}$	gas	-14.78	170.91	70.63
"	"	liq.			
1-Hexadecyne	$C_{16}H_{30}$	gas	-19.71	180.10	72.67
"	"	liq.			
1-Heptadecyne	$C_{17}H_{32}$	gas	-24.64	189.28	74.72
"	"	liq.			
1-Octadecyne	$C_{18}H_{34}$	gas	-29.56	198.46	76.77
"	"	solid			
1-Nonadecyne	$C_{19}H_{36}$	gas	-34.49	207.65	78.82
"	"	solid			
1-Eicosyne	$C_{20}H_{38}$	gas	-39.41	216.83	80.87
"	"	solid			

[a] See footnote a of Table 1p. [b] liq.=liquid [c] See footnote c of Table 1p. [d] See footnote d of Table 1p.

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TABLE 1q - PARAFFINS, C_1 To C_5
STANDARD HEAT, ENTROPY, AND FREE ENERGY OF VAPORIZATION, AT 25°C
May 31, 1944

Compound	Formula	Standard Heat of Vaporization[a] ΔHv^o	Standard Entropy of Vaporization[a] ΔSv^o	Standard Free Energy of Vaporization[a] ΔFv^o
		At 25°C	At 25°C	At 25°C
		kcal/mole	cal/deg mole	kcal/mole
Methane	CH_4	-	-	-
Ethane	C_2H_6			
Propane	C_3H_8	3.823[b]		
n-Butane	C_4H_{10}	5.138[b]		
2-Methylpropane (Isobutane)	"	4.717[b]		
n-Pentane	C_5H_{12}	6.357	20.48	0.252
2-Methylbutane (Isopentane)	"	5.934	19.60	0.090
2,2-Dimethylpropane (Neopentane)	"	5.311[b]		

[a] ΔHv^o, ΔSv^o, and ΔFv^o represent the increments in heat content, entropy, and free energy, respectively, for the process C_mH_n (liq.)= C_mH_n (gas), with the liquid and gas in their appropriate standard reference states, unless otherwise indicated. For the heat of vaporization at saturation pressure see Table 1m.

[b] Liquid at saturation pressure.

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TABLE 2q - PARAFFINS, C_6 AND C_7
STANDARD HEAT, ENTROPY, AND FREE ENERGY OF VAPORIZATION, AT 25°C
May 31, 1944

Compound	Formula	Standard Heat of Vaporization[a] ΔHv^o	Standard Entropy of Vaporization[a] ΔSv^o	Standard Free Energy of Vaporization[a] ΔFv^o
		At 25°C	At 25°C	At 25°C
		kcal/mole	cal/deg mole	kcal/mole
n-Hexane	C_6H_{14}	7.555	22.11	0.963
2-Methylpentane	"	7.160	21.44	0.767
3- "	"	7.255	21.55	0.830
2,2-Dimethylbutane	"	6.651	20.54	0.527
2,3- "	"	6.985	21.06	0.706
n-Heptane	C_7H_{16}	8.739	23.72	1.666
2-Methylhexane	"	8.325	23.06	1.448
3- "	"	8.391	23.14	1.491
3-Ethylpentane	"	8.425	23.14	1.525
2,2-Dimethylpentane	"	7.764	22.10	1.174
2,3- "	"	8.191	22.69	1.426
2,4- "	"	7.872	22.33	1.214
3,3- "	"	7.901	22.09	1.316
2,2,3-Trimethylbutane	"	7.669	21.73	1.190

[a] See footnote a of Table 1q. For the heat of vaporization at saturation pressure see Table 2m.

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TABLE 3q - PARAFFINS, C_8

STANDARD HEAT, ENTROPY, AND FREE ENERGY OF VAPORIZATION, AT 25°C

May 31, 1944

Compound	Formula	Standard Heat of Vaporization[a] ΔHv^o	Standard Entropy of Vaporization[a] ΔSv^o	Standard Free Energy of Vaporization[a] ΔFv^o
		At 25°C	At 25°C	At 25°C
		kcal/mole	cal/deg mole	kcal/mole
n-Octane	C_8H_{18}	9.915	25.32	2.365
2-Methylheptane	"	9.484	24.65	2.135
3- "	"	9.521	24.66	2.167
4- "	"	9.483	24.63	2.138
3-Ethylhexane	"	9.476	24.56	2.152
2,2-Dimethylhexane	"	8.915	23.73	1.839
2,3- "	"	9.272	24.19	2.060
2,4- "	"	9.029	23.89	1.907
2,5- "	"	9.051	23.97	1.905
3,3- "	"	8.973	23.58	1.942
3,4- "	"	9.316	24.18	2.107
2-Methyl-3-ethylpentane	"	9.209	24.02	2.048
3- " -3- "	"	9.081	23.51	2.071
2,2,3-Trimethylpentane	"	8.826	23.32	1.874
2,2,4- "	"	8.402	22.75	1.620
2,3,3- "	"	8.897	23.21	1.976
2,3,4- "	"	9.014	23.60	1.976
2,2,3,3-Tetramethylbutane	"	10.24[b]	27.17[b]	2.139[b]

[a] See footnote a of Table 1q. For the heat of vaporization at saturation pressure see Table 3m.

[b] For the process of sublimation, C_mH_n (solid) = C_mH_n (gas), with the solid and gas in their appropriate standard reference states.

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TABLE 5o - ALKYL BENZENES, C_6 to C_9

STANDARD HEAT, ENTROPY, AND FREE ENERGY OF VAPORIZATION, AT 25°C

July 31, 1944; revised March 31, 1945

Compound	Formula	Standard Heat of Vaporization[a] ΔHv^o	Standard Entropy of Vaporization[a] ΔSv^o	Standard Free Energy of Vaporization[a] ΔFv^o
		At 25°C	At 25°C	At 25°C
		kcal/mole	cal/deg mole	kcal/mole
Benzene	C_6H_6	8.102	23.04	1.233
Methylbenzene (Toluene)	C_7H_8	9.083	23.94	1.946
Ethylbenzene	C_8H_{10}	10.097	25.16	2.594
1,2-Dimethylbenzene (o-Xylene)	"	10.381	25.40	2.807
1,3- " (m- ")	"	10.195	25.22	2.675
1,4- " (p- ")	"	10.128	25.11	2.642
n-Propylbenzene	C_9H_{12}	11.048	26.3	3.21
Isopropylbenzene (Cumene)	"	10.788	26.0	3.03
1-Methyl-2-ethylbenzene	"	11.40	27.0	3.35
1- " -3- "	"	11.21	26.7	3.24
1- " -4- "	"	11.14	26.5	3.24
1,2,3-Trimethylbenzene (Hemimellitene)	"	11.723	27.1	3.64
1,2,4- " (Pseudocumene)	"	11.455	26.8	3.45
1,3,5- " (Mesitylene)	"	11.344	26.8	3.34

[a] See footnote a of Table 1q. For the heat of vaporization at saturation pressure see Table 5m.

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TABLE 7q - ALKYL CYCLOHEXANES, C_6 to C_8

STANDARD HEAT, ENTROPY, AND FREE ENERGY OF VAPORIZATION, AT 25°C

March 31, 1947

Compound	Formula	Standard Heat of Vaporization[a] ΔHv^o	Standard Entropy of Vaporization[a] ΔSv^o	Standard Free Energy of Vaporization[a] ΔFv^o
		At 25°C	At 25°C	At 25°C
		kcal/mole	cal/deg mole	kcal/mole
Cyclohexane	C_6H_{12}	7.908	22.43	1.219
Methylcyclohexane	C_7H_{14}	8.458	22.80	1.659
Ethylcyclohexane	C_8H_{16}	9.674	24.32	2.423
1,1-Dimethylcyclohexane	"	9.046	23.35	2.083
cis-1,2-Dimethylcyclohexane	"	9.493	23.95	2.351
trans-1,2- "	"	9.169	23.45	2.176
cis-1,3-[b] "	"	9.139	23.56	2.114
trans-1,3-[c] "	"	9.370	23.93	2.235
cis-1,4- "	"	9.330	23.84	2.223
trans-1,4- "	"	9.055	23.39	2.082

[a] See footnote a of Table 1q. For the heat of vaporization at saturation pressure see Table 7m.

[b] Formerly labeled "trans"; see footnote d of Table 7a. [c] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 00r - 0, H, N, C

HEAT CONTENT FUNCTION, $(H^{\circ}-H^{\circ}_0)/T$, FOR THE IDEAL GAS STATE, AT 0° to $4000^{\circ}K$

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in $^{\circ}K$														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^{\circ}-H^{\circ}_0)/T$, in cal/deg mole[c]														
Oxygen	O	0	5.391	5.390	5.337	5.291	5.253	5.222	5.197	5.176	5.159	5.144	5.131	5.120	5.111	5.102
Hydrogen	H	0	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968
Nitrogen	N	0	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968
Carbon	C	0	5.228	5.227	5.164	5.126	5.100	5.082	5.068	5.057	5.048	5.041	5.035	5.030	5.026	5.022

Compound (gas, monatomic)	Formula	Temperature in $^{\circ}K$														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Heat Content Function, $(H^{\circ}- H^{\circ}_0)/T$, in cal/deg mole														
Oxygen	O	5.159	5.126	5.102	5.085	5.071	5.061	5.053	5.047	5.043	5.040	5.043				
Hydrogen	H	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968				
Nitrogen	N	4.968	4.968	4.968	4.968	4.968	4.968	4.969	4.970	4.973	4.983	5.003				
Carbon	C	5.048	5.032	5.022	5.016	5.014	5.015	5.019	5.026	5.036	5.062	5.092				

[a] Interpolation to other temperatures in the interval 298.16° to $4000^{\circ}K$ may be made by appropriate graphical or analytical methods. For temperatures between 200° and $298.16^{\circ}K$, values may be estimated by extrapolating to the lower temperatures the values for 300°, 400°, 500°, and $600^{\circ}K$.

[b] The heat content function, $(H^{\circ} - H^{\circ}_0)/T$, is the heat content at the given temperature less the heat content at $0^{\circ}K$, divided by the absolute temperature ($^{\circ}K$), of the given substance in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE Or - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CONTENT FUNCTION, $(H^o - H^o_0)/T$, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °K													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]													
Oxygen	O_2	gas	0				6.9220	6.9307	6.9418	6.9424	6.9811	7.0484	7.1320	7.2248	7.3176	7.4107
Hydrogen	H_2	gas	0	6.5265	7.1670	6.9233	6.8028	6.7772	6.7877	6.7882	6.8275	6.8590	6.8810	6.9022	6.9218	6.9423
Hydroxyl	OH	gas	0						7.064	7.075	7.074	7.070	7.068	7.067	7.073	7.086
Water	H_2O	gas	0						7.934	7.933	7.975	8.039	8.122	8.222	8.333	8.452
Nitrogen	N_2	gas	0		6.9365		6.9465	6.9482	6.9502	6.9503	6.9559	6.9701	6.9967	7.0361	7.0857	7.1422
Nitric Oxide	NO	gas	0		7.427	7.481	7.453	7.411	7.359	7.356	7.302	7.288	7.302	7.338	7.387	7.445
Carbon	C	solid, graphite	0		0.1445	0.28770	0.45986	0.64987	0.84369	0.85101	1.2565	1.6416	1.9968	2.3171	2.6021	2.8549
Carbon Monoxide	CO	gas	0		6.9337		6.9471	6.9495	6.9514	6.9515	6.9594	6.9799	7.0159	7.0654	7.1247	7.1895
Carbon Dioxide	CO_2	gas	0						7.5064	7.5154	7.9870	8.4455	8.8707	9.2589	9.6117	9.9317

Compound	Formula	State	Temperature in °K													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Heat Content Function, $(H^o-H^o_0)/T$, in cal/deg mole													
Oxygen	O_2	gas	7.4970	7.5775	7.6533	7.7238	7.7893	7.8509	7.9885	8.1094	8.2195	8.3196	8.4133	8.5000	8.6595	8.8038
Hydrogen	H_2	gas	6.9658	6.9927	7.0230	7.0563	7.0919	7.1295	7.2307	7.3358	7.4394	7.5402	7.6379	7.7286	7.8963	8.0420
Hydroxyl	OH	gas	7.106	7.131	7.161	7.196	7.234	7.273	7.375	7.480	7.5819	7.677	7.7691	7.854	8.007	8.144
Water	H_2O	gas	8.580	8.709	8.844	8.981	9.116	9.251	9.57	9.88	10.16	10.42	10.65	10.86		
Nitrogen	N_2	gas	7.2025	7.2650	7.3273	7.3882	7.4467	7.5024	7.6327	7.7497	7.8488	7.9356	8.0131	8.0816	8.1986	8.2944
Nitric Oxide	NO	gas	7.506	7.567	7.628	7.686	7.742	7.796	7.913	8.015	8.104	8.180	8.247	8.307	8.408	8.493
Carbon	C	solid, graphite	3.0746	3.269	3.442	3.600	3.744	3.876								
Carbon Monoxide	CO	gas	7.2565	7.3238	7.3898	7.4538	7.5149	7.5725	7.7033	7.8182	7.9171	8.0028	8.0784	8.1448	8.2572	8.3487
Carbon Dioxide	CO_2	gas	10.222	10.486	10.728	10.949	11.151	11.336	11.738	12.072	12.35	12.59	12.80	12.98	13.29	

[a] Interpolation to other temperatures in the interval 50^o to 4000^oK may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table OOr.

[c] See footnote c of Table OOr.

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TABLE 1r - PARAFFINS, C_1 to C_5

HEAT CONTENT FUNCTION, $(H^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

August 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$ cal/deg mole[c]														
Methane	CH_4	0	8.039	8.042	8.307	8.730	9.249	9.816	10.401	10.985	11.56	12.11	12.65	13.15	13.63	14.09
Ethane	C_2H_6	0	9.578	9.596	10.74	12.02	13.36	14.68	15.95	17.15	18.28	19.35	20.35	21.29	22.17	23.00
Propane	C_3H_8	0	11.78	11.82	13.89	16.08	18.22	20.27	22.20	24.00	25.67	27.23	28.68	30.02	31.27	32.43
n-Butane	C_4H_{10}	0	15.58	15.63	18.42	21.27	24.06	26.71	29.18	31.46	33.58	35.56	37.40	39.12	40.71	42.18
2-Methylpropane (Isobutane)	"	0	14.34	14.39	17.41	20.50	23.45	26.20	28.76	31.13	33.31	35.34	37.23	38.96	40.56	42.03
n-Pentane	C_5H_{12}	0	19.01	19.07	22.62	26.18	29.64	32.90	35.93	38.73	41.34	43.76	46.01	48.10	50.04	51.84
2-Methylbutane (Isopentane)	"	0	17.24	17.31	21.23	25.13	28.83	32.27	35.44	38.36	41.03	43.52	45.83	47.94	49.90	51.69
2,2-Dimethylpropane (Neopentane)	"	0	16.87	16.94	21.07	25.13	28.98	32.53	35.80	38.78	41.51	44.02	46.34	48.49	50.47	52.28

[a] Interpolation to other temperatures in the interval 298.16° to 1500°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500°, and 600°K.

[b] The heat content function, $(H^o-H^o_0)/T$, is the heat content at the given temperature less the heat content at 0°K, divided by the absolute temperature (°K), of the given hydrocarbon in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2r (Part 1) - PARAFFINS, C_6

HEAT CONTENT FUNCTION, $(H^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o - H^o_0)/T$ cal/deg mole[c]														
n - Hexane	C_6H_{14}	0	22.44	22.52	26.83	31.10	35.23	39.11	42.71	46.02	49.11	51.97	54.63	57.10	59.39	61.50
2 - Methylpentane. . .	"	0	20.45	20.54	25.2	29.9	34.2	38.3	42.0	45.5	48.7					
3 - " . . .	"	0	20.62	20.71	25.5	30.2	34.6	38.6	42.4	45.8	48.9					
2,2 - Dimethylbutane .	"	0	19.91	19.99	24.9	29.6	34.2	38.3	42.2	45.6	48.9					
2,3 - " .	"	0	20.36	20.45	25.2	29.9	34.4	38.4	42.2	45.7	48.8					

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

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TABLE 2r (Part 2) - PARAFFINS, C_7

HEAT CONTENT FUNCTION, $(H^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30,1944

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o - H^o_0)/T$ cal/deg mole[c]														
n - Heptane	C_7H_{16}	0	25.87	25.96	31.04	36.01	40.81	45.33	49.48	53.32	56.89	60.19	63.25	66.09	68.73	71.16
2 - Methylhexane . .	"	0	23.89	23.98	29.6	35.0	40.2	44.9	49.2	53.2	56.7					
3 - " . .	"	0	23.32	23.41	29.0	34.5	39.7	44.5	48.8	52.8	56.4					
3 - Ethylpentane . .	"	0	22.52	22.61	28.3	33.8	39.0	43.8	48.2	52.2	55.8					
2,2- Dimethylpentane	"	0	22.35	22.44	28.4	34.1	39.5	44.5	49.0	53.0	56.7					
2,3- "	"	0	22.21	22.30	28.2	33.8	39.2	44.1	48.5	52.5	56.1					
2,4- "	"	0	22.25	22.34	28.3	34.1	39.5	44.5	49.0	53.0	56.6					
3,3- "	"	0	22.48	22.57	28.5	34.2	39.7	44.7	49.2	53.2	56.9					
2,2,3- Trimethylbutane	"	0	22.01	22.10	28.2	34.1	39.7	44.8	49.3	53.4	57.0					

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3r - PARAFFINS, C_8

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

October 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$ cal/deg mole [c]														
n-Octane	C_8H_{18}	0	29.30	29.41	35.25	40.93	46.40	51.54	56.26	60.61	64.66	68.40	71.87	75.09	78.08	80.82
2-Methylheptane	"	0	27.32	27.43	33.8	40.0	45.8	51.2	56.0	60.3	64.5					
3- "	"	0	26.99	27.10	33.5	39.7	45.6	51.0	55.8	60.2	64.4					
4- "	"	0	26.72	26.83	33.3	39.5	45.3	50.7	55.6	60.0	64.2					
3-Ethylhexane	"	0	25.28	25.39	31.8	38.1	44.0	49.5	54.5	59.0	63.2					
2,2-Dimethylhexane	"	0	25.98	26.09	32.8	39.2	45.2	50.8	55.9	60.4	64.6					
2,3- "	"	0	26.35	26.46	33.2	39.9	46.0	51.6	56.4	60.8	64.9					
2,4- "	"	0	25.24	25.35	32.1	38.5	44.6	50.2	55.2	59.6	63.8					
2,5- "	"	0	25.58	25.69	32.4	38.9	45.0	50.6	55.5	59.9	64.1					
3,3- "	"	0	25.21	25.32	32.1	38.6	44.8	50.5	55.6	60.2	64.4					
3,4- "	"	0	26.28	26.39	33.3	39.8	45.9	51.4	56.2	60.5	64.8					
2-Methyl-3-ethylpentane	"	0	25.85	25.96	32.7	39.2	45.3	50.8	55.6	60.1	64.3					
3- " -3- "	"	0	25.24	25.35	32.4	38.9	45.0	50.6	55.7	60.3	64.7					
2,2,3-Trimethylpentane	"	0	24.77	24.88	31.9	38.6	44.8	50.5	55.5	60.1	64.4					
2,2,4- "	"	0	24.77	24.88	31.9	38.6	44.8	50.5	55.5	60.1	64.4					
2,3,3- "	"	0	25.17	25.28	32.2	38.9	45.2	50.8	55.7	60.3	64.7					
2,3,4- "	"	0	24.74	24.85	31.9	38.8	45.1	50.7	55.6	60.0	64.4					
2,2,3,3-Tetramethylbutane	"	0	24.87	24.68	31.8	38.8	45.3	51.2	56.3	60.9	65.3					

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

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SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards

Washington, D. C.

TABLE 5r - ALKYL BENZENES, C_6 to C_9

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Benzene	C_6H_6	0	11.41	11.46	14.41	17.50	20.48	23.24	25.76	28.07	30.16	32.07	33.82	35.42	36.89	38.24
Methylbenzene (Toluene)	C_7H_8	0	14.44	14.51	18.17	21.94	25.56	28.92	32.03	34.86	37.45	39.82	41.99	43.98	45.81	47.50
Ethylbenzene	C_8H_{10}	0	17.89	17.97	22.44	26.99	31.33	35.35	39.03	42.38	45.45	48.25	50.82	53.18	55.34	57.35
1,2-Dimethylbenzene (o-Xylene)	"	0	18.70	18.78	23.23	27.61	31.78	35.66	39.23	42.52	45.53	48.30	50.84	53.17	55.32	57.31
1,3- " (m- ")	"	0	17.86	17.94	22.31	26.72	30.94	34.88	38.52	41.86	44.93	47.74	50.32	52.69	54.87	56.88
1,4- " (p- ")	"	0	17.97	18.04	22.32	26.66	30.83	34.74	38.36	41.69	44.76	47.56	50.14	52.52	54.70	56.72
n-Propylbenzene	C_9H_{12}	0	21.69	21.78	27.0	32.2	37.2	41.8	46.0	49.8	53.4	56.6	59.5	62.3	64.8	67.1
Isopropylbenzene (Cumene)	"	0	20.45	20.54	26.0	31.4	36.6	41.3	45.6	49.5	53.1	56.4	59.4	62.1	64.6	67.0
1-Methyl-2-ethylbenzene	"	0	22.15	22.25	27.5	32.7	37.6	42.1	46.2	50.0	53.5	56.7	59.7	62.4	64.9	67.2
1- " -3- "	"	0	21.31	21.40	26.6	31.8	36.7	41.3	45.5	49.4	52.9	56.2	59.2	61.9	64.4	66.7
1- " -4- "	"	0	21.42	21.51	26.6	31.7	36.6	41.2	45.4	49.2	52.8	56.0	59.0	61.7	64.2	66.6
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	22.10	22.19	27.0	32.0	36.6	41.1	45.2	48.9	52.4	55.6	58.6	61.3	63.9	66.2
1,2,4- " (Pseudocumene)	"	0	22.17	22.26	27.1	32.1	36.8	41.2	45.3	49.1	52.6	55.8	58.7	61.5	64.0	66.3
1,3,5- " (Mesitylene)	"	0	21.22	21.31	26.21	31.23	36.04	40.55	44.74	48.59	52.13	55.39	58.39	61.15	63.70	66.05

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 7r - ALKYL CYCLOHEXANES, C_6 to C_8

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1947

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	14.21	14.28	18.38	22.85	27.34	31.64	35.67	39.40	42.85	46.0	48.9	51.6	54.0	56.3
Methylcyclohexane	C_7H_{14}	0	17.55	17.66	22.84	28.26	33.53	38.53	43.16	47.42	51.33	54.9	58.2	61.2	64.0	66.5
Ethylcyclohexane.	C_8H_{16}	0	20.45	20.58	26.7	32.9	38.9	44.6	49.9	54.7	59.1	63.1	66.8	70.2	73.3	76.2
1,1-Dimethylcyclohexane . . .	"	0	19.72	19.85	25.9	32.1	38.2	44.0	49.4	54.4	58.9	63.0	66.8	70.3	73.5	76.4
cis-1,2-Dimethylcyclohexane .	"	0	20.16	20.29	26.3	32.5	38.6	44.3	49.6	54.4	58.9	63.0	66.7	70.1	73.3	76.1
trans-1,2- " .	"	0	20.44	20.58	26.7	33.0	39.0	44.7	50.0	54.9	59.3	63.4	67.1	70.5	73.6	76.5
cis-1,3-[d] " .	"	0	20.35	20.48	26.5	32.7	38.8	44.5	49.8	54.7	59.1	63.2	67.0	70.5	73.6	76.5
trans-1,3-[e] " .	"	0	20.35	20.48	26.5	32.7	38.7	44.3	49.6	54.4	58.8	62.9	66.6	70.0	73.1	76.0
cis-1,4- " .	"	0	20.35	20.48	26.5	32.7	38.7	44.3	49.6	54.4	58.8	62.9	66.6	70.0	73.1	76.0
trans-1,4- " .	"	0	20.38	20.51	26.6	32.8	38.9	44.7	50.0	54.8	59.3	63.4	67.1	70.5	73.6	76.5

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

TABLE 8r (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function,[b] $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	8.47	8.48	9.28	10.23	11.22	12.18	13.10	13.96	14.76	15.52	16.22	16.88	17.50	18.07
Propene (Propylene)	C_3H_6	0	10.86	10.88	12.48	14.15	15.82	17.42	18.94	20.36	21.69	22.92	24.07	25.13	26.12	27.05
1-Butene.	C_4H_8	0	14.17	14.21	16.72	19.26	21.69	23.96	26.07	28.02	29.83	31.51	33.06	34.49	35.82	37.06
cis-2-Butene.	"	0	13.23	13.27	15.36	17.68	20.01	22.26	24.39	26.38	28.23	29.96	31.57	33.06	34.45	35.74
trans-2- "	"	0	14.05	14.10	16.46	18.84	21.16	23.37	25.43	27.38	29.19	30.87	32.43	33.88	35.22	36.47
2-Methylpropene(Isobutene).	"	0	13.69	13.74	16.30	18.83	21.25	23.50	25.62	27.56	29.37	31.06	32.63	34.08	35.42	36.67

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r. Specifically, for these compounds, the uncertainty in the heat content function at room temperature may be estimated as follows: for ethylene, ±0.05 cal/deg mole; for propylene, cis-2-butene, trans-2-butene, isobutene, ±0.15 cal/deg mole; for 1-butene, ±0.40 cal/deg mole. At higher temperatures the uncertainties will be larger.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8r (Part 2) - MONOOLEFINS, C_5

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg.mole[c]														
1-Pentene	C_5H_{10}	0	17.97	18.02	21.25	24.45	27.53	30.40	33.05	35.48	37.74	39.84	41.78	43.59	45.26	46.81
cis-2-Pentene	"	0	16.25	16.29	19.24	22.38	25.47	28.41	31.14	33.68	36.05	38.22	40.24	42.12	43.86	45.48
trans-2- "	"	0	17.27	17.32	20.54	23.76	26.85	29.71	32.39	34.86	37.16	39.28	41.24	43.06	44.75	46.33
2-Methyl-1-butene	"	0	16.77	16.82	20.20	23.53	26.69	29.63	32.34	34.83	37.15	39.30	41.27	43.11	44.82	46.39
3- " -1- "	"	0	17.23	17.29	20.95	24.42	27.61	30.53	33.20	35.66	37.94	40.04	41.99	43.79	45.44	46.97
2- " -2- "	"	0	16.38	16.43	19.55	22.70	25.77	28.66	31.37	33.87	36.20	38.36	40.37	42.23	43.96	45.57

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

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TABLE 6r (Part 3) - MONOOLEFINS, C_6

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
1-Hexene	C_6H_{12}	0	21.40	21.46	25.5	29.4	33.1	36.6	39.8	42.8	45.5	48.0	50.4	52.6	54.6	56.5
cis-2-Hexene	"	0	20.05	20.11	23.8	27.6	31.3	34.8	38.1	41.1	44.0					
trans-2- "	"	0	21.07	21.13	25.1	29.0	32.7	36.2	39.4	42.3	45.1					
cis-3- "	"	0	19.29	19.36	23.1	27.0	30.8	34.4	37.7	40.8	43.7					
trans-3- "	"	0	20.51	20.57	24.7	28.7	32.5	36.1	39.3	42.3	45.1					
2-Methyl-1-pentene	"	0	20.57	20.63	24.7	28.7	32.5	36.1	39.3	42.3	45.1					
3- " -1- "	"	0	20.13	20.21	24.8	29.1	33.0	36.6	39.9	42.9	45.7					
4- " -1- "	"	0	19.63	19.70	24.1	28.3	32.3	36.0	39.3	42.4	45.2					
2- " -2- "	"	0	19.05	19.11	23.0	27.0	30.8	34.4	37.8	40.8	43.7					
cis-3-Methyl-2-pentene	"	0	19.05	19.11	23.0	27.0	30.8	34.4	37.8	40.8	43.7					
trans-3- " -2- "	"	0	19.05	19.11	23.0	27.0	30.8	34.4	37.8	40.8	43.7					
cis-4- " -2- "	"	0	19.51	19.58	23.8	27.9	31.8	35.3	38.6	41.6	44.5					
trans-4- " -2- "	"	0	20.33	20.40	24.8	28.9	32.8	36.3	39.5	42.5	45.3					
2-Ethyl-1-butene	"	0	19.81	19.87	24.0	28.1	32.0	35.6	38.9	42.0	44.8					
2,3-Dimethyl-1-butene	"	0	20.03	20.10	24.7	29.0	33.0	36.6	39.8	42.8	45.6					
3,3- " -1- "	"	0	18.71	18.75	23.2	27.6	31.7	35.6	39.1	42.2	45.1					
2,3- " -2- "	"	0	19.11	19.16	23.0	26.9	30.7	34.2	37.5	40.5	43.4					

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 12r - ACETYLENES, C_2 to C_5

HEAT CONTENT FUNCTION, $(H^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Ethyne (Acetylene).	C_2H_2	0	8.021	8.036	8.853	9.582	10.212	10.762	11.249	11.689	12.090	12.460	12.802	13.119	13.416	13.694
Propyne (Methylacetylene) . .	C_3H_4	0	10.41	10.44	11.82	13.17	14.44	15.62	16.72	17.73	18.67	19.54	20.35	21.10	21.80	22.45
1-Butyne (Ethylacetylene) . .	C_4H_6	0	12.81	12.83	15.08	17.22	19.22	21.09	22.80	24.38	25.83	27.18	28.42	29.58	30.65	31.64
2- " (Dimethylacetylene).	"	0	13.28	13.32	15.15	17.03	18.86	20.62	22.28	23.84	25.29	26.64	27.90	29.06	30.15	31.16
1-Pentyne	C_5H_8	0	16.61	16.64	19.6	22.4	25.1	27.5	29.8	31.8	33.7	35.5	37.1	38.7	40.1	41.4
2- "	"	0	15.68	15.72	18.4	21.1	23.6	26.1	28.4	30.5	32.4	34.3	36.0	37.5	39.0	40.4
3-Methyl-1-butyne	"	0	15.37	15.40	18.6	21.6	24.5	27.0	29.4	31.5	33.5	35.3	37.0	38.5	39.9	41.2

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

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TABLE 20r - NORMAL PARAFFINS, C_1 to C_{20}

HEAT CONTENT FUNCTION, $(H^\circ - H^\circ_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^\circ - H^\circ_0)/T$, in cal/deg mole[c]														
Methane	CH_4	0	8.039	8.042	8.307	8.730	9.249	9.816	10.401	10.985	11.56	12.11	12.65	13.15	13.63	14.09
Ethane	C_2H_6	0	9.578	9.596	10.74	12.02	13.36	14.68	15.95	17.15	18.28	19.35	20.35	21.29	22.17	23.00
Propane	C_3H_8	0	11.78	11.82	13.89	16.08	18.22	20.27	22.20	24.00	25.67	27.23	28.68	30.02	31.27	32.43
n-Butane	C_4H_{10}	0	15.58	15.63	18.42	21.27	24.06	26.71	29.18	31.46	33.58	35.56	37.40	39.12	40.71	42.18
n-Pentane	C_5H_{12}	0	19.01	19.07	22.62	26.18	29.64	32.90	35.93	38.73	41.34	43.76	46.01	48.10	50.04	51.84
n-Hexane	C_6H_{14}	0	22.44	22.52	26.83	31.10	35.23	39.11	42.71	46.02	49.11	51.97	54.63	57.10	59.39	61.50
n-Heptane	C_7H_{16}	0	25.87	25.96	31.04	36.01	40.81	45.33	49.48	53.32	56.89	60.19	63.25	66.09	68.73	71.16
n-Octane	C_8H_{18}	0	29.30	29.41	35.25	40.93	46.40	51.54	56.26	60.61	64.66	68.40	71.87	75.09	78.08	80.82
n-Nonane	C_9H_{20}	0	32.73	32.86	39.46	45.85	51.99	57.75	63.04	67.90	72.43	76.61	80.49	84.09	87.43	90.48
n-Decane	$C_{10}H_{22}$	0	36.16	36.30	43.67	50.76	57.57	63.97	69.81	75.20	80.21	84.83	89.11	93.08	96.77	100.14
n-Undecane	$C_{11}H_{24}$	0	39.59	39.75	47.88	55.68	63.16	70.18	76.59	82.49	87.98	93.04	97.73	102.08	106.12	109.80
n-Dodecane	$C_{12}H_{26}$	0	43.02	43.20	52.09	60.60	68.75	76.39	83.37	89.78	95.75	101.25	106.35	111.08	115.47	119.46
n-Tridecane	$C_{13}H_{28}$	0	46.45	46.64	56.30	65.52	74.34	82.60	90.14	97.08	103.52	109.46	114.97	120.08	124.82	129.12
n-Tetradecane	$C_{14}H_{30}$	0	49.88	50.09	60.51	70.43	79.92	88.82	96.92	104.37	111.30	117.68	123.59	129.07	134.16	138.78
n-Pentadecane	$C_{15}H_{32}$	0	53.31	53.54	64.72	75.35	85.51	95.03	103.70	111.66	119.07	125.89	132.21	138.07	143.51	148.44
n-Hexadecane	$C_{16}H_{34}$	0	56.74	56.99	68.93	80.27	91.10	101.24	110.48	118.95	126.84	134.10	140.83	147.07	152.86	158.10
n-Heptadecane	$C_{17}H_{36}$	0	60.17	60.43	73.14	85.18	96.68	107.46	117.25	126.25	134.62	142.32	149.45	156.06	162.20	167.76
n-Octadecane	$C_{18}H_{38}$	0	63.60	63.88	77.35	90.10	102.27	113.67	124.03	133.54	142.39	150.53	158.07	165.06	171.55	177.42
n-Nonadecane	$C_{19}H_{40}$	0	67.03	67.33	81.56	95.02	107.86	119.88	130.81	140.83	150.16	158.74	166.69	174.06	180.90	187.08
n-Eicosane	$C_{20}H_{42}$	0	70.46	70.77	85.77	99.93	113.44	126.10	137.58	148.13	157.94	166.96	175.31	183.05	190.24	196.74
Increment per CH_2 group		0	3.430	3.447	4.210	4.917	5.587	6.213	6.777	7.293	7.773	8.213	8.620	8.997	9.347	9.660

[a] See footnote a of Table 1r

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 21r - NORMAL ALKYL BENZENES, C_6 TO C_{22}

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Benzene	C_6H_6	0	11.41	11.46	14.41	17.50	20.48	23.24	25.76	28.07	30.16	32.07	33.82	35.42	36.89	38.24
Methylbenzene (Toluene)	C_7H_8	0	14.44	14.51	18.17	21.94	25.56	28.92	32.03	34.86	37.45	39.82	41.99	43.98	45.81	47.50
Ethylbenzene	C_8H_{10}	0	17.89	17.97	22.44	26.99	31.33	35.35	39.03	42.38	45.45	48.25	50.82	53.18	55.34	57.35
n-Propylbenzene	C_9H_{12}	0	21.69	21.78	27.0	32.2	37.2	41.8	46.0	49.8	53.4	56.6	59.5	62.3	64.8	67.1
n-Butylbenzene	$C_{10}H_{14}$	0	25.12	25.22	31.2	37.1	42.8	48.0	52.8	57.1	61.1	64.8	68.2	71.3	74.1	76.8
n-Amylbenzene	$C_{11}H_{16}$	0	28.55	28.67	35.4	42.0	48.3	54.2	59.5	64.4	68.9	73.0	76.8	80.3	83.5	86.4
n-Hexylbenzene	$C_{12}H_{18}$	0	31.98	32.11	39.6	46.9	53.9	60.4	66.3	71.7	76.7	81.2	85.4	89.3	92.8	96.1
n-Heptylbenzene	$C_{13}H_{20}$	0	35.41	35.56	43.8	51.8	59.5	66.6	73.1	79.0	84.4	89.4	94.0	98.3	102.2	105.7
n-Octylbenzene	$C_{14}H_{22}$	0	38.84	39.01	48.0	56.8	65.1	72.8	79.9	86.3	92.2	97.6	102.6	107.3	111.5	115.4
n-Nonylbenzene	$C_{15}H_{24}$	0	42.27	42.46	52.2	61.7	70.7	79.0	86.6	93.6	100.0	105.8	111.2	116.3	120.8	125.1
n-Decylbenzene	$C_{16}H_{26}$	0	45.70	45.90	56.4	66.6	76.3	85.3	93.4	100.9	107.8	114.1	119.9	125.3	130.2	134.7
n-Undecylbenzene	$C_{17}H_{28}$	0	49.13	49.35	60.6	71.5	81.9	91.5	100.2	108.2	115.5	122.3	128.5	134.3	139.5	144.4
n-Dodecylbenzene	$C_{18}H_{30}$	0	52.56	52.80	64.8	76.4	87.4	97.7	107.0	115.4	123.3	130.5	137.1	143.3	148.9	154.0
n-Tridecylbenzene	$C_{19}H_{32}$	0	55.99	56.24	69.1	81.3	93.0	103.9	113.8	122.8	131.1	138.7	145.7	152.3	158.2	163.7
n-Tetradecylbenzene	$C_{20}H_{34}$	0	59.42	59.69	73.3	86.2	98.6	110.1	120.5	130.0	138.8	146.9	154.4	161.3	167.6	173.4
n-Pentadecylbenzene	$C_{21}H_{36}$	0	62.85	63.14	77.5	91.2	104.2	116.3	127.3	137.3	146.6	155.1	163.0	170.3	176.9	183.0
n-Hexadecylbenzene	$C_{22}H_{38}$	0	66.28	66.58	81.7	96.1	109.8	122.5	134.1	144.3	154.4	163.3	171.6	179.3	186.3	192.7
Increment per CH_2 group		0	3.430	3.447	4.21	4.92	5.59	6.21	6.78	7.29	7.77	8.21	8.62	9.00	9.35	9.66

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

TABLE 22r - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclopentane	C_5H_{10}	0	12.07	12.12	15.12	18.52	21.98	25.29	28.40	31.29	33.97	36.46	38.75	40.87	42.83	44.65
Methylcyclopentane	C_6H_{12}	0	16.01	16.09	19.88	24.03	28.17	32.09	35.75	39.15	42.28	45.18	47.87	50.34	52.62	54.74
Ethylcyclopentane	C_7H_{14}	0	18.91	19.01	23.70	28.66	33.55	38.16	42.43	46.38	50.00	53.36	56.47	59.32	61.96	64.40
n-Propylcyclopentane	C_8H_{16}	0	22.34	22.46	27.9	33.6	39.1	44.4	49.2	53.7	57.8	61.6	65.1	68.3	71.3	74.1
n-Butylcyclopentane	C_9H_{18}	0	25.77	25.90	32.1	38.5	44.7	50.6	56.0	61.0	65.6	69.8	73.7	77.3	80.6	83.7
n-Pentylcyclopentane	$C_{10}H_{20}$	0	29.20	29.35	36.3	43.4	50.3	56.8	62.8	68.3	73.3	78.0	82.3	86.3	90.0	93.4
n-Hexylcyclopentane	$C_{11}H_{22}$	0	32.63	32.80	40.5	48.3	55.9	63.0	69.5	75.6	81.1	86.2	91.0	95.3	99.4	103.0
n-Heptylcyclopentane	$C_{12}H_{24}$	0	36.06	36.24	44.8	53.2	61.5	69.2	76.3	82.8	88.9	94.4	99.6	104.3	108.7	112.7
n-Octylcyclopentane	$C_{13}H_{26}$	0	39.49	39.69	49.0	58.2	67.1	75.4	83.1	90.1	96.6	102.6	108.2	113.3	118.0	122.4
n-Nonylcyclopentane	$C_{14}H_{28}$	0	42.92	43.14	53.2	63.1	72.7	81.6	89.9	97.4	104.4	110.8	116.8	122.3	127.4	132.0
n-Decylcyclopentane	$C_{15}H_{30}$	0	46.35	46.59	57.4	68.0	78.2	87.9	96.6	104.7	112.2	119.1	125.4	131.3	136.7	141.7
n-Undecylcyclopentane	$C_{16}H_{32}$	0	49.78	50.03	61.6	72.9	83.8	94.1	103.4	112.0	120.0	127.3	134.0	140.3	146.1	151.3
n-Dodecylcyclopentane	$C_{17}H_{34}$	0	53.21	53.48	65.8	77.8	89.4	100.3	110.2	119.3	127.7	135.5	142.7	149.3	155.4	161.0
n-Tridecylcyclopentane	$C_{18}H_{36}$	0	56.64	56.93	70.0	82.8	95.0	106.5	117.0	126.6	135.5	143.7	151.3	158.3	164.8	170.7
n-Tetradecylcyclopentane	$C_{19}H_{38}$	0	60.07	60.37	74.2	87.7	100.6	112.7	123.8	133.9	143.3	151.9	159.9	167.3	174.1	180.3
n-Pentadecylcyclopentane	$C_{20}H_{40}$	0	63.50	63.82	78.4	92.6	106.2	118.9	130.5	141.2	151.0	160.1	168.5	176.3	183.5	190.0
n-Hexadecylcyclopentane	$C_{21}H_{42}$	0	66.93	67.27	82.6	97.5	111.8	125.1	137.3	148.5	158.8	168.3	177.2	185.3	192.8	199.6
Increment per CH_2 group		0	3.430	3.447	4.21	4.92	5.59	6.21	6.78	7.29	7.77	8.21	8.62	9.00	9.35	9.66

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 23r - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	14.21	14.28	18.38	22.85	27.34	31.64	35.67	39.40	42.85	46.0	48.9	51.6	54.0	56.3
Methylcyclohexane	C_7H_{14}	0	17.55	17.66	22.84	28.26	33.53	38.53	43.16	47.42	51.33	54.9	58.2	61.2	64.0	66.5
Ethylcyclohexane.	C_8H_{16}	0	20.45	20.58	26.7	32.9	38.9	44.6	49.9	54.7	59.1	63.1	66.8	70.2	73.3	76.2
n-Propylcyclohexane	C_9H_{18}	0	23.66	23.81	30.6	37.7	44.3	50.6	56.4	61.8	66.7	71.3	75.4	79.2	82.6	85.9
n-Butylcyclohexane.	$C_{10}H_{20}$	0	27.09	27.26	34.8	42.6	50.0	56.8	63.2	69.1	74.5	79.5	84.0	88.2	92.0	95.5
n-Pentylcyclohexane	$C_{11}H_{22}$	0	30.52	30.70	39.0	47.5	55.5	63.0	70.0	76.4	82.2	87.7	92.7	97.2	101.3	105.2
n-Hexylcyclohexane.	$C_{12}H_{24}$	0	33.95	34.15	43.2	52.5	61.1	69.2	76.7	83.7	90.0	96.0	101.3	106.2	110.7	114.8
n-Heptylcyclohexane	$C_{13}H_{26}$	0	37.38	37.60	47.4	57.4	66.6	75.5	83.5	91.0	97.8	104.2	109.9	115.2	120.0	124.5
n-Octylcyclohexane.	$C_{14}H_{28}$	0	40.81	41.05	51.6	62.3	72.2	81.7	90.3	98.3	105.6	112.4	118.5	124.2	129.4	134.2
n-Nonylcyclohexane.	$C_{15}H_{30}$	0	44.24	44.49	55.9	67.2	77.8	87.9	97.1	105.6	113.3	120.6	127.1	133.2	138.7	143.8
n-Decylcyclohexane.	$C_{16}H_{32}$	0	47.67	47.94	60.1	72.1	83.4	94.1	103.8	112.9	121.1	128.8	135.8	142.2	148.1	153.5
n-Undecylcyclohexane. . . .	$C_{17}H_{34}$	0	51.10	51.39	64.3	77.0	89.0	100.3	110.6	120.1	128.9	137.0	144.4	151.2	157.4	163.1
n-Dodecylcyclohexane. . . .	$C_{18}H_{36}$	0	54.53	54.83	68.5	82.0	94.6	106.5	117.4	127.4	136.7	145.2	153.0	160.2	166.8	172.8
n-Tridecylcyclohexane.. . .	$C_{19}H_{38}$	0	57.96	58.28	72.7	86.9	100.2	112.7	124.2	134.7	144.4	153.4	161.6	169.2	176.1	182.5
n-Tetradecylcyclohexane . .	$C_{20}H_{40}$	0	61.39	61.73	76.9	91.8	105.8	118.9	130.9	142.0	152.2	161.7	170.2	178.2	185.5	192.1
n-Pentadecylcyclohexane . .	$C_{21}H_{42}$	0	64.82	65.17	81.1	96.7	111.3	125.2	137.7	149.3	160.0	169.9	178.9	187.2	194.8	201.8
n-Hexadecylcyclohexane. . .	$C_{22}H_{44}$	0	68.25	68.62	85.3	101.6	116.9	131.4	144.5	156.6	167.7	178.1	187.5	196.2	204.2	211.4
Increment per CH_2 group		0	3.430	3.447	4.21	4.92	5.59	6.21	6.78	7.29	7.77	8.21	8.62	9.00	9.35	9.66

[a] See footnote a of Table 1r. [b] See footnote b of Table 1r. [c] See footnote c of Table 1r.

TABLE 24r - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	8.47	8.48	9.28	10.23	11.22	12.18	13.10	13.96	14.76	15.52	16.22	16.88	17.50	18.07
Propene (Propylene)	C_3H_6	0	10.86	10.88	12.48	14.15	15.82	17.42	18.94	20.36	21.69	22.92	24.07	25.13	26.12	27.05
1-Butene.	C_4H_8	0	14.17	14.21	16.72	19.26	21.69	23.96	26.07	28.02	29.83	31.51	33.06	34.49	35.82	37.06
1-Pentene	C_5H_{10}	0	17.97	18.02	21.25	24.45	27.53	30.40	33.05	35.48	37.74	39.84	41.78	43.59	45.26	46.81
1-Hexene.	C_6H_{12}	0	21.40	21.46	25.5	29.4	33.1	36.6	39.8	42.8	45.5	48.0	50.4	52.6	54.6	56.5
1-Heptene	C_7H_{14}	0	24.83	24.91	29.7	34.3	38.7	42.8	46.6	50.0	53.3	56.3	59.0	61.6	63.9	66.1
1-Octene.	C_8H_{16}	0	28.26	28.36	33.9	39.2	44.3	49.0	53.4	57.3	61.0	64.5	67.6	70.6	73.3	75.8
1-Nonene.	C_9H_{18}	0	31.69	31.80	38.1	44.1	49.9	55.2	60.1	64.6	68.8	72.7	76.3	79.6	82.6	85.5
1-Decene.	$C_{10}H_{20}$	0	35.12	35.25	42.3	49.0	55.5	61.5	66.9	71.9	76.6	80.9	84.9	88.6	92.0	95.1
1-Undecene.	$C_{11}H_{22}$	0	38.55	38.70	46.5	53.9	61.0	67.7	73.7	79.2	84.4	89.1	93.5	97.6	101.3	104.8
1-Dodecene.	$C_{12}H_{24}$	0	41.98	42.14	50.7	58.9	66.6	73.9	80.5	86.5	92.1	97.3	102.1	106.6	110.7	114.4
1-Tridecene	$C_{13}H_{26}$	0	45.41	45.59	54.9	63.8	72.2	80.1	87.2	93.8	99.9	105.5	110.7	115.6	120.0	124.1
1-Tetradecene	$C_{14}H_{28}$	0	48.84	49.04	59.1	68.7	77.8	86.3	94.0	101.1	107.7	113.7	119.4	124.6	129.4	133.8
1-Pentadecene	$C_{15}H_{30}$	0	52.27	52.49	63.3	73.6	83.4	92.5	100.8	108.4	115.4	122.0	128.0	133.6	138.7	143.4
1-Hexadecene.	$C_{16}H_{32}$	0	55.70	55.93	67.6	78.5	89.0	98.7	107.6	115.7	123.2	130.2	136.6	142.6	148.1	153.1
1-Heptadecene	$C_{17}H_{34}$	0	59.13	59.38	71.8	83.4	94.6	105.0	114.3	123.0	131.0	138.4	145.2	151.6	157.4	162.7
1-Octadecene.	$C_{18}H_{36}$	0	62.56	62.83	76.0	88.4	100.1	111.2	121.1	130.3	138.8	146.6	153.8	160.6	166.8	172.4
1-Nonadecene.	$C_{19}H_{38}$	0	65.99	66.27	80.2	93.3	105.7	117.4	127.9	137.6	146.6	154.8	162.5	169.6	176.1	182.1
1-Eicosene.	$C_{20}H_{40}$	0	69.42	69.72	84.4	98.2	111.3	123.6	134.7	144.9	154.3	163.0	171.1	178.6	185.5	191.7
Increment per CH_2 group . .		0	3.430	3.447	4.21	4.92	5.59	6.21	6.78	7.29	7.77	8.21	8.62	9.00	9.35	9.66

[a] See footnote a of Table 1r. [b] See footnote b of Table 1r. [c] See footnote c of Table 1r.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25r - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}
HEAT CONTENT FUNCTION, $(H^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content Function[b], $(H^o-H^o_0)/T$, in cal/deg mole[c]														
Ethyne (Acetylene)	C_2H_2	0	8.021	8.036	8.853	9.582	10.212	10.762	11.249	11.689	12.090	12.460	12.802	13.119	13.416	13.694
Propyne (Methylacetylene).	C_3H_4	0	10.41	10.44	11.82	13.17	14.44	15.62	16.72	17.73	18.67	19.54	20.35	21.10	21.80	22.45
1-Butyne (Ethylacetylene).	C_4H_6	0	12.81	12.83	15.08	17.22	19.22	21.09	22.80	24.38	25.83	27.18	28.42	29.58	30.65	31.64
1-Pentyne.	C_5H_8	0	16.61	16.64	19.6	22.4	25.1	27.5	29.8	31.8	33.7	35.5	37.1	38.7	40.1	41.4
1-Hexyne	C_6H_{10}	0	20.04	20.08	23.8	27.3	30.6	33.7	36.5	39.1	41.5	43.7	45.8	47.7	49.4	51.0
1-Heptyne.	C_7H_{12}	0	23.47	23.53	28.0	32.2	36.2	39.9	43.3	46.4	49.3	51.9	54.4	56.7	58.8	60.7
1-Octyne	C_8H_{14}	0	26.90	26.98	32.2	37.2	41.8	46.1	50.1	53.7	57.0	60.1	63.0	65.7	68.1	70.4
1-Nonyne	C_9H_{16}	0	30.33	30.42	36.4	42.1	47.4	52.4	56.9	61.0	64.8	68.4	71.6	74.6	77.5	80.0
1-Decyne	$C_{10}H_{18}$	0	33.76	33.87	40.6	47.0	53.0	58.6	63.6	68.3	72.6	76.6	80.2	83.6	86.8	89.7
1-Undecyne	$C_{11}H_{20}$	0	37.19	37.32	44.9	51.9	58.6	64.8	70.4	75.6	80.4	84.8	88.8	92.6	96.2	99.4
1-Dodecyne	$C_{12}H_{22}$	0	40.62	40.76	49.1	56.8	64.2	71.0	77.2	82.9	88.1	93.0	97.5	101.6	105.5	109.0
1-Tridecyne.	$C_{13}H_{24}$	0	44.05	44.21	53.3	61.7	69.8	77.2	84.0	90.2	95.9	101.2	106.1	110.6	114.8	118.7
1-Tetradecyne.	$C_{14}H_{26}$	0	47.48	47.66	57.5	66.7	75.3	83.4	90.8	97.4	103.7	109.4	114.7	119.6	124.2	128.3
1-Pentadecyne.	$C_{15}H_{28}$	0	50.91	51.11	61.7	71.6	80.9	89.6	97.5	104.7	111.4	117.6	123.3	128.6	133.6	138.0
1-Hexadecyne	$C_{16}H_{30}$	0	54.34	54.55	65.9	76.5	86.5	95.8	104.3	112.0	119.2	125.8	132.0	137.6	142.9	147.6
1-Heptadecyne.	$C_{17}H_{32}$	0	57.77	58.00	70.1	81.4	92.1	102.1	111.1	119.3	127.0	134.0	140.6	146.6	152.2	157.3
1-Octadecyne	$C_{18}H_{34}$	0	61.20	61.45	74.3	86.3	97.7	108.3	117.9	126.6	134.8	142.3	149.2	155.6	161.6	167.0
1-Nonadecyne	$C_{19}H_{36}$	0	64.63	64.89	78.5	91.2	103.3	114.5	124.6	133.9	142.6	150.5	157.8	164.6	170.9	176.6
1-Eicosyne	$C_{20}H_{38}$	0	68.06	68.34	82.8	96.2	108.9	120.7	131.4	141.2	150.3	158.7	166.4	173.6	180.3	186.3
Increment per CH_2 group		0	3.430	3.447	4.21	4.92	5.59	6.21	6.78	7.29	7.77	8.21	8.62	9.00	9.35	9.66

[a] See footnote a of Table 1r.

[b] See footnote b of Table 1r.

[c] See footnote c of Table 1r.

TABLE 00s - O, H, N, C

FREE ENERGY FUNCTION, $(F^{o}-H^{o}_{0})/T$, FOR THE IDEAL GAS STATE, AT 0^{o} to 4000^{o}K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^{o}-H^{o}_{0})/T$, in cal/deg mole[c]														
Oxygen	O	0	-33.078	-33.111	-34.654	-35.840	-36.801	-37.609	-38.304	-38.915	-39.460	-39.950	-40.397	-40.808	-41.187	-41.539
Hydrogen	H	0	-22.425	-22.455	-23.884	-24.993	-25.899	-26.665	-27.328	-27.913	-28.436	-28.910	-29.342	-29.740	-30.108	-30.451
Nitrogen	N	0	-31.646	-31.677	-33.106	-34.215	-35.120	-35.886	-36.550	-37.135	-37.658	-38.132	-38.564	-38.962	-39.330	-39.673
Carbon	C	0	-32.533	-32.565	-34.059	-35.207	-36.139	-36.924	-37.602	-38.198	-38.730	-39.211	-39.649	-40.052	-40.425	-40.772

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Free Energy Function, $(F^{o}-H^{o}_{0})/T$, in cal/deg mole														
Oxygen	O	-39.460	-40.609	-41.539	-42.324	-43.002	-43.599	-44.132	-44.613	-45.052	-45.829	-46.502				
Hydrogen	H	-28.436	-29.545	-30.451	-31.217	-31.880	-32.465	-32.989	-33.462	-33.894	-34.660	-35.324				
Nitrogen	N	-37.658	-38.767	-39.673	-40.438	-41.102	-41.687	-42.210	-42.684	-43.117	-43.884	-44.550				
Carbon	C	-38.730	-39.855	-40.772	-41.545	-42.215	-42.805	-43.334	-43.812	-44.250	-45.028	-45.706				

[a] Interpolation to other temperatures in the interval 298.16^{o} to 4000^{o}K may be made by appropriate graphical or analytical methods. For temperatures between 200^{o} and 298.16^{o}K, values may be estimated by extrapolating to lower temperatures the values for 300^{o}, 400^{o}, 500^{o}, and 600^{o}K.

[b] The free energy function, $(F^{o}-H^{o}_{0})/T$, is the free energy at the given temperature less the heat content at 0^{o}K, divided by the absolute temperature (^{o}K), of the given substance in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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National Bureau of Standards — Washington, D. C.

TABLE 0s - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °K													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]													
Oxygen	O_2	gas	0				-39.294	-40.835	-42.061	-42.106	-44.112	-45.675	-46.968	-48.071	-49.044	-49.911
Hydrogen	H_2	gas	0					-23.331	-24.423	-24.465	-26.422	-27.950	-29.203	-30.265	-31.186	-32.004
Hydroxyl	OH	gas	0						-36.824	-36.859	-38.904	-40.483	-41.772	-42.860	-43.804	-44.637
Watsr	H_2O	gas	0						-37.172	-37.221	-39.508	-41.295	-42.768	-44.026	-45.131	-46.120
Nitrogen	N_2	gas	0		-31.229		-36.043	-37.595	-38.817	-38.859	-40.861	-42.415	-43.688	-44.769	-45.711	-46.550
Nitric Oxide	NO	gas	0		-34.844	-37.864	-40.012	-41.667	-42.980	-43.028	-45.134	-46.760	-48.090	-49.219	-50.202	-51.075
Carbon	C	solid, graphite	0		-0.0739	-0.1582	-0.2639	-0.3866	-0.5172	-0.5227	-0.8245	-1.146	-1.477	-1.810	-2.138	-2.459
Carbon Monoxide	CO	gas	0		-32.762		-37.573	-39.124	-40.350	-40.391	-42.393	-43.947	-45.222	-46.308	-47.254	-48.097
Carbon Dioxids	CO_2	gas	0						-43.555	-43.601	-45.828	-47.663	-49.239	-50.634	-51.895	-53.047

Compound	Formula	State	Tempsrature in °K													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Free Ensrgy Function, $(F^o-H^o_0)/T$, in cal/dsg mole													
Oxygsn	O_2	gas	-50.697	-51.415	-52.077	-52.695	-53.272	-53.808	-55.027	-56.103	-57.059	-57.930	-58.730	-59.468	-60.798	-61.958
Hydrogen	H_2	gas	-32.738	-33.402	-34.012	-34.576	-35.098	-35.590	-36.696	-37.669	-38.539	-39.328	-40.051	-40.719	-41.922	-42.988
Hydroxyl	OH	gas	-45.385	-46.063	-46.686	-47.259	-47.795	-48.295	-49.424	-50.415	-51.301	-52.104	-52.840	-53.521	-54.744	-55.822
Watsr	H_2O	gas	-47.018	-47.842	-48.605	-49.318	-49.989	-50.622	-52.08	-53.38	-54.57	-55.65	-56.65	-57.59		
Nitrogen	N_2	gas	-47.306	-47.994	-48.629	-49.218	-49.768	-50.284	-51.449	-52.478	-53.396	-54.228	-54.988	-55.687	-56.941	-58.043
Nitric Oxide	NO	gas	-51.864	-52.583	-53.245	-53.858	-54.428	-54.964	-56.175	-57.239	-58.188	-59.045	-59.828	-60.549	-61.839	-62.966
Carbon	C	solid, graphite	-2.771	-3.073	-3.365	-3.647	-3.919	-4.181								
Carbon Monoxide	CO	gas	-48.860	-49.554	-50.196	-50.789	-51.345	-51.864	-53.041	-54.078	-55.003	-55.842	-56.610	-57.314	-58.578	-59.688
Carbon Dioxids	CO_2	gas	-54.109	-55.096	-56.018	-56.888	-57.706	-58.481	-60.26	-61.85	-63.28	-64.60	-65.86	-67.11	-68.98	

[a] Interpolation to othsr tempsraturss in the interval 50^o to 4000^oK may bs made by appropriate graphical or analytical msthods.

[b] Sss footnots b of Table 00s.

[c] Sse footnots c of Table 00s.

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National Bureau of Standards — Washington, D. C.

TABLE 1s - PARAFFINS, C_1 to C_5

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

August 31, 1944

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$ cal/deg mole[c]														
Methane	CH_4	0	-36.46	-36.51	-38.86	-40.75	-42.39	-43.86	-45.21	-46.47	-47.65	-48.78	-49.86	-50.89	-51.88	-52.84
Ethane	C_2H_6	0	-45.27	-45.33	-48.24	-50.77	-53.08	-55.25	-57.29	-59.24	-61.11	-62.90	-64.63	-66.30	-67.91	-69.46
Propane	C_3H_8	0	-52.73	-52.80	-56.48	-59.81	-62.93	-65.90	-68.74	-71.47	-74.10	-76.63	-79.07	-81.43	-83.70	-85.96
n-Butane	C_4H_{10}	0	-58.52	-58.62	-63.49	-67.93	-72.05	-75.95	-79.69	-83.28	-86.73	-90.03	-93.20	-96.25	-99.20	-102.04
2-Methylpropane (Isobutane)	"	0	-56.08	-56.16	-60.72	-64.95	-68.95	-72.78	-76.45	-79.98	-83.38	-86.65	-89.80	-92.86	-95.81	-98.64
n-Pentane	C_5H_{12}	0	-64.26	-64.37	-70.33	-75.76	-80.84	-85.66	-90.26	-94.68	-98.92	-102.98	-106.88	-110.64	-114.27	-117.76
2-Methylbutane (Isopentane)	"	0	-64.74	-64.84	-70.35	-75.52	-80.40	-85.13	-89.67	-94.01	-98.21	-102.24	-106.12	-109.88	-113.51	-116.98
2,2-Dimethylpropane (Neopentane)	"	0	-56.36	-56.46	-61.93	-67.04	-71.96	-76.70	-81.27	-85.67	-89.90	-93.98	-97.92	-101.71	-105.37	-108.91

[a] Interpolation to other temperatures in the interval 298.16^o to 1500^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o, and 600^oK.

[b] The free energy function, $(F^o-H^o_0)/T$, is the free energy at the given temperature less the heat content at 0^oK, divided by the absolute temperature (^oK), of the given hydrocarbon in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2s (Part 1) - PARAFFINS, C_6

FREE ENERGY FUNCTION, $(F^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o - H^o_0)/T$ cal/deg mole[c]														
n - Hexane	C_6H_{14}	0	-70.01	-70.15	-77.20	-83.65	-89.68	-95.41	-100.89	-106.14	-111.18	-116.00	-120.64	-125.10	-129.40	-133.53
2 - Methylpentane. .	"	0	-70.20	-70.34	-76.9	-83.0	-88.8	-94.4	-99.8	-105.0	-110.0	-114.7	-119.3	-123.8	-129.1	-132.2
3 - " . .	"	0	-70.15	-70.29	-76.9	-83.1	-89.0	-94.6	-100.1	-105.3	-110.3	-115.1	-119.7	-124.2	-128.5	-132.6
2,2 - Dimethylbutane	"	0	-65.81	-65.93	-72.4	-78.4	-84.2	-89.8	-95.2	-100.4	-105.4	-110.2	-114.8	-119.3	-123.6	-127.8
2,3 - "	"	0	-66.97	-67.08	-73.6	-79.8	-85.7	-91.2	-96.6	-101.8	-106.8	-111.6	-116.0	-120.6	-125.0	-129.1

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

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National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2s (Part 2) - PARAFFINS, C_7

FREE ENERGY FUNCTION, $(F^o - H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o - H^o_0)/T$ cal/deg mole[c]														
n - Heptane	C_7H_{16}	0	-75.77	-75.92	-84.06	-91.53	-98.53	-105.17	-111.51	-117.60	-123.43	-129.03	-134.40	-139.57	-144.54	-149.29
2 - Methylhexane. . .	"	0	-75.75	-75.90	-83.7	-90.9	-97.7	-104.2	-110.4	-116.5	-122.3					
3 - " . . .	"	0	-76.05	-76.19	-85.8	-92.9	-99.6	-106.0	-112.2	-118.2	-124.0					
3 - Ethylpentane. . .	"	0	-75.95	-76.09	-83.5	-90.4	-96.9	-103.1	-109.2	-115.1	-120.9					
2,2 - Dimethylpentane	"	0	-71.25	-71.39	-78.8	-85.7	-92.3	-98.6	-104.8	-110.8	-116.7					
2,3 - "	"	0	-76.75	-76.89	-84.4	-91.2	-97.8	-104.0	-110.1	-116.1	-121.8					
2,4 - "	"	0	-72.55	-72.69	-80.2	-87.1	-93.7	-100.0	-106.1	-112.2	-118.0					
3,3 - "	"	0	-73.05	-73.19	-80.8	-87.7	-94.4	-100.7	-106.9	-113.0	-118.8					
2,2,3 - Trimethylbutane	"	0	-70.45	-70.59	-78.1	-85.0	-91.6	-97.9	-104.1	-110.1	-116.0					

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 3s - PARAFFINS, C_8

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

October 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$ cal/deg mole[c]														
n-Octane	C_8H_{18}	0	-81.52	-81.70	-90.93	-99.42	-107.37	-114.92	-122.14	-129.06	-135.69	-142.05	-148.16	-154.03	-159.67	-165.06
2-Methylheptane	"	0	-81.49	-81.66	-90.5	-98.7	-106.5	-113.9	-121.1	-128.1	-134.6					
3- "	"	0	-83.33	-83.50	-92.3	-100.4	-108.1	-115.5	-122.7	-129.6	-136.1					
4- "	"	0	-81.63	-81.79	-90.5	-98.6	-106.2	-113.6	-120.7	-127.6	-134.1					
3-Ethylhexane	"	0	-84.23	-84.39	-92.8	-100.5	-107.8	-114.9	-121.9	-128.7	-135.1					
2,2-Dimethylhexane	"	0	-77.08	-77.24	-85.9	-93.9	-101.4	-108.7	-115.9	-122.8	-129.3					
2,3 "	"	0	-79.76	-79.92	-88.7	-96.9	-104.6	-112.0	-119.2	-126.2	-132.8					
2,4- "	"	0	-81.27	-81.43	-89.9	-97.8	-105.3	-112.5	-119.6	-126.4	-133.0					
2,5- "	"	0	-79.35	-79.51	-88.1	-96.0	-103.5	-110.7	-117.8	-124.6	-131.2					
3,3- "	"	0	-79.49	-79.65	-88.1	-95.9	-103.4	-110.6	-117.7	-124.6	-131.2					
3,4- "	"	0	-78.10	-78.26	-87.0	-95.1	-102.8	-110.2	-117.4	-124.4	-130.9					
2-Methyl-3-ethylpentane	"	0	-79.58	-79.74	-88.3	-96.3	-103.9	-111.3	-118.4	-125.3	-131.8					
3- " -3- "	"	0	-78.24	-78.40	-86.9	-94.8	-102.2	-109.5	-116.6	-123.6	-130.1					
2,2,3-Trimethylpentane	"	0	-76.85	-77.00	-85.4	-93.2	-100.6	-107.8	-114.9	-121.8	-128.4					
2,2,4- "	"	0	-76.85	-77.00	-85.4	-93.2	-100.6	-107.8	-114.9	-121.8	-128.4					
2,3,3- "	"	0	-77.37	-78.12	-86.7	-94.5	-102.0	-109.3	-116.4	-123.3	-129.9					
2,3,4- "	"	0	-78.25	-78.40	-86.9	-94.7	-102.2	-109.4	-116.5	-123.3	-129.9					
2,2,3,3-Tetramethylbutane	"	0	-69.77	-69.92	-78.3	-86.2	93.7	-101.1	-108.3	-115.2	-121.7					

[a] See footnote a of Table 1s. [b] See footnote b of Table 1s. [c] See footnote c of Table 1s.

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National Bureau of Standards — Washington, D. C.

TABLE 5s - ALKYL BENZENES, C_6 to C_9

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Benzene	C_6H_6	0	-52.93	-53.00	-56.69	-60.24	-63.70	- 67.06	- 70.34	- 73.50	- 76.57	- 79.54	- 82.40	- 85.18	- 87.85	- 90.45
Methylbenzene (Toluene)	C_7H_8	0	-61.98	-62.07	-66.74	-71.20	-75.52	- 79.72	- 83.79	- 87.72	- 91.53	- 95.21	- 98.77	-102.21	-105.53	-108.75
Ethylbenzene	C_8H_{10}	0	-68.26	-68.37	-74.14	-79.64	-84.94	- 90.08	- 95.05	- 99.84	-104.47	-108.94	-113.25	-117.42	-121.44	-125.32
1,2-Dimethylbenzene (o-Xylene)	"	0	-65.61	-65.73	-71.74	-77.40	-82.81	- 88.01	- 93.01	- 97.82	-102.46	-106.93	-111.24	-115.39	-119.42	-123.30
1,3- " (m- ")	"	0	-67.63	-67.74	-73.50	-78.95	-84.20	- 89.28	- 94.18	- 98.91	-103.48	-107.89	-112.15	-116.27	-120.25	-124.11
1,4- " (p- ")	"	0	-66.26	-66.37	-72.15	-77.59	-82.83	- 87.89	- 92.76	- 97.48	-102.02	-106.42	-110.66	-114.77	-118.74	-122.59
n-Propylbenzene	C_9H_{12}	0	-74.05	-74.19	-81.2	-87.8	-94.1	-100.1	-106.0	-111.6	-117.1	-122.3	-127.4	-132.2	-136.9	-141.5
Isopropylbenzene (Cumene)	"	0	-72.42	-72.54	-79.2	-85.6	-91.8	- 97.8	-103.6	-109.2	-114.6	-119.8	-124.8	-129.6	-134.4	-138.9
1-Methyl-2-ethylbenzene	"	0	-73.27	-73.41	-80.5	-87.2	-93.6	- 99.8	-105.6	-111.3	-116.8	-122.0	-127.1	-132.0	-136.7	-141.2
1- " -3- "	"	0	-75.29	-75.42	-82.3	-88.8	-95.0	-101.0	-106.8	-112.4	-117.8	-123.0	-128.0	-132.9	-137.5	-142.1
1- " -4- "	"	0	-73.92	-74.05	-80.9	-87.4	-93.6	- 99.6	-105.4	-111.0	-116.3	-121.5	-126.5	-131.4	-136.0	-140.5
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	-71.40	-71.53	-78.4	-84.9	-91.2	- 97.2	-102.9	-108.5	-113.8	-119.0	-123.9	-128.7	-133.4	-137.8
1,2,4- " (Pseudocumene)	"	0	-72.57	-72.70	-79.6	-86.2	-92.4	- 98.4	-104.2	-109.8	-115.1	-120.3	-125.3	-130.1	-134.7	-139.2
1,3,5- " (Mesitylene)	"	0	-70.93	-71.06	-77.66	-84.04	-90.18	- 96.08	-101.77	-107.26	-112.56	-117.68	-122.62	-127.40	-132.03	-136.50

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 7s - ALKYL CYCLOHEXANES, C_6 to C_8

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30. 1947

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	-57.07	-57.16	-61.80	-66.39	-70.96	-75.50	-79.98	-84.40	-88.74	-93.0	-97.1	-101.1	-105.0	-108.8
Methylcyclohexane	C_7H_{14}	0	-64.51	-64.62	-70.38	-76.06	-81.68	-87.24	-92.70	-98.04	-103.24	-108.3	-113.2	-118.0	-122.6	-127.1
Ethylcyclohexane	C_8H_{16}	0	-70.99	-71.12	-77.8	-84.5	-91.0	-97.4	-103.7	-109.9	-115.9	-121.7	-127.3	-132.8	-138.1	-143.3
1,1-Dimethylcyclohexane	"	0	-67.52	-67.67	-74.1	-80.6	-87.0	-93.3	-99.6	-105.7	-111.7	-117.5	-123.1	-128.5	-133.8	-139.1
cis-1,2- "	"	0	-69.35	-69.49	-76.1	-82.6	-89.1	-95.5	-101.8	-107.9	-113.9	-119.7	-125.3	-130.7	-136.0	-141.3
trans-1,2- "	"	0	-68.21	-68.36	-75.1	-81.7	-88.3	-94.7	-101.1	-107.3	-113.3	-119.1	-124.8	-130.2	-135.6	-140.8
cis-1,3-[d] "	"	0	-68.19	-68.34	-75.0	-81.6	-88.1	-94.5	-100.8	-107.0	-113.0	-118.8	-124.4	-129.9	-135.2	-140.4
trans-1,3-[e] "	"	0	-69.57	-69.72	-76.4	-83.0	-89.4	-95.8	-102.1	-108.3	-114.2	-120.0	-125.6	-131.0	-136.3	-141.5
cis-1,4- "	"	0	-68.19	-68.34	-75.0	-81.6	-88.1	-94.5	-100.8	-106.9	-112.8	-118.6	-124.2	-129.6	-134.9	-140.1
trans-1,4- "	"	0	-66.81	-66.96	-73.6	-80.2	-86.7	-93.2	-99.6	-105.7	-111.8	-117.6	-123.2	-128.7	-134.0	-139.3

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

TABLE 8s (Part 1) - MONOOLEFINS, C_2 to C_4

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	-43.98	-44.03	-46.61	-48.74	-50.70	-52.50	-54.19	-55.78	-57.29	-58.74	-60.12	-61.44	-62.71	-63.94
Propene (Propylene)	C_3H_6	0	-52.95	-53.02	-56.39	-59.32	-62.05	-64.61	-67.04	-69.36	-71.57	-73.69	-75.73	-77.70	-79.60	-81.43
1-Butene.	C_4H_8	0	-59.32	-59.41	-63.87	-67.84	-71.56	-75.08	-78.42	-81.61	-84.66	-87.58	-90.39	-93.09	-95.70	-98.21
cis-2-Butene.	"	0	-58.67	-58.75	-62.89	-66.51	-69.94	-73.19	-76.30	-79.29	-82.17	-84.95	-87.62	-90.20	-92.70	-95.12
trans-2- "	"	0	-56.80	-56.89	-61.31	-65.19	-68.84	-72.27	-75.53	-78.64	-81.62	-84.47	-87.22	-89.87	-92.44	-94.91
2-Methylpropene (Isobutene).	"	0	-56.47	-56.56	-60.90	-64.77	-68.42	-71.88	-75.15	-78.29	-81.29	-84.17	-86.94	-89.60	-92.17	-94.66

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s. Specifically, for these compounds, the uncertainty in the free energy function at room temperature may be estimated as follows: for ethylene, ±0.05 cal/deg mole; for propylene, cis-2-butene, trans-2-butene, isobutene, ±0.15 cal/deg mole; for 1-butene, ±0.40 cal/deg mole. At higher temperature the uncertainty will be larger.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8s (Part 2) - MONOOLEFINS, C_5

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
1-Pentene.	C_5H_{10}	0	- 65.11	- 65.23	- 70.88	- 75.96	- 80.68	- 85.13	- 89.37	- 93.42	- 97.29	-100.98	-104.52	-107.91	-111.20	-114.39
cis-2-Pentene.	"	0	- 66.51	- 66.60	- 71.73	- 76.30	- 80.64	- 84.80	- 88.76	- 92.59	- 96.27	- 99.82	-103.22	-106.52	-109.70	-112.81
trans-2- "	"	0	- 64.54	- 64.65	- 70.13	- 75.01	- 79.60	- 83.97	- 88.12	- 92.07	- 95.87	- 99.51	-103.02	-106.39	-109.64	-112.78
2-Methyl-1-butene. . . .	"	0	- 64.96	- 65.06	- 70.41	- 75.23	- 79.80	- 84.14	- 88.27	- 92.24	- 96.04	- 99.69	-103.18	-106.55	-109.80	-112.96
3- " -1- "	"	0	- 62.47	- 62.57	- 67.99	- 73.12	- 77.87	- 82.34	- 86.59	- 90.65	- 94.51	- 98.23	-101.77	-105.20	-108.51	-111.73
2- " -2- "	"	0	- 64.52	- 64.63	- 69.84	- 74.48	- 78.88	- 83.09	- 87.09	- 90.93	- 94.62	- 98.18	-101.60	-104.91	-108.09	-111.19

[a] See footnote a of Table 1s. [b] See footnote b of Table 1s. [c] See footnote c of Table 1s.

TABLE 8s (Part 3) - MONOOLEFINS, C_6

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o- H^o_0)/T$, in cal/deg mole[c]														
1-Hexene	C_6H_{12}	0	-70.85	-70.98	-77.7	-83.8	-89.5	-94.8	-99.9	-104.8	-109.5	-113.9	-118.2	-122.3	-126.3	-130.1
cis-2-Hexene	"	0	-72.30	-72.42	-78.7	-84.4	-89.8	-94.9	-99.7	-104.4	-108.9					
trans-2- "	"	0	-70.33	-70.47	-77.1	-83.1	-88.7	-94.0	-99.1	-103.9	-108.5					
cis-3- "	"	0	-71.44	-71.54	-77.7	-83.6	-88.4	-93.4	-98.2	-102.9	-107.3					
trans-3- "	"	0	-69.53	-69.66	-76.2	-82.1	-87.6	-92.9	-98.0	-102.8	-107.4					
2-Methyl-1-pentene	"	0	-70.75	-70.88	-77.4	-83.4	-88.9	-94.2	-99.2	-104.1	-108.7					
3- " -1- "	"	0	-70.32	-70.44	-76.8	-82.9	-88.5	-93.9	-99.0	-103.9	-108.5					
4- " -1- "	"	0	-69.95	-70.07	-76.4	-82.2	-87.7	-92.9	-98.0	-102.8	-107.4					
2- " -2- "	"	0	-71.40	-71.51	-77.6	-83.1	-88.3	-93.4	-98.2	-102.8	-107.3					
cis-3-Methyl-2-pentene	"	0	-71.40	-71.51	-77.6	-83.1	-88.3	-93.4	-98.2	-102.8	-107.3					
trans-3- " -2- "	"	0	-72.21	-72.32	-78.4	-83.9	-89.2	-94.2	-99.0	-103.6	-108.1					
cis-4- " -2- "	"	0	-69.72	-69.83	-76.0	-81.8	-87.2	-92.4	-97.3	-102.1	-106.6					
trans-4- " -2- "	"	0	-67.69	-67.81	-74.3	-80.3	-85.9	-91.2	-96.3	-101.1	-105.7					
2-Ethyl-1-butene	"	0	-70.20	-70.31	-76.7	-82.4	-87.9	-93.1	-98.1	-102.8	-107.4					
2,3-Dimethyl-1-butene	"	0	-67.36	-67.48	-73.9	-79.9	-85.6	-90.9	-96.0	-100.9	-105.5					
3,3- " -1- "	"	0	-65.08	-65.19	-71.4	-77.1	-82.4	-87.5	-92.4	-97.2	-101.9					
2,3- " -2- "	"	0	-67.56	-67.68	-73.8	-79.3	-84.5	-89.5	-94.3	-98.9	-103.3					

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

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TABLE 12s - ACETYLENES, C_2 to C_5

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o- H^o_0)/T$, in cal/deg mole[c]														
Ethyne (Acetylene).	C_2H_2	0	-39.976	-40.025	-42.451	-44.508	-46.313	-47.930	-49.400	-50.752	-52.005	-53.175	-54.275	-55.313	-56.296	-57.231
Propyne (Methylacetylene) .	C_3H_4	0	-48.89	-48.95	-52.14	-54.92	-57.44	-59.76	-61.91	-63.94	-65.86	-67.68	-69.42	-71.07	-72.66	-74.19
1-Butyne (Ethylacetylene) .	C_4H_6	0	-56.70	-56.78	-60.78	-64.38	-67.70	-70.81	-73.74	-76.51	-79.16	-81.69	-84.11	-86.43	-88.66	-90.81
2- " (Dimethylacetylene)	"	0	-54.43	-54.51	-58.59	-62.18	-65.44	-68.48	-71.35	-74.06	-76.65	-79.12	-81.50	-83.78	-85.97	-88.09
1-Pentyne	C_5H_8	0	-62.49	-62.60	-67.8	-72.5	-76.8	-80.9	-84.7	-88.3	-91.8	-95.1	-98.2	-101.2	-104.2	-107.0
2- "	"	0	-63.62	-63.72	-68.6	-73.0	-77.1	-80.9	-84.5	-88.0	-91.3	-94.5	-97.6	-100.5	-103.3	-106.1
3-Methyl-1-butyne	"	0	-60.86	-60.95	-65.8	-70.3	-74.5	-78.5	-82.2	-85.8	-89.2	-92.5	-95.6	-98.7	-101.6	-104.4

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

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TABLE 20s - NORMAL PARAFFINS, C_1 to C_{20}

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Methane	CH_4	0	-36.46	-36.51	-38.86	-40.75	-42.39	-43.86	-45.21	-46.47	-47.65	-48.78	-49.86	-50.89	-51.88	-52.84
Ethane	C_2H_6	0	-45.27	-45.33	-48.24	-50.77	-53.08	-55.25	-57.29	-59.24	-61.11	-62.90	-64.63	-66.30	-67.91	-69.46
Propane	C_3H_8	0	-52.73	-52.80	-56.48	-59.81	-62.93	-65.90	-68.74	-71.47	-74.10	-76.63	-79.07	-81.43	-83.70	-85.86
n-Butane	C_4H_{10}	0	-58.52	-58.62	-63.49	-67.93	-72.05	-75.95	-79.69	-83.28	-86.73	-90.03	-93.20	-96.25	-99.20	-102.04
n-Pentane	C_5H_{12}	0	-64.26	-64.37	-70.33	-75.76	-80.84	-85.66	-90.26	-94.68	-98.92	-102.98	-106.88	-110.64	-114.27	-117.76
n-Hexane	C_6H_{14}	0	-70.01	-70.15	-77.20	-83.65	-89.68	-95.41	-100.89	-106.14	-111.18	-116.00	-120.64	-125.10	-129.40	-133.53
n-Heptane	C_7H_{16}	0	-75.77	-75.92	-84.06	-91.53	-98.53	-105.17	-111.51	-117.60	-123.43	-129.03	-134.40	-139.57	-144.54	-149.29
n-Octane	C_8H_{18}	0	-81.52	-81.70	-90.93	-99.42	-107.37	-114.92	-122.14	-129.06	-135.69	-142.05	-148.16	-154.03	-159.67	-165.06
n-Nonane	C_9H_{20}	0	-87.27	-87.48	-97.80	-107.31	-116.21	-124.67	-132.77	-140.52	-147.95	-155.07	-161.92	-168.49	-174.80	-180.83
n-Decane	$C_{10}H_{22}$	0	-93.03	-93.25	-104.66	-115.19	-125.06	-134.43	-143.39	-151.98	-160.20	-168.10	-175.68	-182.96	-189.94	-196.59
n-Undecane	$C_{11}H_{24}$	0	-98.78	-99.03	-111.53	-123.08	-133.90	-144.18	-154.02	-163.44	-172.46	-181.12	-189.44	-197.42	-205.07	-212.36
n-Dodecane	$C_{12}H_{26}$	0	-104.53	-104.81	-118.40	-130.97	-142.74	-153.94	-164.65	-174.90	-184.72	-194.14	-203.20	-211.88	-220.20	-228.13
n-Tridecane	$C_{13}H_{28}$	0	-110.28	-110.58	-125.26	-138.86	-151.58	-163.69	-175.28	-186.36	-196.98	-207.16	-216.96	-226.34	-235.34	-243.90
n-Tetradecane	$C_{14}H_{30}$	0	-116.04	-116.36	-132.13	-146.74	-160.43	-173.44	-185.90	-197.82	-209.23	-220.19	-230.71	-240.81	-250.47	-259.66
n-Pentadecane	$C_{15}H_{32}$	0	-121.79	-122.14	-139.00	-154.63	-169.27	-183.20	-196.53	-209.28	-221.49	-233.21	-244.47	-255.27	-265.60	-275.43
n-Hexadecane	$C_{16}H_{34}$	0	-127.54	-127.92	-145.87	-162.52	-178.11	-192.95	-207.16	-220.74	-233.75	-246.23	-258.23	-269.73	-280.73	-291.20
n-Heptadecane	$C_{17}H_{36}$	0	-133.30	-133.69	-152.73	-170.40	-186.96	-202.71	-217.78	-232.20	-246.00	-259.26	-271.99	-284.20	-295.87	-306.96
n-Octadecane	$C_{18}H_{38}$	0	-139.05	-139.47	-159.60	-178.29	-195.80	-212.46	-228.41	-243.66	-258.26	-272.28	-285.75	-298.66	-311.00	-322.73
n-Nonadecane	$C_{19}H_{40}$	0	-144.80	-145.25	-166.47	-186.18	-204.64	-222.21	-239.04	-255.12	-270.52	-285.30	-299.51	-313.12	-326.13	-338.59
n-Eicosane	$C_{20}H_{42}$	0	-150.56	-151.02	-173.33	-194.06	-213.49	-231.97	-249.66	-266.58	-282.77	-298.33	-313.27	-327.59	-341.27	-354.26
Increment per CH_2 group		0	-5.753	-5.777	-6.867	-7.887	-8.843	-9.754	-10.627	-11.460	-12.257	-13.023	-13.759	-14.463	-15.133	-15.767

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 21s - NORMAL ALKYL BENZENES, C_6 TO C_{22}

FREE ENERGY FUNCTION, $(F^\circ-H^\circ_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^\circ-H^\circ_0)/T$, in cal/deg mole[c]														
Benzene	C_6H_6	0	-52.93	-53.00	-56.69	-60.24	-63.70	-67.06	-70.34	-73.50	-76.57	-79.54	-82.40	-85.18	-87.85	-90.45
Methylbenzene (Toluene)	C_7H_8	0	-61.98	-62.07	-66.74	-71.20	-75.52	-79.72	-83.79	-87.72	-91.53	-95.21	-98.77	-102.21	-105.53	-108.75
Ethylbenzene	C_8H_{10}	0	-68.26	-68.37	-74.14	-79.64	-84.94	-90.08	-95.05	-99.84	-104.47	-108.94	-113.25	-117.42	-121.44	-125.32
n-Propylbenzene	C_9H_{12}	0	-74.05	-74.19	-81.2	-87.8	-94.1	-100.1	-106.0	-111.6	-117.1	-122.3	-127.4	-132.2	-136.9	-141.5
n-Butylbenzene	$C_{10}H_{14}$	0	-79.79	-79.94	-88.0	-95.6	-102.8	-109.8	-116.6	-123.0	-129.3	-135.3	-141.1	-146.6	-152.0	-157.2
n-Amylbenzene	$C_{11}H_{16}$	0	-85.54	-85.72	-94.9	-103.5	-111.7	-119.6	-127.2	-134.5	-141.6	-148.3	-154.8	-161.1	-167.1	-173.0
n-Hexylbenzene	$C_{12}H_{18}$	0	-91.30	-91.49	-101.7	-111.4	-120.5	-129.4	-137.8	-146.0	-153.8	-161.3	-168.6	-175.6	-182.3	-188.8
n-Heptylbenzene	$C_{13}H_{20}$	0	-97.05	-97.27	-108.6	-119.2	-129.4	-139.1	-148.4	-157.4	-166.1	-174.4	-182.3	-190.0	-197.4	-204.5
n-Octylbenzene	$C_{14}H_{22}$	0	-102.80	-103.05	-115.5	-127.1	-138.2	-148.9	-159.1	-168.9	-178.3	-187.4	-196.1	-204.5	-212.5	-220.3
n-Nonylbenzene	$C_{15}H_{24}$	0	-108.56	-108.82	-122.3	-135.0	-147.1	-158.6	-169.7	-180.4	-190.6	-200.4	-209.9	-218.9	-227.7	-236.1
n-Decylbenzene	$C_{16}H_{26}$	0	-114.31	-114.60	-129.2	-142.9	-155.9	-168.4	-180.3	-191.8	-202.8	-213.4	-223.6	-233.4	-242.8	-251.8
n-Undecylbenzene	$C_{17}H_{28}$	0	-120.06	-120.38	-136.1	-150.8	-164.8	-178.1	-191.0	-203.3	-215.1	-226.4	-237.4	-247.9	-257.9	-267.6
n-Dodecylbenzene	$C_{18}H_{30}$	0	-125.81	-126.16	-142.9	-158.7	-173.6	-187.9	-201.6	-214.7	-227.4	-239.5	-251.1	-262.3	-273.1	-283.4
n-Tridecylbenzene	$C_{19}H_{32}$	0	-131.57	-131.93	-149.8	-166.6	-182.4	-197.6	-212.2	-226.2	-239.6	-252.5	-264.9	-276.8	-288.2	-299.1
n-Tetradecylbenzene	$C_{20}H_{34}$	0	-137.32	-137.71	-156.7	-174.5	-191.3	-207.4	-222.8	-237.6	-251.9	-265.5	-278.6	-291.3	-303.3	-314.9
n-Pentadecylbenzene	$C_{21}H_{36}$	0	-143.07	-143.49	-163.5	-182.4	-200.1	-217.1	-233.5	-249.1	-264.1	-278.5	-292.4	-305.7	-318.5	-330.7
n-Hexadecylbenzene	$C_{22}H_{38}$	0	-148.83	-149.26	-170.4	-190.2	-209.0	-226.9	-244.1	-260.6	-276.4	-291.6	-306.2	-320.2	-333.6	-346.4
Increment per CH_2 Group		0	-5.753	-5.777	-6.87	-7.89	-8.84	-9.75	-10.63	-11.46	-12.26	-13.02	-13.76	-14.46	-15.13	-15.77

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 22s - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclopentane.	C_5H_{10}	0	-57.93	-58.00	-61.88	-65.62	-69.30	-72.95	-76.52	-80.04	-83.48	-86.84	-90.13	-93.31	-96.40	-99.42
Methylcyclopentane. . . .	C_6H_{12}	0	-65.23	-65.33	-70.45	-75.33	-80.07	-84.72	-89.26	-93.68	-97.97	-102.13	-106.18	-110.08	-113.89	-117.63
Ethylcyclopentane	C_7H_{14}	0	-71.71	-71.83	-77.90	-83.72	-89.34	-94.89	-100.30	-105.53	-110.62	-115.54	-120.32	-124.97	-129.41	-133.79
n-Propylcyclopentane. . .	C_8H_{16}	0	-77.46	-77.61	-84.8	-91.6	-98.2	-104.6	-110.9	-117.0	-122.9	-128.6	-134.1	-139.4	-144.5	-149.6
n-Butylcyclopentane . . .	C_9H_{18}	0	-83.22	-83.38	-91.6	-99.5	-107.0	-114.4	-121.6	-128.4	-135.1	-141.6	-147.8	-153.9	-159.7	-165.3
n-Pentylcyclopentane. . .	$C_{10}H_{20}$	0	-88.97	-89.16	-98.5	-107.4	-115.9	-124.2	-132.2	-139.9	-147.4	-154.6	-161.6	-168.4	-174.8	-181.1
n-Hexylcyclopentane.. . .	$C_{11}H_{22}$	0.	-94.72	-94.94	-105.4	-115.3	-124.7	-133.9	-142.8	-151.4	-159.6	-167.6	-175.4	-182.8	-189.9	-196.9
n-Heptylcyclopentane. . .	$C_{12}H_{24}$	0	-100.48	-100.72	-112.2	-123.2	-133.6	-143.7	-153.4	-162.8	-171.9	-180.7	-189.1	-197.3	-205.1	-212.6
n-Octylcyclopentane . . .	$C_{13}H_{26}$	0	-106.23	-106.49	-119.1	-131.0	-142.4	-153.4	-164.1	-174.3	-184.2	-193.7	-202.9	-211.8	-220.2	-228.4
n-Nonylcyclopentane . . .	$C_{14}H_{28}$	0	-111.98	-112.27	-126.0	-138.9	-151.2	-163.2	-174.7	-185.8	-196.4	-206.7	-216.6	-226.2	-235.3	-244.2
n-Decylcyclopentane . . .	$C_{15}H_{30}$	0	-117.73	-118.05	-132.8	-146.8	-160.1	-172.9	-185.3	-197.2	-208.7	-219.7	-230.4	-240.7	-250.5	-259.9
n-Undecylcyclopentane . .	$C_{16}H_{32}$	0	-123.49	-123.82	-139.7	-154.7	-168.9	-182.7	-195.9	-208.7	-220.9	-232.8	-244.2	-255.1	-265.6	-275.7
n-Dodecylcyclopentane . .	$C_{17}H_{34}$	0	-129.24	-129.60	-146.6	-162.6	-177.8	-192.4	-206.6	-220.1	-233.2	-245.8	-257.9	-269.6	-280.7	-291.5
n-Tridecylcyclopentane. .	$C_{18}H_{36}$	0	-134.99	-135.38	-153.4	-170.5	-186.6	-202.2	-217.2	-231.6	-245.4	-258.8	-271.7	-284.1	-295.9	-307.2
n-Tetradecylcyclopentane.	$C_{19}H_{38}$	0	-140.75	-141.15	-160.3	-178.4	-195.5	-211.9	-227.8	-243.0	-257.7	-271.8	-285.4	-298.5	-311.0	-323.0
n-Pentadecylcyclopentane.	$C_{20}H_{40}$	0	-146.50	-146.93	-167.2	-186.2	-204.3	-221.7	-238.4	-254.5	-270.0	-284.8	-299.2	-313.0	-326.1	-338.8
n-Hexadecylcyclopentane	$C_{21}H_{42}$	0	-152.25	-152.71	-174.0	-194.1	-213.1	-231.4	-249.1	-266.0	-282.2	-297.9	-313.0	-327.4	-341.3	-354.5
Increment per CH_2 group		0	-5.753	-5.777	-6.87	-7.89	-8.84	-9.75	-10.63	-11.46	-12.26	-13.02	-13.76	-14.46	-15.13	-15.77

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 23s - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Cyclohexane.	C_6H_{12}	0	-57.07	-57.16	-61.80	-66.39	-70.96	-75.50	-79.98	-84.40	-88.74	-93.0	-97.1	-101.1	-105.0	-108.8
Methylcyclohexane.	C_7H_{14}	0	-64.51	-64.62	-70.38	-76.06	-81.68	-87.24	-92.70	-98.04	-103.24	-108.3	-113.2	-118.0	-122.6	-127.1
Ethylcyclohexane..	C_8H_{16}	0	-70.99	-71.12	-77.8	-84.5	-91.0	-97.4	-103.7	-109.9	-115.9	-121.7	-127.3	-132.8	-138.1	-143.3
n-Propylcyclohexane. . . .	C_9H_{18}	0	-76.45	-76.62	-84.4	-91.9	-99.4	-106.7	-113.9	-120.9	-127.7	-134.2	-140.5	-146.8	-152.7	-158.5
n-Butylcyclohexane	$C_{10}H_{20}$	0	-82.20	-82.40	-91.3	-99.8	-108.2	-116.5	-124.5	-132.4	-140.0	-147.2	-154.3	-161.3	-167.8	-174.3
n-Pentylcyclohexane. . . .	$C_{11}H_{22}$	0	-87.96	-88.17	-98.1	-107.7	-117.1	-126.2	-135.2	-143.8	-152.2	-160.2	-168.0	-175.7	-183.0	-190.0
n-Hexylcyclohexane	$C_{12}H_{24}$	0	-93.71	-93.95	-105.0	-115.6	-125.9	-136.0	-145.8	-155.3	-164.5	-173.3	-181.8	-190.2	-198.1	-205.8
n-Heptylcyclohexane. . . .	$C_{13}H_{26}$	0	-99.46	-99.73	-111.9	-123.4	-134.8	-145.7	-156.4	-166.7	-176.7	-186.3	-195.5	-204.7	-213.2	-221.6
n-Octylcyclohexane	$C_{14}H_{28}$	0	-105.22	-105.51	-118.7	-131.3	-143.6	-155.5	-167.0	-178.2	-189.0	-199.3	-209.3	-219.1	-228.4	-237.3
n-Nonylcyclohexane	$C_{15}H_{30}$	0	-110.97	-111.28	-125.6	-139.2	-152.5	-165.2	-177.7	-189.7	-201.2	-212.3	-223.1	-233.6	-243.5	-253.1
n-Decylcyclohexane	$C_{16}H_{32}$	0	-116.72	-117.06	-132.5	-147.1	-161.3	-175.0	-188.3	-201.1	-213.5	-225.4	-236.8	-248.0	-258.6	-268.9
n-Undecylcyclohexane . . .	$C_{17}H_{34}$	0	-122.47	-122.84	-139.3	-155.0	-170.1	-184.7	-198.9	-212.6	-225.8	-238.4	-250.6	-262.5	-273.8	-284.6
n-Dodecylcyclohexane . . .	$C_{18}H_{36}$	0	-128.23	-128.61	-146.2	-162.9	-179.0	-194.5	-209.5	-224.0	-238.0	-251.4	-264.3	-277.0	-288.9	-300.4
n-Tridecylcyclohexane . .	$C_{19}H_{38}$	0	-133.98	-134.39	-153.1	-170.8	-187.8	-204.2	-220.2	-235.5	-250.3	-264.4	-278.1	-291.4	-304.0	-316.2
n-Tetradecylcyclohexane. .	$C_{20}H_{40}$	0	-139.73	-140.17	-159.9	-178.7	-196.7	-214.0	-230.8	-247.0	-262.5	-277.5	-291.8	-305.9	-319.2	-331.9
n-Pentadecylcyclohexane. .	$C_{21}H_{42}$	0	-145.49	-145.94	-166.8	-186.5	-205.5	-223.7	-241.4	-258.4	-274.8	-290.5	-305.6	-320.4	-334.3	-347.7
n-Hexadecylcyclohexane . .	$C_{22}H_{44}$	0	-151.24	-151.72	-173.7	-194.4	-214.4	-233.5	-252.1	-269.9	-287.0	-303.5	-319.4	-334.8	-349.4	-363.5
Increment per CH_2 group		0	-5.753	-5.777	-6.87	-7.89	-8.84	-9.75	-10.63	-11.46	-12.26	-13.02	-13.76	-14.46	-15.13	-15.77

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

TABLE 24s - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	-43.98	-44.03	-46.61	-48.74	-50.70	-52.50	-54.19	-55.78	-57.29	-58.74	-60.12	-61.44	-62.71	-63.94
Propene (Propylene)	C_3H_6	0	-52.95	-53.02	-56.39	-59.32	-62.05	-64.61	-67.04	-69.36	-71.57	-73.69	-75.73	-77.70	-79.60	-81.43
1-Butene	C_4H_8	0	-59.32	-59.41	-63.87	-67.84	-71.56	-75.08	-78.42	-81.61	-84.66	-87.58	-90.39	-93.09	-95.70	-98.21
1-Pentene	C_5H_{10}	0	-65.11	-65.23	-70.88	-75.96	-80.68	-85.13	-89.37	-93.42	-97.29	-100.98	-104.52	-107.91	-111.20	-114.39
1-Hexene	C_6H_{12}	0	-70.85	-70.98	-77.7	-83.8	-89.5	-94.8	-99.9	-104.8	-109.5	-113.9	-118.2	-122.3	-126.3	-130.1
1-Heptene	C_7H_{14}	0	-76.60	-76.76	-84.6	-91.7	-98.3	-104.6	-110.6	-116.3	-121.7	-127.0	-132.0	-136.8	-141.4	-145.9
1-Octene	C_8H_{16}	0	-82.35	-82.54	-91.5	-99.6	-107.2	-114.4	-121.2	-127.7	-134.0	-140.0	-145.7	-151.2	-156.5	-161.7
1-Nonene	C_9H_{18}	0	-88.11	-88.31	-98.3	-107.5	-116.0	-124.1	-131.8	-139.2	-146.3	-153.0	-159.5	-165.7	-171.7	-177.4
1-Decene	$C_{10}H_{20}$	0	-93.86	-94.09	-105.2	-115.3	-124.9	-133.9	-142.5	-150.7	-158.5	-166.0	-173.2	-180.2	-186.8	-193.2
1-Undecene	$C_{11}H_{22}$	0	-99.61	-99.87	-112.1	-123.2	-133.7	-143.6	-153.1	-162.1	-170.8	-179.1	-187.0	-194.6	-202.0	-209.0
1-Dodecene	$C_{12}H_{24}$	0	-105.36	-105.64	-118.9	-131.1	-142.5	-153.4	-163.7	-173.6	-183.0	-192.1	-200.8	-209.1	-217.1	-224.7
1-Tridecene	$C_{13}H_{26}$	0	-111.12	-111.42	-125.8	-139.0	-151.4	-163.1	-174.3	-185.0	-195.3	-205.1	-214.5	-223.5	-232.2	-240.5
1-Tetradecene	$C_{14}H_{28}$	0	-116.87	-117.20	-132.7	-146.9	-160.2	-172.9	-185.0	-196.5	-207.6	-218.2	-228.3	-238.0	-247.3	-256.3
1-Pentadecene	$C_{15}H_{30}$	0	-122.62	-122.98	-139.5	-154.8	-169.1	-182.6	-195.6	-208.0	-219.8	-231.2	-242.0	-252.5	-262.5	-272.0
1-Hexadecene	$C_{16}H_{32}$	0	-128.38	-128.75	-146.4	-162.7	-177.9	-192.4	-206.2	-219.4	-232.1	-244.2	-255.8	-266.9	-277.6	-287.8
1-Heptadecene	$C_{17}H_{34}$	0	-134.13	-134.53	-153.2	-170.5	-186.7	-202.1	-216.8	-230.9	-244.3	-257.2	-269.6	-281.4	-292.7	-303.6
1-Octadecene	$C_{18}H_{36}$	0	-139.88	-140.31	-160.1	-178.4	-195.6	-211.9	-227.5	-242.3	-256.6	-270.2	-283.3	-295.8	-307.9	-319.4
1-Nonadecene	$C_{19}H_{38}$	0	-145.64	-146.08	-167.0	-186.3	-204.5	-221.7	-238.1	-253.8	-268.9	-283.2	-297.1	-310.3	-323.0	-335.1
1-Eicosene	$C_{20}H_{40}$	0	-151.39	-151.86	-173.8	-194.2	-213.3	-231.4	-248.7	-265.3	-281.1	-296.2	-310.8	-324.8	-338.1	-350.9
Increment per CH_2 group		0	-5.753	-5.777	-6.87	-7.89	-8.84	-9.75	-10.63	-11.46	-12.26	-13.02	-13.76	-14.46	-15.13	-15.77

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25s - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

FREE ENERGY FUNCTION, $(F^o-H^o_0)/T$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy Function[b], $(F^o-H^o_0)/T$, in cal/deg mole[c]														
Ethyne (Acetylene)	C_2H_2	0	-39.976	-40.025	-42.451	-44.508	-46.313	-47.930	-49.400	-50.752	-52.005	-53.175	-54.275	-55.313	-56.296	-57.231
Propyne (Methylacetylene)	C_3H_4	0	-48.89	-48.95	-52.14	-54.92	-57.44	-59.76	-61.91	-63.94	-65.86	-67.68	-69.42	-71.07	-72.66	-74.19
1-Butyne (Ethylacetylene)	C_4H_6	0	-56.70	-56.78	-60.78	-64.38	-67.70	-70.81	-73.74	-76.51	-79.16	-81.69	-84.11	-86.43	-88.66	-90.81
1-Pentyne	C_5H_8	0	-62.49	-62.60	-67.8	-72.5	-76.8	-80.9	-84.7	-88.3	-91.8	-95.1	-98.2	-101.2	-104.2	-107.0
1-Hexyne	C_6H_{10}	0	-68.23	-68.35	-74.6	-80.3	-85.6	-90.6	-95.3	-99.7	-104.0	-108.0	-111.9	-115.6	-119.2	-122.7
1-Heptyne	C_7H_{12}	0	-73.98	-74.13	-81.5	-88.2	-94.4	-100.3	-105.9	-111.2	-116.2	-121.1	-125.7	-130.1	-134.4	-138.5
1-Octyne	C_8H_{14}	0	-79.73	-79.91	-88.4	-96.1	-103.3	-110.1	-116.5	-122.6	-128.5	-134.1	-139.4	-144.6	-149.5	-154.2
1-Nonyne	C_9H_{16}	0	-85.49	-85.68	-95.2	-104.0	-112.1	-119.8	-127.1	-134.1	-140.8	-147.1	-153.2	-159.0	-164.6	-170.0
1-Decyne	$C_{10}H_{18}$	0	-91.24	-91.46	-102.1	-111.9	-121.0	-129.6	-137.8	-145.6	-153.0	-160.1	-167.0	-173.5	-179.8	-185.8
1-Undecyne	$C_{11}H_{20}$	0	-96.99	-97.24	-109.0	-119.8	-129.8	-139.3	-148.4	-157.0	-165.3	-173.2	-180.7	-188.0	-194.9	-201.6
1-Dodecyne	$C_{12}H_{22}$	0	-102.74	-103.02	-115.8	-127.7	-138.7	-149.1	-159.0	-168.5	-177.5	-186.2	-194.5	-202.4	-210.0	-217.3
1-Tridecyne	$C_{13}H_{24}$	0	-108.50	-108.79	-122.7	-135.5	-147.5	-158.8	-169.6	-179.9	-189.8	-199.2	-208.2	-216.9	-225.2	-233.1
1-Tetradecyne	$C_{14}H_{26}$	0	-114.25	-114.57	-129.6	-143.4	-156.4	-168.6	-180.3	-191.4	-202.0	-212.2	-222.0	-231.3	-240.3	-248.8
1-Pentadecyne	$C_{15}H_{28}$	0	-120.00	-120.35	-136.4	-151.3	-165.2	-178.4	-190.9	-202.9	-214.3	-225.2	-235.8	-245.8	-255.4	-264.6
1-Hexadecyne	$C_{16}H_{30}$	0	-125.76	-126.12	-143.3	-159.2	-174.0	-188.1	-201.5	-214.3	-226.6	-238.3	-249.5	-260.3	-270.6	-280.4
1-Heptadecyne	$C_{17}H_{32}$	0	-131.51	-131.90	-150.2	-167.1	-182.9	-197.9	-212.2	-225.8	-238.8	-251.3	-263.3	-274.7	-285.7	-296.2
1-Octadecyne	$C_{18}H_{34}$	0	-137.26	-137.68	-157.0	-175.0	-191.7	-207.6	-222.8	-237.2	-251.1	-264.3	-277.0	-289.2	-300.8	-311.9
1-Nonadecyne	$C_{19}H_{36}$	0	-143.02	-143.45	-163.9	-182.9	-200.6	-217.4	-233.4	-248.7	-263.3	-277.3	-290.8	-303.7	-316.0	-327.7
1-Eicosyne	$C_{20}H_{38}$	0	-148.77	-149.23	-170.8	-190.8	-209.4	-227.1	-244.0	-260.2	-275.6	-290.4	-304.6	-318.1	-331.1	-343.4
Increment per CH_2 group		0	-5.753	-5.777	-6.87	-7.89	-8.84	-9.75	-10.63	-11.46	-12.26	-13.02	-13.76	-14.46	-15.13	-15.77

[a] See footnote a of Table 1s.

[b] See footnote b of Table 1s.

[c] See footnote c of Table 1s.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 00t - O, H, N, C

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 4000^oK

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Oxygen	O	0	38.469	38.501	39.992	41.131	42.054	42.831	43.501	44.091	44.618	45.094	45.529	45.928	46.298	46.641
Hydrogen	H	0	27.393	27.423	28.852	29.961	30.867	31.633	32.296	32.881	33.404	33.878	34.310	34.708	35.076	35.419
Nitrogen	N	0	36.614	36.645	38.074	39.183	40.088	40.854	41.518	42.103	42.626	43.100	43.532	43.930	44.298	44.641
Carbon	C	0	37.761	37.792	39.224	40.333	41.240	42.006	42.670	43.255	43.778	44.252	44.684	45.082	45.451	45.794

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Entropy, S^o, in cal/deg mole														
Oxygen	O	44.618	45.734	46.641	47.409	48.074	48.660	49.185	49.660	50.095	50.869	51.545				
Hydrogen	H	33.404	34.513	35.419	36.185	36.848	37.433	37.957	38.430	38.862	39.628	40.292				
Nitrogen	N	42.626	43.735	44.641	45.406	46.070	46.655	47.179	47.654	48.089	48.867	49.554				
Carbon	C	43.778	44.887	45.794	46.561	47.229	47.820	48.353	48.839	49.286	50.090	50.798				

[a] Interpolation to other temperatures in the interval 298.16^o to 4000^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o, and 600^oK.

[b] S^o is the entropy (exclusive of nuclear spin) of the given substance in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere) at the temperature indicated.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 0t - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

ENTROPY, S^o, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in ^oK													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Entropy[b], S^o, in cal/deg mole[c]													
Oxygen	O_2	gas	0	36.567			46.216	47.766	49.003	49.048	51.093	52.723	54.100	55.296	56.362	57.322
Hydrogen	H_2	gas	0					30.108	31.211	31.253	33.250	34.809	36.084	37.167	38.108	38.946
Hydroxyl	OH	gas	0						43.888	43.934	45.978	47.553	48.840	49.927	50.877	51.723
Water	H_2O	gas	0						45.106	45.154	47.483	49.334	50.890	52.248	53.464	54.572
Nitrogen	N_2	gas	0		38.166		42.990	44.543	45.767	45.809	47.818	49.385	50.685	51.805	52.797	53.692
Nitric Oxide	NO	gas	0	36.916	42.271	45.345	47.465	49.078	50.339	50.384	52.436	54.048	55.392	56.556	57.589	58.520
Carbon	C	solid, graphite	0		0.2184	0.4459	0.7238	1.0365	1.3609	1.3737	2.081	2.788	3.474	4.127	4.740	5.314
Carbon Monoxide	CO	gas	0		39.696		44.520	46.074	47.301	47.342	49.352	50.927	52.238	53.373	54.379	55.287
Carbon Dioxide	CO_2	gas	0						51.061	51.116	53.815	56.109	58.110	59.893	61.507	62.979

Compound	Formula	State	Temperature in ^oK													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Entropy, S^o, in cal/deg mole													
Oxygen	O_2	gas	58.194	58.992	59.730	60.419	61.061	61.659	63.015	64.212	65.278	66.250	67.143	67.968	69.458	70.762
Hydrogen	H_2	gas	39.704	40.395	41.035	41.632	42.190	42.720	43.928	45.005	45.978	46.868	47.689	48.448	49.818	51.030
Hydroxyl	OH	gas	52.491	53.194	53.847	54.455	55.029	55.568	56.799	57.895	58.883	59.781	60.609	61.375	62.751	63.966
Water	H_2O	gas	55.598	56.551	57.449	58.299	59.105	59.873	61.65	63.26	64.73	66.07	67.30	68.45		
Nitrogen	N_2	gas	54.509	55.259	55.955	56.606	57.215	57.786	59.082	60.228	61.245	62.163	63.001	63.770	65.141	66.338
Nitric Oxide	NO	gas	59.370	60.150	60.873	61.544	62.170	62.760	64.088	65.254	66.292	67.225	68.075	68.856	70.247	71.459
Carbon	C	solid, graphite	5.846	6.342	6.807	7.247	7.663	8.057								
Carbon Monoxide	CO	gas	56.116	56.878	57.586	58.243	58.860	59.436	60.744	61.896	62.920	63.845	64.688	65.459	66.835	68.037
Carbon Dioxide	CO_2	gas	64.331	65.582	66.746	67.837	68.857	69.817	72.00	73.92	75.63	77.19	78.66	80.09	82.27	

[a] Interpolation to other temperatures in the interval 50^o to 4000^oK may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table 00t.

[c] See footnote c of Table 00t.

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American Petroleum Institute Research Project 44

National Bureau of Standards

Washington, D. C.

TABLE 1t - PARAFFINS, C_1 to C_5
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK
August 31, 1944

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o cal/deg mole[c]														
Methane	CH_4	0	44.50	44.55	47.17	49.48	51.64	53.68	55.61	57.45	59.21	60.89	62.50	64.04	65.51	66.93
Ethane	C_2H_6	0	54.85	54.93	58.98	62.79	66.44	69.93	73.24	76.39	79.39	82.25	84.98	87.59	90.08	92.46
Propane	C_3H_8	0	64.51	64.62	70.37	75.89	81.15	86.17	90.94	95.47	99.77	103.86	107.75	111.45	114.97	118.29
n-Butane	C_4H_{10}	0	74.10	74.25	81.91	89.20	96.11	102.66	108.87	114.74	120.31	125.59	130.60	135.37	139.91	144.22
2-Methylpropane (Isobutane)	"	0	70.42	70.55	78.13	85.45	92.40	98.98	105.21	111.11	116.69	121.99	127.03	131.82	136.37	140.67
n-Pentane	C_5H_{12}	0	83.27	83.44	92.95	101.94	110.48	118.56	126.19	133.41	140.26	146.74	152.89	158.74	164.31	169.60
2-Methylbutane (Isopentane)	"	0	81.98	82.15	91.58	100.65	109.23	117.40	125.11	132.37	139.24	145.76	151.95	157.82	163.41	168.67
2,2-Dimethylpropane (Neopentane)	"	0	73.23	73.40	83.00	92.17	100.94	109.23	117.07	124.45	131.41	138.00	144.26	150.20	155.84	161.19

[a] Interpolation to other temperatures in the interval 298.16^o to 1500^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o, and 600^oK.

[b] S^o is the entropy (exclusive of nuclear spin) of the given hydrocarbon in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2t (Part 1) - PARAFFINS, C_6

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o cal/deg mole[c]														
n - Hexane.	C_6H_{14}	0	92.45[d]	92.67	104.03	114.75	124.91	134.52	143.60	152.16	160.29	167.97	175.27	182.20	188.79	195.03
2 - Methylpentane. .	"	0	90.65	90.88	102.1	112.9	123.1	132.7	141.9	150.5	158.6					
3 - " . .	"	0	90.77	91.00	102.4	113.3	123.6	133.3	142.4	151.0	159.2					
2,2 - Dimethylbutane	"	0	85.72	85.92	97.2	108.1	118.4	128.1	137.4	146.0	154.3					
2,3 "	"	0	87.33	87.53	98.8	109.7	120.0	129.7	138.8	147.4	155.6					

[a] See footnote a of Table 1t. [b] See footnote b of Table 1t. [c] See footnote c of Table 1t. [d] See footnote e of Table 2p.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2t (Part 2) - PARAFFINS, C_7

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o cal/deg mole[c]														
n - Heptane	C_7H_{16}	0	101.64	101.88	115.10	127.54	139.34	150.50	160.99	170.92	180.32	189.22	197.65	205.66	213.27	220.45
2 - Methylhexane . . .	"	0	99.34	99.58	113.3	125.9	137.9	149.1	159.6	169.7	179.0					
3 - " . . .	"	0	101.37	101.60	114.8	127.4	139.3	150.5	161.0	171.0	180.4					
3 - Ethylpentane . . .	"	0	98.47	98.70	111.8	124.2	135.9	146.9	157.4	167.3	176.7					
2,2 - Dimethylpentane.	"	0	93.60	93.83	107.2	119.8	131.8	143.1	153.8	163.8	173.4					
2,3 - "	"	0	98.96	99.19	112.6	125.0	137.0	148.1	158.6	168.6	177.9					
2,4 - "	"	0	94.80	95.03	108.5	121.2	133.2	144.5	155.1	165.2	174.6					
3,3 - "	"	0	95.53	95.76	109.3	121.9	134.1	145.4	156.1	166.2	175.7					
2,2,3-Trimethylbutane.	"	0	92.46	92.69	106.3	119.1	131.3	142.7	153.4	163.5	173.0					

[a] See footnote a of Table 1t. [b] See footnote b of Table 1t. [c] See footnote c of Table 1t.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 3t - PARAFFINS, C_8

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

October 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o cal/deg mole[c]														
n-Octane	C_8H_{18}	0	110.82	111.11	126.18	140.35	153.77	166.46	178.40	189.67	200.35	210.45	220.03	229.12	237.75	245.88
2-Methylheptane	"	0	108.81	109.09	124.3	138.7	152.3	165.1	177.1	188.4	199.1					
3- "	"	0	110.32	110.60	125.8	140.1	153.7	166.5	178.5	189.8	200.5					
4- "	"	0	108.35	108.62	123.8	138.1	151.5	164.3	176.3	187.6	198.3					
3-Ethylhexane	"	0	109.51	109.78	124.6	138.6	151.8	164.4	176.4	187.7	198.3					
2,2-Dimethylhexane	"	0	103.06	103.33	118.7	133.1	146.6	159.5	171.8	183.2	193.9					
2,3- "	"	0	106.11	106.38	121.9	136.8	150.6	163.6	175.6	187.0	197.7					
2,4- "	"	0	106.51	106.78	122.0	136.3	149.9	162.7	174.8	186.0	196.8					
2,5- "	"	0	104.93	105.20	120.5	134.9	148.5	161.3	173.3	184.5	195.3					
3,3- "	"	0	104.70	104.97	120.2	134.5	148.2	161.1	173.3	184.8	195.6					
3,4- "	"	0	104.38	104.65	120.3	134.9	148.7	161.6	173.6	184.9	195.7					
2-Methyl-3-ethylpentane	"	0	105.43	105.70	121.0	135.5	149.2	162.1	174.0	185.4	196.1					
3- " -3- "	"	0	103.48	103.75	119.3	133.7	147.2	160.1	172.3	183.9	194.8					
2,2,3-Trimethylpentane	"	0	101.62	101.88	117.3	131.8	145.4	158.3	170.4	181.9	192.8					
2,2,4- "	"	0	101.62	101.88	117.3	131.8	145.4	158.3	170.4	181.9	192.8					
2,3,3- "	"	0	103.14	103.40	118.9	133.4	147.2	160.1	172.1	183.6	194.6					
2,3,4- "	"	0	102.99	103.25	118.8	133.5	147.3	160.1	172.1	183.3	194.3					
2,2,3,3-Tetramethylbutane	"	0	94.34	94.60	110.1	125.0	139.0	152.3	164.6	176.1	187.0					

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

TABLE 5t - ALKYL BENZENES, C_6 to C_9

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K: 0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole														
Benzene	C_6H_6	0	64.34	64.46	71.10	77.74	84.17	90.30	96.10	101.57	106.73	111.61	116.22	120.59	124.74	128.68
Methylbenzene (Toluene)	C_7H_8	0	76.42	76.57	84.91	93.13	101.08	108.64	115.81	122.58	128.98	135.03	140.76	146.19	151.34	156.25
Ethylbenzene	C_8H_{10}	0	86.15	86.34	96.59	106.63	116.28	125.43	134.08	142.23	149.92	157.19	164.07	170.59	176.79	182.67
1,2-Dimethylbenzene (o-Xylene)	"	0	84.31	84.51	94.96	105.01	114.60	123.67	132.24	140.34	147.99	155.22	162.07	168.56	174.73	180.61
1,3- " (m- ")	"	0	85.49	85.68	95.81	105.67	115.14	124.16	132.70	140.78	148.41	155.63	162.47	168.96	175.12	181.00
1,4- " (p- ")	"	0	84.23	84.41	94.47	104.25	113.66	122.63	131.13	139.17	146.78	153.98	160.81	167.29	173.44	179.31
n-Propylbenzene	C_9H_{12}	0	95.74	95.97	108.1	119.9	131.2	141.9	152.0	161.5	170.5	178.9	186.9	194.5	201.7	208.6
Isopropylbenzene (Cumene)	"	0	92.87	93.08	105.2	117.0	128.3	139.0	149.2	158.7	167.6	176.1	184.2	191.8	199.0	205.9
1-Methyl-2-ethylbenzene	"	0	95.42	95.66	108.0	119.9	131.2	141.8	151.9	161.4	170.3	178.8	186.8	194.3	201.6	208.4
1- " -3- "	"	0	96.60	96.83	108.9	120.5	131.7	142.3	152.3	161.8	170.7	179.2	187.2	194.7	201.9	208.8
1- " -4- "	"	0	95.34	95.56	107.5	119.1	130.2	140.8	150.8	160.2	169.1	177.5	185.5	193.1	200.3	207.1
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	93.50	93.73	105.4	116.9	127.8	138.3	148.1	157.4	166.2	174.6	182.5	190.1	197.2	204.0
1,2,4- " (Pseudocumene)	"	0	94.73	94.96	106.7	118.2	129.2	139.6	149.5	158.8	167.7	176.0	184.0	191.5	198.7	205.5
1,3,5- " (Mesitylene)	"	0	92.15	92.37	103.87	115.28	126.22	136.64	146.51	155.85	164.69	173.07	181.01	188.56	195.73	202.55

[a] See footnote a of Table 1t. [b] See footnote b of Table 1t. [c] See footnote c of Table 1t.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 7t - ALKYL CYCLOHEXANES, C_6 to C_8
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
April 30, 1947

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	71.28	71.44	80.18	89.24	98.30	107.14	115.65	123.80	131.59	139.0	146.0	152.7	159.0	165.1
Methylcyclohexane	C_7H_{14}	0	82.06	82.28	93.22	104.32	115.21	125.77	135.86	145.46	154.57	163.2	171.4	179.2	186.6	193.7
Ethylcyclohexane	C_8H_{16}	0	91.44	91.70	104.5	117.3	129.9	142.0	153.6	164.5	174.9	184.8	194.2	203.0	211.4	219.5
1,1-Dimethylcyclohexane	"	0	87.24	87.52	100.0	112.7	125.2	137.4	149.0	160.1	170.6	180.5	189.9	198.8	207.3	215.5
cis-1,2- "	"	0	89.51	89.79	102.4	115.2	127.7	139.8	151.4	162.4	172.8	182.7	192.0	200.8	209.3	217.4
trans-1,2- "	"	0	88.65	88.94	101.7	114.7	127.3	139.5	151.1	162.2	172.6	182.5	191.9	200.8	209.2	217.3
cis-1,3-[d] "	"	0	88.54	88.82	101.5	114.3	126.8	139.0	150.6	161.6	172.1	182.0	191.4	200.3	208.8	216.9
trans-1,3-[e] "	"	0	89.92	90.20	102.8	115.6	128.1	140.2	151.7	162.6	173.0	182.9	192.2	201.0	209.4	217.5
cis-1,4- "	"	0	88.54	88.82	101.5	114.2	126.7	138.8	150.3	161.2	171.6	181.5	190.8	199.6	208.0	216.1
trans-1,4- "	"	0	87.19	87.47	100.2	113.1	125.7	137.9	149.5	160.6	171.1	181.0	190.3	199.2	207.7	215.8

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8t (Part 1) - MONOOLEFINS, C_2 to C_4
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK
December 31, 1944, April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	52.45	52.51	55.89	58.98	61.92	64.68	67.28	69.74	72.06	74.26	76.34	78.32	80.21	82.01
Propene (Propylene)	C_3H_6	0	63.80	63.90	68.86	73.47	77.87	82.04	85.98	89.72	93.26	96.61	99.80	102.84	105.72	108.48
1-Butene.	C_4H_8	0	73.48	73.62	80.59	87.09	93.25	99.05	104.50	109.63	114.49	119.09	123.45	127.59	131.52	135.27
cis-2-Butene.	"	0	71.90	72.02	78.25	84.19	89.95	95.46	100.69	105.67	110.40	114.91	119.19	123.26	127.15	130.86
trans-2- "	"	0	70.86	70.98	77.76	84.04	90.00	95.64	100.97	106.02	110.81	115.34	119.65	123.75	127.66	131.38
2-Methylpropene (Isobutene).	"	0	70.17	70.30	77.21	83.60	89.67	95.38	100.77	105.85	110.66	115.23	119.56	123.68	127.59	131.33

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t. Specifically, for these compounds, the uncertainty in the entropy at room temperature may be estimated as follows: for ethylene, ±0.05 cal/deg mole; for propylene, cis-2-butene, trans-2-butene, isobutene, ±0.15 cal/deg mole; for 1-butene, ±0.40 cal/deg mole. At higher temperatures the uncertainties will be larger.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8t (Part 2) - MONOOLEFINS, C_5

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
1-Pentene.	C_5H_{10}	0	83.08	83.25	92.13	100.41	108.21	115.53	122.42	128.90	135.03	140.82	146.30	151.50	156.46	161.20
cis-2-Pentene.	"	0	82.76	82.89	90.97	98.68	106.11	113.21	119.90	126.27	132.32	138.04	143.46	148.64	153.56	158.29
trans-2- "	"	0	81.81	81.97	90.67	98.77	106.45	113.68	120.51	126.93	133.03	138.79	144.26	149.45	154.39	159.11
2-Methyl-1-butene. . . .	"	0	81.73	81.88	90.61	98.76	106.49	113.77	120.61	127.07	133.19	138.99	144.45	149.66	154.62	159.35
3- " -1- "	"	0	79.70	79.86	88.94	97.54	105.48	112.87	119.79	126.31	132.45	138.27	143.76	148.99	153.95	158.70
2- " -2- "	"	0	80.90	81.06	89.39	97.18	104.65	111.75	118.46	124.80	130.82	136.54	141.97	147.14	152.05	156.76

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

TABLE 8t (Part 3) - MONOOLEFINS, C_6

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
1-Hexene	C_6H_{12}	0	92.25	92.44	103.2	113.2	122.6	131.4	139.7	147.6	155.0	161.9	168.6	174.9	180.9	186.6
cis-2-Hexene	"	0	92.35	92.53	102.5	112.0	121.1	129.7	137.8	145.5	152.9					
trans-2- "	"	0	91.40	91.60	102.2	112.1	121.4	130.2	138.5	146.2	153.6					
cis-3- "	"	0	90.73	91.78	100.7	110.6	119.2	126.8	136.0	143.7	151.0					
trans-3- "	"	0	90.04	90.23	100.9	110.8	120.1	129.0	137.3	145.1	152.5					
2-Methyl-1-pentene	"	0	91.32	91.51	102.1	112.1	121.4	130.3	138.5	146.4	153.8					
3- " -1- "	"	0	90.45	90.65	101.6	112.0	121.5	130.5	138.9	146.8	154.2					
4- " -1- "	"	0	89.58	89.77	100.5	110.5	120.0	128.9	137.3	145.2	152.6					
2- " -2- "	"	0	90.45	90.62	100.6	110.1	119.2	127.8	135.9	143.6	151.0					
cis-3-Methyl-2-pentene	"	0	90.45	90.62	100.6	110.1	119.2	127.8	136.9	143.6	151.0					
trans-3- " -2- "	"	0	91.26	91.43	101.4	110.9	120.0	128.6	136.8	144.5	151.8					
cis-4- " -2- "	"	0	89.23	89.41	99.8	109.7	119.0	127.7	135.9	143.7	151.0					
trans-4- " -2- "	"	0	88.02	88.21	99.1	109.2	118.7	127.5	135.8	143.6	151.0					
2-Ethyl-1-butene	"	0	90.01	90.18	100.7	110.5	119.9	128.7	137.0	144.8	152.2					
2,3-Dimethyl-1-butene	"	0	87.39	87.58	98.6	108.9	118.6	127.5	135.8	143.7	151.1					
3,3- " -1- "	"	0	83.79	83.94	94.7	104.6	114.1	123.0	131.5	139.5	147.0					
2,3- " -2- "	"	0	86.67	86.84	96.8	106.2	115.2	123.7	131.8	139.4	146.7					

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12t - ACETYLENES, C_2 to C_5

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Ethyne (Acetylene).	C_2H_2	0	47.997	48.061	51.304	54.090	56.525	58.692	60.649	62.441	64.095	65.635	67.077	68.432	69.712	70.925
Propyne (Methylacetylene) .	C_3H_4	0	59.30	59.39	63.96	68.09	71.88	75.38	78.63	81.67	84.53	87.22	89.77	92.17	94.46	96.64
1-Butyne (Ethylacetylene) .	C_4H_6	0	69.51	69.61	75.86	81.60	86.92	91.90	96.54	100.89	104.99	108.87	112.53	116.01	119.31	122.45
2- " (Dimethylacetylene)	"	0	67.71	67.83	73.74	79.21	84.30	89.10	93.63	97.90	101.94	105.76	109.40	112.84	116.12	119.25
1-Pentyne	C_5H_8	0	79.10	79.24	87.4	94.9	101.9	108.4	114.5	120.1	125.5	130.6	135.3	139.9	144.3	148.4
2- "	"	0	79.30	79.44	87.0	94.1	100.7	107.0	112.9	118.5	123.7	128.8	133.6	138.0	142.3	146.5
3-Methyl-1-butyne	"	0	76.23	76.35	84.4	91.9	99.0	105.5	111.6	117.3	122.7	127.8	132.6	137.2	141.5	145.6

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

TABLE 20t - NORMAL PARAFFINS, C_1 to C_{20}

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Methane	CH_4	0	44.50	44.55	47.17	49.48	51.64	53.68	55.61	57.45	59.21	60.89	62.50	64.04	65.51	66.93
Ethane	C_2H_6	0	54.85	54.93	58.98	62.79	66.44	69.93	73.24	76.39	79.39	82.25	84.98	87.59	90.08	92.46
Propane	C_3H_8	0	64.51	64.62	70.37	75.89	81.15	86.17	90.94	95.47	99.77	103.86	107.75	111.45	114.97	118.29
n-Butane	C_4H_{10}	0	74.10	74.25	81.91	89.20	96.11	102.66	108.87	114.74	120.31	125.59	130.60	135.37	139.91	144.22
n-Pentane	C_5H_{12}	0	83.27	83.44	92.95	101.94	110.48	118.56	126.19	133.41	140.26	146.74	152.89	158.74	164.31	169.60
n-Hexane	C_6H_{14}	0	92.45	92.67	104.03	114.75	124.91	134.52	143.60	152.16	160.29	167.97	175.27	182.20	188.79	195.03
n-Heptane	C_7H_{16}	0	101.64	101.88	115.10	127.54	139.34	150.50	160.99	170.92	180.32	189.22	197.65	205.66	213.27	220.45
n-Octane	C_8H_{18}	0	110.82	111.11	126.18	140.35	153.77	166.46	178.40	189.67	200.35	210.45	220.03	229.12	237.75	245.88
n-Nonane	C_9H_{20}	0	120.00	120.33	137.26	153.15	168.20	182.43	195.80	208.42	220.38	231.69	242.41	252.58	262.23	271.31
n-Decane	$C_{10}H_{22}$	0	129.19	129.56	148.33	165.96	182.63	198.39	213.21	227.18	240.41	252.92	264.79	276.04	286.71	296.73
n-Undecane	$C_{11}H_{24}$	0	138.37	138.78	159.41	178.76	197.06	214.36	230.61	245.93	260.44	274.16	287.17	299.50	311.19	322.16
n-Dodecane	$C_{12}H_{26}$	0	147.55	148.01	170.49	191.57	211.49	230.33	248.02	264.68	280.47	295.39	309.55	322.96	335.67	347.59
n-Tridecane	$C_{13}H_{28}$	0	156.74	157.23	181.56	204.37	225.92	246.30	265.42	283.44	300.50	316.63	331.92	346.42	360.15	373.02
n-Tetradecane	$C_{14}H_{30}$	0	165.92	166.45	192.64	217.17	240.35	262.26	282.82	302.19	320.53	337.87	354.30	369.88	384.63	398.44
n-Pentadecane	$C_{15}H_{32}$	0	175.10	175.68	203.72	229.98	254.78	278.23	300.23	320.94	340.56	359.10	376.68	393.34	409.11	423.87
n-Hexadecane	$C_{16}H_{34}$	0	184.28	184.90	214.80	242.78	269.21	294.20	317.63	339.69	360.59	380.34	399.06	416.80	433.59	449.30
n-Heptadecane	$C_{17}H_{36}$	0	193.47	194.13	225.87	255.59	283.64	310.16	335.04	358.45	380.62	401.57	421.44	440.26	458.07	474.72
n-Octadecane	$C_{18}H_{38}$	0	202.65	203.35	236.95	268.39	298.07	326.13	352.44	377.20	400.65	422.81	443.82	463.72	482.55	500.15
n-Nonadecane	$C_{19}H_{40}$	0	211.83	212.57	248.03	281.19	312.50	342.10	369.84	395.95	420.68	444.05	466.20	487.18	507.03	525.58
n-Eicosane	$C_{20}H_{42}$	0	221.02	221.80	259.10	294.00	326.93	358.06	387.25	414.71	440.71	465.28	488.58	510.64	531.51	551.00
Increment per CH_2 group		0	9.183	9.224	11.077	12.804	14.430	15.967	17.404	18.753	20.030	21.236	22.379	23.460	24.480	25.427

[a] See footnote a of Table 1t

[b] See footnote b of Table 1t

[c] See footnote c of Table 1t

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21t - NORMAL ALKYL BENZENES, C_6 TO C_{22}
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK
November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Benzene	C_6H_6	0	64.34	64.46	71.10	77.74	84.17	90.30	96.10	101.57	106.73	111.61	116.22	120.59	124.74	128.68
Methylbenzene (Toluene)	C_7H_8	0	76.42	76.57	84.91	93.13	101.08	108.64	115.81	122.58	128.98	135.03	140.76	146.19	151.34	156.25
Ethylbenzene	C_8H_{10}	0	86.15	86.34	96.59	106.63	116.28	125.43	134.08	142.23	149.92	157.19	164.07	170.59	176.79	182.67
n-Propylbenzene	C_9H_{12}	0	95.74	95.97	108.1	119.9	131.2	141.9	152.0	161.5	170.5	178.9	186.9	194.5	201.7	208.6
n-Butylbenzene	$C_{10}H_{14}$	0	104.91	105.16	119.2	132.7	145.6	157.8	169.3	180.2	190.4	200.1	209.2	217.9	226.1	234.0
n-Amylbenzene	$C_{11}H_{16}$	0	114.09	114.38	130.2	145.5	160.0	173.8	186.7	198.9	210.4	221.3	231.6	241.4	250.6	259.4
n-Hexylbenzene	$C_{12}H_{18}$	0	123.28	123.61	141.3	158.3	174.5	189.8	204.1	217.7	230.5	242.5	254.0	264.8	275.1	284.8
n-Heptylbenzene	$C_{13}H_{20}$	0	132.46	132.83	152.4	171.1	188.9	205.7	221.5	236.4	250.5	263.8	276.4	288.3	299.6	310.3
n-Octylbenzene	$C_{14}H_{22}$	0	141.64	142.06	163.5	183.9	203.3	221.7	239.0	255.2	270.5	285.0	298.7	311.7	324.0	335.7
n-Nonylbenzene	$C_{15}H_{24}$	0	150.82	151.28	174.5	196.7	217.8	237.7	256.4	273.9	290.6	306.2	321.1	335.2	348.5	361.1
n-Decylbenzene	$C_{16}H_{26}$	0	160.01	160.50	185.6	209.5	232.2	253.6	273.8	292.7	310.6	327.5	343.5	358.6	373.0	386.5
n-Undecylbenzene	$C_{17}H_{28}$	0	169.19	169.73	196.7	222.3	246.6	269.6	291.2	311.4	330.6	348.7	365.9	382.1	397.5	412.0
n-Dodecylbenzene	$C_{18}H_{30}$	0	178.37	178.95	207.8	235.1	261.0	285.6	308.6	330.2	350.6	370.0	388.2	405.6	422.0	437.4
n-Tridecylbenzene	$C_{19}H_{32}$	0	187.56	188.18	218.8	247.9	275.5	301.5	326.0	348.9	370.7	391.2	410.6	429.0	446.4	462.8
n-Tetradecylbenzene	$C_{20}H_{34}$	0	196.74	197.40	229.9	260.7	289.9	317.5	343.4	367.7	390.7	412.4	433.0	452.5	470.9	488.2
n-Pentadecylbenzene	$C_{21}H_{36}$	0	205.92	206.62	241.0	273.5	304.3	333.5	360.8	386.4	410.7	433.7	455.4	476.0	495.4	513.7
n-Hexadecylbenzene	$C_{22}H_{38}$	0	215.11	215.85	252.1	286.3	318.8	349.4	378.2	405.2	430.8	454.9	477.8	499.4	519.9	539.1
Increment per CH_2 group		0	9.183	9.224	11.08	12.80	14.43	15.97	17.40	18.75	20.03	21.24	22.38	23.46	24.48	25.43

[a] See footnote a of Table 1t

[b] See footnote b of Table 1t

[c] See footnote c of Table 1t

TABLE 22t - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Cyclopentane	C_5H_{10}	0	70.00	70.12	77.00	84.14	91.28	98.24	104.92	111.33	117.45	123.30	128.88	134.18	139.23	144.07
Methylcyclopentane	C_6H_{12}	0	81.24	81.42	90.33	99.36	108.24	116.81	125.01	132.83	140.25	147.31	154.05	160.42	166.51	172.37
Ethylcyclopentane.	C_7H_{14}	0	90.62	90.84	101.60	112.38	122.89	133.05	142.73	151.91	160.62	168.90	176.79	184.29	191.37	198.19
n-Propylcyclopentane . . .	C_8H_{16}	0	99.80	100.06	112.7	125.2	137.3	149.0	160.1	170.7	180.6	190.1	199.2	207.8	215.8	223.6
n-Butylcyclopentane. . . .	C_9H_{18}	0	108.99	109.29	123.8	138.0	151.8	165.0	177.5	189.4	200.7	211.4	221.6	231.2	240.3	249.0
n-Pentylcyclopentane . . .	$C_{10}H_{20}$	0	118.17	118.51	134.8	150.8	166.2	181.0	194.9	208.2	220.7	232.6	243.9	254.7	264.8	274.5
n-Hexylcyclopentane. . . .	$C_{11}H_{22}$	0	127.35	127.74	145.9	163.6	180.6	196.9	212.4	226.9	240.7	253.8	266.3	278.1	289.3	299.9
n-Heptylcyclopentane . . .	$C_{12}H_{24}$	0	136.54	136.96	157.0	176.4	195.0	212.9	229.8	245.7	260.8	275.1	288.7	301.6	313.8	325.3
n-Octylcyclopentane. . . .	$C_{13}H_{26}$	0	145.72	146.18	168.1	189.2	209.5	228.8	247.2	264.4	280.8	296.3	311.1	325.0	338.2	350.8
n-Nonylcyclopentane. . . .	$C_{14}H_{28}$	0	154.90	155.41	179.1	202.0	223.9	244.8	264.6	283.2	300.8	317.6	333.4	348.5	362.7	376.2
n-Decylcyclopentane. . . .	$C_{15}H_{30}$	0	164.08	164.63	190.2	214.8	238.3	260.8	282.0	301.9	320.9	338.8	355.8	372.0	387.2	401.6
n-Undecylcyclopentane. . .	$C_{16}H_{32}$	0	173.27	173.86	201.3	227.6	252.8	276.7	299.4	320.7	340.9	360.0	378.2	395.4	411.7	427.0
n-Dodecylcyclopentane. . .	$C_{17}H_{34}$	0	182.45	183.08	212.4	240.4	267.2	292.7	316.8	339.4	360.9	381.3	400.6	418.9	436.2	452.5
n-Tridecylcyclopentane . .	$C_{18}H_{36}$	0	191.63	192.30	223.4	253.2	281.6	308.7	334.2	358.2	381.0	402.5	423.0	442.4	460.6	477.9
n-Tetradecylcyclopentane .	$C_{19}H_{38}$	0	200.82	201.53	234.5	266.0	296.0	324.6	351.6	377.0	401.0	423.7	445.3	465.8	485.1	503.3
n-Pentadecylcyclopentane .	$C_{20}H_{40}$	0	210.00	210.75	245.6	278.8	310.5	340.6	369.0	395.7	421.0	445.0	467.7	489.3	509.6	528.7
n-Hexadecylcyclopentane. .	$C_{21}H_{42}$	0	219.18	219.98	256.7	291.6	324.9	356.6	386.4	414.4	441.0	466.2	490.1	512.7	534.1	554.2
Increment per CH_2 group		0	9.183	9.224	11.08	12.80	14.43	15.97	17.40	18.75	20.03	21.24	22.38	23.46	24.48	25.43

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 23t - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}
ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Cyclchexane.	C_6H_{12}	0	71.28	71.44	80.18	89.24	98.30	107.14	115.65	123.80	131.59	139.0	146.0	152.7	159.0	165.1
Methylcyclohexane.	C_7H_{14}	0	82.06	82.28	93.22	104.32	115.21	125.77	135.86	145.46	154.57	163.2	171.4	179.2	186.6	193.7
Ethylcyclohexane	C_8H_{16}	0	91.44	91.70	104.5	117.3	129.9	142.0	153.6	164.5	174.9	184.8	194.2	203.0	211.4	219.5
n-Propylcyclohexane. . . .	C_9H_{18}	0	100.11	100.43	115.0	129.6	143.7	157.3	170.4	182.7	194.3	205.5	215.9	226.0	235.3	244.4
n-Butylcyclohexane	$C_{10}H_{20}$	0	109.29	109.66	126.1	142.4	158.1	173.3	187.8	201.5	214.3	226.7	238.3	249.5	259.8	269.8
n-Pentylcyclohexane. . . .	$C_{11}H_{22}$	0	118.48	118.87	137.2	155.2	172.6	189.2	205.2	220.2	234.4	248.0	260.7	272.9	284.3	295.3
n-Hexylcyclohexane	$C_{12}H_{24}$	0	127.66	128.10	148.2	168.0	187.0	205.2	222.6	239.0	254.4	269.2	283.0	296.4	308.7	320.7
n-Heptylcyclohexane. . . .	$C_{13}H_{26}$	0	136.84	137.33	159.3	180.8	201.4	221.2	240.0	257.7	274.4	290.4	305.4	319.8	333.2	346.1
n-Octylcyclohexane	$C_{14}H_{28}$	0	146.03	146.56	170.4	193.6	215.8	237.1	257.4	276.5	294.4	311.7	327.8	343.3	357.7	371.5
n-Nonylcyclohexane	$C_{15}H_{30}$	0	155.21	155.77	181.5	206.4	230.3	253.1	274.8	295.2	314.5	332.9	350.2	366.8	382.2	397.0
n-Decylcyclohexane	$C_{16}H_{32}$	0	164.39	165.00	192.5	219.2	244.7	269.1	292.2	314.0	334.5	354.2	372.6	390.2	406.7	422.4
n-Undecylcyclohexane. . .	$C_{17}H_{34}$	0	173.57	174.23	203.6	232.0	259.1	285.0	309.6	332.7	354.5	375.4	394.9	413.7	431.1	447.8
n-Dodecylcyclohexane . . .	$C_{18}H_{36}$	0	182.76	183.44	214.7	244.8	273.6	301.0	327.0	351.5	374.6	396.6	417.3	437.1	455.6	473.2
n-Tridecylcyclohexane. . .	$C_{19}H_{38}$	0	191.94	192.67	225.8	257.6	288.0	317.0	344.4	370.2	394.6	417.9	439.7	460.6	480.1	498.7
n-Tetradecylcyclohexane. .	$C_{20}H_{40}$	0	201.12	201.90	236.8	270.4	302.4	332.9	361.8	389.0	414.6	439.1	462.1	484.1	504.6	524.1
n-Pentadecylcyclohexane. .	$C_{21}H_{42}$	0	210.31	211.11	247.9	283.2	316.9	348.9	379.2	407.7	434.7	460.3	484.4	507.5	529.1	549.5
n-Hexadecylcyclohexane . .	$C_{22}H_{44}$	0	219.49	220.34	259.0	296.1	331.3	364.9	396.7	426.5	454.7	481.6	506.8	531.0	553.5	575.0
Increment per CH_2 group.		0	9.183	9.224	11.08	12.80	14.43	15.97	17.40	18.75	20.03	21.24	22.38	23.46	24.48	25.43

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

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TABLE 24t - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945; April 30, 1946

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	52.45	52.51	55.89	58.98	61.92	64.68	67.28	69.74	72.06	74.26	76.34	78.32	80.21	82.01
Propene (Propylene)	C_3H_6	0	63.80	63.90	68.86	73.47	77.87	82.04	85.98	89.72	93.26	96.61	99.80	102.84	105.72	108.48
1-Butene	C_4H_8	0	73.48	73.62	80.59	87.09	93.25	99.05	104.50	109.63	114.49	119.09	123.45	127.59	131.52	135.27
1-Pentene	C_5H_{10}	0	83.08	83.25	92.13	100.41	108.21	115.53	122.42	128.90	135.03	140.82	146.30	151.50	156.46	161.20
1-Hexene	C_6H_{12}	0	92.25	92.44	103.2	113.2	122.6	131.4	139.7	147.6	155.0	161.9	168.6	174.9	180.9	186.6
1-Heptene	C_7H_{14}	0	101.43	101.67	114.3	126.0	137.0	147.4	157.2	166.3	175.0	183.2	191.0	198.3	205.3	212.0
1-Octene	C_8H_{16}	0	110.61	110.89	125.3	138.8	151.4	163.4	174.6	185.1	195.1	204.4	213.4	221.8	229.8	237.4
1-Nonene	C_9H_{18}	0	119.80	120.12	136.4	151.6	165.9	179.3	192.0	203.8	215.1	225.7	235.7	245.3	254.3	262.9
1-Decene	$C_{10}H_{20}$	0	128.98	129.34	147.5	164.4	180.3	195.3	209.4	222.6	235.1	246.9	258.1	268.7	278.8	288.3
1-Undecene	$C_{11}H_{22}$	0	138.16	138.57	158.6	177.2	194.7	211.3	226.8	241.3	255.1	268.1	280.5	292.2	303.3	313.7
1-Dodecene	$C_{12}H_{24}$	0	147.34	147.79	169.6	190.0	209.2	227.2	244.2	260.1	275.2	289.4	302.9	315.6	327.7	339.2
1-Tridecene	$C_{13}H_{26}$	0	156.53	157.01	180.7	202.8	223.6	243.2	261.6	278.9	295.2	310.6	325.3	339.1	352.2	364.6
1-Tetradecene	$C_{14}H_{28}$	0	165.71	166.24	191.8	215.6	238.0	259.2	279.0	297.6	315.2	331.9	347.6	362.6	376.7	390.0
1-Pentadecene	$C_{15}H_{30}$	0	174.89	175.46	202.9	228.4	252.5	275.2	296.4	316.4	335.3	353.1	370.0	386.0	401.2	415.5
1-Hexadecene	$C_{16}H_{32}$	0	184.08	184.69	213.9	241.2	266.9	291.1	313.8	335.1	355.3	374.3	392.4	409.5	425.7	440.9
1-Heptadecene	$C_{17}H_{34}$	0	193.26	193.91	225.0	254.0	281.3	307.1	331.2	353.9	375.3	395.6	414.8	432.9	450.1	466.3
1-Octadecene	$C_{18}H_{36}$	0	202.44	203.13	236.1	266.8	295.7	323.1	348.6	372.6	395.3	416.8	437.2	456.4	474.6	491.7
1-Nonadecene	$C_{19}H_{38}$	0	211.63	212.36	247.2	279.6	310.2	339.0	366.0	391.4	415.4	438.0	459.5	479.9	499.1	517.2
1-Eicosene	$C_{20}H_{40}$	0	220.81	221.58	258.2	292.4	324.6	355.0	383.4	410.1	435.4	459.3	481.9	503.3	523.6	542.6
Increment per CH_2 group		0	9.183	9.224	11.08	12.80	14.43	15.97	17.40	18.75	20.03	21.24	22.38	23.46	24.48	25.43

[a] See footnote a of Table 1t

[b] See footnote b of Table 1t

[c] See footnote c of Table 1t

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 25t - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

ENTROPY, S^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Entropy[b], S^o, in cal/deg mole[c]														
Ethyne (Acetylene)	C_2H_2	0	47.997	48.061	51.304	54.090	56.525	58.692	60.649	62.441	64.095	65.635	67.077	68.432	69.712	70.925
Propyne (Methylacetylene).	C_3H_4	0	59.30	59.39	63.96	68.09	71.88	75.38	78.63	81.67	84.53	87.22	89.77	92.17	94.46	96.64
1-Butyne (Ethylacetylene).	C_4H_6	0	69.51	69.61	75.86	81.60	86.92	91.90	96.54	100.89	104.99	108.87	112.53	116.01	119.31	122.45
1-Pentyne.	C_5H_8	0	79.10	79.24	87.4	94.9	101.9	108.4	114.5	120.1	125.5	130.6	135.3	139.9	144.3	148.4
1-Hexyne	C_6H_{10}	0	88.27	88.43	98.4	107.6	116.2	124.3	131.8	138.8	145.5	151.8	157.7	163.3	168.6	173.8
1-Heptyne.	C_7H_{12}	0	97.45	97.66	109.5	120.5	130.7	140.2	149.2	157.6	165.5	173.0	180.0	186.8	193.1	199.2
1-Octyne	C_8H_{14}	0	106.63	106.88	120.6	133.3	145.1	156.2	166.6	176.3	185.5	194.2	202.4	210.2	217.6	224.6
1-Nonyne	C_9H_{16}	0	115.82	116.11	131.7	146.1	159.5	172.2	184.0	195.1	205.6	215.4	224.8	233.7	242.1	250.0
1-Decyne	$C_{10}H_{18}$	0	125.00	125.33	142.8	158.9	174.0	188.2	201.4	213.8	225.6	236.7	247.2	257.1	266.6	275.5
1-Undecyne	$C_{11}H_{20}$	0	134.18	134.56	153.8	171.7	188.4	204.1	218.8	232.6	245.6	257.9	269.6	280.6	291.0	300.9
1-Dodecyne	$C_{12}H_{22}$	0	143.36	143.78	164.9	184.5	202.8	220.1	236.2	251.3	265.7	279.2	291.9	304.1	315.5	326.3
1-Tridecyne.	$C_{13}H_{24}$	0	152.55	153.00	176.0	197.3	217.3	236.0	253.6	270.1	285.7	300.4	314.3	327.5	340.0	351.8
1-Tetradecyne.	$C_{14}H_{26}$	0	161.73	162.23	187.1	210.1	231.7	252.0	271.0	288.8	305.7	321.6	336.7	351.0	364.5	377.2
1-Pentadecyne.	$C_{15}H_{28}$	0	170.91	171.45	198.1	222.9	246.1	268.0	288.4	307.6	325.8	342.9	359.1	374.4	389.0	402.6
1-Hexadecyne	$C_{16}H_{30}$	0	180.10	180.68	209.2	235.7	260.6	284.0	305.8	326.4	345.8	364.1	381.5	397.9	413.4	428.0
1-Heptadecyne.	$C_{17}H_{32}$	0	189.28	189.90	220.3	248.5	275.0	299.9	323.2	345.1	365.8	385.3	403.8	421.4	437.9	453.5
1-Octadecyne	$C_{18}H_{34}$	0	198.46	199.12	231.4	261.3	289.4	315.9	340.6	363.9	385.8	406.6	426.2	444.8	462.4	478.9
1-Nonadecyne	$C_{19}H_{36}$	0	207.65	208.35	242.4	274.1	303.8	331.8	358.0	382.6	405.9	427.8	448.6	468.3	486.9	504.3
1-Eicosyne	$C_{20}H_{38}$	0	216.83	217.57	253.5	286.9	318.3	347.8	375.4	401.4	425.9	449.0	471.0	491.7	511.4	529.7
Increment per CH_2 group		0	9.183	9.224	11.08	12.80	14.43	15.97	17.40	18.75	20.03	21.24	22.38	23.46	24.48	25.43

[a] See footnote a of Table 1t.

[b] See footnote b of Table 1t.

[c] See footnote c of Table 1t.

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National Bureau of Standards

Washington D. C.

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TABLE 00u - O, H, N, C

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 4000°K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Oxygen	O	0	1607.4	1617.0	2134.9	2645.4	3151.7	3655.5	4157.6	4658.7	5158.8	5656.4	6157.6	6656.4	7155.0	7655.3
Hydrogen	H	0	1481.2	1490.4	1987.2	2484.0	2980.8	3477.6	3974.4	4471.2	4968.0	5464.7	5961.5	6458.3	6955.1	7451.9
Nitrogen	N	0	1481.2	1490.4	1987.2	2484.0	2980.8	3477.6	3974.4	4471.2	4968.0	5464.7	5961.5	6458.3	6955.1	7451.9
Carbon	C	0	1558.9	1568.1	2065.8	2563.1	3060.3	3557.3	4054.3	4551.3	5048.2	5545.1	6042.0	6539.1	7036.3	7533.4

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Heat Content, $(H^o-H^o_0)$, in cal/mole														
Oxygen	O	5158.8	6407.0	7653.3	8898.2	10143.	11387.	12632.	13879.	15129.	17639.	20172.				
Hydrogen	H	4968.0	6209.9	7451.9	8693.9	9935.9	11178.	12420.	13662.	14904.	17388.	19872.				
Nitrogen	N	4968.0	6210.0	7451.9	8693.9	9936.2	11179.	12422.	13663.	14918.	17440.	20015.				
Carbon	C	5048.2	6290.5	7533.4	8778.5	10028.	11283.	12547.	13822.	15108.	17715.	20367.				

[a]Interpolation to other temperatures in the interval 298.16° to 4000°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500°, and 600°K.

[b]$(H^o-H^o_0)$ is the heat content at the given temperature less the heat content at 0°K of the given substance in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c]The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual value in order to retain the internal consistency of the eeveral thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 0u - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CONTENT, $(H^o-H^o_0)$, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in ^oK													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]													
Oxygen	O_2	gas	0				1384.40	1732.68	2069.78	2082.72	2792.4	3524.2	4279.2	5057.4	5854.1	6669.6
Hydrogen	H_2	gas	0	326.32	716.70	1038.50	1360.56	1694.30	2023.81	2036.47	2731.0	3429.5	4128.6	4831.5	5537.4	6248.0
Hydroxyl	OH	gas	0						2106.2	2122.5	2829.6	3535.0	4240.8	4946.9	5658.4	6377.4
Water	H_2O	gas	0						2365.1	2379.9	3190.0	4019.5	4873.2	5755.4	6666.4	7606.8
Nitrogen	N_2	gas	0		693.65		1389.30	1737.05	2072.27	2085.09	2782.4	3485.0	4198.0	4925.3	5668.6	6428.0
Nitric Oxide	NO	gas	0		742.7	1122.2	1490.6	1852.8	2194.2	2206.8	2920.8	3644.0	4381.2	5136.6	5909.6	6700.5
Carbon	C	solid, graphite	0		14.451	43.155	91.973	162.468	251.56	255.31	502.6	820.8	1198.1	1622.0	2081.7	2569.4
Carbon Monoxide	CO	gas	0		693.37		1389.40	1737.38	2072.63	2085.45	2783.8	3490.0	4209.5	4945.8	5699.8	6470.6
Carbon Dioxide	CO_2	gas	0						2238.11	2254.6	3194.8	4222.8	5322.4	6481.2	7689.4	8938.5

Compound	Formula	State	Temperature in ^oK													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Heat Content, $(H^o-H^o_0)$, in cal/mole													
Oxygen	O_2	gas	7497.0	8335.2	9183.9	10041.0	10905.1	11776.4	13980.	16219.	18494.	20799.	23136.	25500.	30308.	35215.
Hydrogen	H_2	gas	6965.8	7692.0	8427.5	9173.2	9928.7	10694.2	12653.7	14672.	16739.	18851.	21004.	23186.	27637.	32168.
Hydroxyl	OH	gas	7106.0	7844.1	8593.2	9354.8	10128.	10910.	12906.	14960.	17059.	19192.	21365.	23562.	28024.	32576.
Water	H_2O	gas	8580.0	9579.9	10613.	11675.	12762.	13876.	16748.	19760.	22860.	26050.	29290.	32580.		
Nitrogen	N_2	gas	7202.5	7991.5	8792.8	9604.7	10425.4	11253.6	13357.	15499.	17660.	19839.	22036.	24245.	28695.	33178.
Nitric Oxide	NO	gas	7506.0	8323.7	9153.6	9991.8	10839.	11694.	13848.	16030.	18234.	20450.	22679.	24921.	29428.	33972.
Carbon	C	solid, graphite	3074.6	3596.	4130.	4680.	5242.	5814.								
Carbon Monoxide	CO	gas	7256.5	8056.2	8867.8	9689.9	10520.9	11358.8	13481.	15636.	17813.	20007.	22216.	24434.	28900.	33395.
Carbon Dioxide	CO_2	gas	10222.	11535.	12874.	14234.	15611.	17004.	20542.	24144.	27790.	31480.	35200.	38950.	46520.	

[a] Interpolation to other temperatures in the interval 50^o to 4000^oK may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table 00u.

[c] See footnote c of Table 00u.

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TABLE 1u - PARAFFINS, C_1 to C_5

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

August 31, 1944

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$ cal/mole[c]														
Methane	CH_4	0	2397.	2413.	3323.	4365.	5549.	6871.	8321.	9887.	11560.	13320.	15170.	17100.	19090.	21130.
Ethane	C_2H_6	0	2856.	2879.	4296.	6010.	8016.	10280.	12760.	15440.	18280.	21290.	24420.	27680.	31040.	34500.
Propane	C_3H_8	0	3512.	3546.	5556.	8040.	10930.	14190.	17760.	21600.	25670.	29950.	34420.	39030.	43780.	48650.
n-Butane	C_4H_{10}	0	4645.	4689.	7368.	10635.	14440.	18700.	23340.	28310.	33580.	39120.	44880.	50860.	56990.	63270.
2-Methylpropane (Isobutane)	"	0	4276.	4317.	6964.	10250.	14070.	18340.	23010.	28020.	33310.	38870.	44680.	50650.	56780.	63050.
n-Pentane	C_5H_{12}	0	5668.	5721.	9048.	13090.	17780.	23030.	28740.	34860.	41340.	48140.	55210.	62530.	70060.	77760.
2-Methylbutane (Isopentane)	"	0	5140.	5193.	8490.	12570.	17300.	22590.	28350.	34520.	41030.	47870.	55000.	62320.	69860.	77540.
2,2-Dimethylpropane (Neopentane)	"	0	5030.	5082.	8428.	12570.	17390.	22770.	28640.	34900.	41510.	48420.	55610.	63040.	70660.	78420.

[a] Interpolation to other temperatures in the interval 298.16^o to 1500^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o and 600^oK.

[b] $(H^o-H_0{}^o)$ is the heat content at the given temperature less the heat content at 0^oK, of the given hydrocarbon in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2u (Part 1) - PARAFFINS, C_6

HEAT CONTENT, $(H^o - H^o_0)$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o - H^o_0)$ cal/mole[c]														
n - Hexane	C_6H_{14}	0	6691.	6756.	10732.	15550.	21140.	27380.	34170.	41420.	49110.	57170.	65560.	74230.	83150.	92250.
2 - Methylpentane . .	"	0	6097.	6162.	10080.	14950.	20520.	26810.	33600.	40950.	48700.					
3 - " . .	"	0	6148.	6213.	10200.	15100.	20760.	27020.	33920.	41220.	48900.					
2,2 - Dimethylbutane.	"	0	5936.	5997.	9960.	14800.	20520.	26810.	33760.	41040.	48900.					
2,3 - "	"	0	6070.	6135.	10080.	14950.	20640.	26880.	33760.	41130.	48800.					

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2u (Part 2) - PARAFFINS, C_7

HEAT CONTENT, $(H^o - H^o_0)$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30,1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o - H_0)$ cal/mole[c,d]														
n - Heptane	C_7H_{16}	0	7713.	7788.	12416.	18005.	24490.	31730.	39580.	47990.	56890.	66210.	75900.	85920.	96220.	106740.
2 - Methylhexane. . . .	"	0	7123.	7194.	11840.	17510.	24100.	31450.	39400.	47800.	56700.					
3 - "	"	0	6953.	7023.	11620.	17240.	23800.	31130.	39100.	47500.	56400.					
3 - Ethylpentane. . . .	"	0	6715.	6783.	11320.	16890.	23390.	30680.	38600.	47000.	55800.					
2,2 - Dimethylpentane .	"	0	6664.	6732.	11350.	17050.	23690.	31140.	39200.	47700.	56700.					
2,3 - "	"	0	6622.	6690.	11270.	16910.	23500.	30860.	38800.	47300.	56100.					
2,4 - "	"	0	6634.	6702.	11330.	17040.	23690.	31140.	39200.	47700.	56600.					
3,3 - "	"	0	6703.	6771.	11410.	17120.	23800.	31250.	39300.	47900.	56900.					
2,2,3-Trimethylbutane .	"	0	6563.	6630.	11300.	17070.	23800.	31330.	39400.	48000.	57000.					

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

[d] The uncertainty in the temperature coefficient of the heat content (the heat capacity) for the branched-chain heptanes is of the same order of magnitude as the difference in this quantity between the normal and the branched-chain heptanes (cf. footnote d of Table 2v (Part 2)).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 3u - PARAFFINS, C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

October 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$ cal/mole[c,d]														
n-Octane	C_8H_{18}	0	8736.	8823.	14100.	20465.	27840.	36080.	45010.	54550.	64660.	75240.	86240.	97620.	109300.	121200.
2-Methylheptane	"	0	8146.	8229.	13530.	19990.	27490.	35840.	44800.	54300.	64500.					
3- "	"	0	8047.	8130.	13400.	19850.	27350.	35700.	44600.	54200.	64400.					
4- "	"	0	7967.	8049.	13300.	19740.	27200.	35500.	44400.	54000.	64200.					
3-Ethylhexane	"	0	7537.	7617.	12720.	19050.	26410.	34640.	43600.	53100.	63200.					
2,2-Dimethylhexane	"	0	7746.	7827.	13110.	19600.	27120.	35530.	44700.	54400.	64600.					
2,3- "	"	0	7857.	7938.	13280.	19940.	27620.	36110.	45200.	54700.	64900.					
2,4- "	"	0	7526.	7605.	12840.	19260.	26760.	35140.	44100.	53700.	63800.					
2,5- "	"	0	7627.	7707.	12970.	19470.	27020.	35410.	44400.	53900.	64100.					
3,3- "	"	0	7517.	7596.	12850.	19310.	26860.	35320.	44500.	54200.	64400.					
3,4- "	"	0	7836.	7917.	13310.	19910.	27550.	36000.	45000.	54500.	64800.					
2-Methyl-3-ethylpentane	"	0	7707.	7788.	13100.	19630.	27180.	35550.	44500.	54000.	64300.					
3- " -3- "	"	0	7526.	7605.	12960.	19470.	27000.	35400.	44500.	54300.	64700.					
2,2,3-Trimethylpentane	"	0	7385.	7464.	12750.	19290.	26880.	35340.	44400.	54100.	64400.					
2,2,4- "	"	0	7385.	7464.	12750.	19290.	26880.	35340.	44400.	54100.	64400.					
2,3,3- "	"	0	7505.	7584.	12890.	19470.	27090.	35540.	44600.	54200.	64700.					
2,3,4- "	"	0	7376.	7455.	12750.	19380.	27030.	35470.	44400.	54000.	64400.					
2,2,3,3-Tetramethylbutane	"	0	7326.	7404.	12730.	19390.	27180.	35850.	45100.	54900.	65300.					

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote of Table 1u.

[d] The uncertainty in the temperature coefficient of the heat content (the heat capacity) for the branched-chain octanes is of the same order of magnitude as the difference in this quantity between the normal and the branched-chain octanes (cf. footnote d of Table 3v).

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National Bureau of Standards — Washington, D. C.

TABLE 5u - ALKYL BENZENES, C_6 to C_9

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Benzene	C_6H_6	0	3401.	3437.	5762.	8750.	12285.	16267.	20612.	25260.	30163.	35280.	40590.	46040.	51640.	57350.
Methylbenzene (Toluene)	C_7H_8	0	4306.	4352.	7269.	10969.	15334.	20247.	25621.	31373.	37449.	43800.	50390.	57180.	64130.	71250.
Ethylbenzene	C_8H_{10}	0	5335.	5391.	8976.	13496.	18799.	24746.	31222.	38144.	45448.	53080.	60980.	69130.	77480.	86020.
1,2-Dimethylbenzene (o-Xylene)	"	0	5576.	5635.	9291.	13806.	19070.	24962.	31386.	38265.	45531.	53130.	61000.	69120.	77450.	85960.
1,3- " (m- ")	"	0	5325.	5382.	8925.	13359.	18563.	24415.	30817.	37678.	44933.	52520.	60390.	68500.	76820.	85330.
1,4- " (p- ")	"	0	5358.	5414.	8929.	13330.	18499.	24319.	30690.	37525.	44755.	52320.	60170.	68270.	76580.	85080.
n-Propylbenzene	C_9H_{12}	0	6467.	6534.	10790.	16090.	22300.	29250.	36810.	44860.	53360.	62200.	71400.	81000.	90700.	100600.
Isopropylbenzene (Cumene)	"	0	6097.	6162.	10380.	15700.	21940.	28900.	36470.	44560.	53090.	62000.	71200.	80800.	90500.	100400.
1-Methyl-2-ethylbenzene	"	0	6604.	6674.	11000.	16330.	22530.	29460.	36990.	45040.	53530.	62400.	71600.	81100.	90800.	100700.
1- " -3- "	"	0	6354.	6421.	10630.	15890.	22030.	28910.	36420.	44450.	52930.	61800.	71000.	80500.	90200.	100100.
1- " -4- "	"	0	6386.	6453.	10640.	15860.	21960.	28820.	36290.	44300.	52750.	61600.	70800.	80200.	89900.	99900.
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	6590.	6658.	10810.	15980.	21990.	28750.	36130.	44050.	52430.	61200.	70300.	79700.	89400.	99300.
1,2,4- " (Pseudocumene)	"	0	6609.	6677.	10860.	16030.	22060.	28830.	36230.	44160.	52550.	61300.	70500.	79900.	89600.	99500.
1,3,5- " (Mesitylene)	"	0	6326.	6392.	10486.	15616.	21623.	28386.	35789.	43728.	52131.	60930.	70070.	79500.	89180.	99080.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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National Bureau of Standards — Washington, D. C.

TABLE 7u - ALKYL CYCLOHEXANES, C_6 to C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Cyclohexane.	C_6H_{12}	0	4237.	4284.	7352.	11425.	16404.	22148.	28536.	35460.	42850.	50600.	58680.	67080.	75600.	84450.
Methylcyclohexane.	C_7H_{14}	0	5233.	5298.	9136.	14130.	20118.	26971.	34528.	42678.	51330.	60390.	69840.	79560.	89600.	99750.
Ethlcyclohexane.	C_8H_{16}	0	6097.	6174.	10680.	16450.	23340.	31220.	39920.	49230.	59100.	69400.	80200.	91300.	102600.	114300.
1,1-Dimethylcyclohexane. . .	"	0	5880.	5955.	10360.	16050.	22920.	30800.	39520.	48960.	58900.	69300.	80200.	91400.	102900.	114600.
cis-1,2- " . . .	"	0	6011.	6087.	10520.	16250.	23160.	31010.	39680.	48960.	58900.	69300.	80000.	91100.	102600.	114200.
trans-1,2- " . . .	"	0	6094.	6174.	10680.	16500.	23400.	31290.	40000.	49410.	59300.	69700.	80500.	91700.	103000.	114800.
cis-1,3-[d] " . . .	"	0	6068.	6144.	10600.	16350.	23280.	31150.	39840.	49230.	59100.	69500.	80400.	91700.	103000.	114800.
trans-1,3-[e] " . . .	"	0	6068.	6144.	10600.	16350.	23220.	31010.	39680.	48960.	58800.	69200.	79900.	91000.	102300.	114000.
cis-1,4- " . . .	"	0	6068.	6144.	10600.	16350.	23220.	31010.	39680.	48960.	58800.	69200.	79900.	91000.	102300	114000.
trans-1,4- " . . .	"	0	6076.	6153.	10640.	16400.	23340.	31290.	40000.	49320.	59300.	69700.	80500.	91700.	103000.	114800.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

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National Bureau of Standards — Washington, D. C.

TABLE 8u (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Ethene (Ethylene)	C_2H_4	0	2525.	2544.	3711.	5117.	6732.	8527.	10480.	12560.	14760.	17070.	19470.	21950.	24490.	27100.
Propene (Propylene)	C_3H_6	0	3237.	3265.	4990.	7076.	9492.	12200.	15150.	18320.	21690.	25210.	28880.	32670.	36570.	40570.
1-Butene.	C_4H_8	0	4224.	4263.	6687.	9629.	13010.	16770.	20860.	25220.	29830.	34660.	39670.	44840.	50150.	55590.
cis-2-Butene.	"	0	3945.	3981.	6144.	8839.	12010.	15580.	19510.	23740.	28230.	32960.	37880.	42980.	48230.	53620.
trans-2- "	"	0	4190.	4228.	6582.	9422.	12690.	16360.	20350.	24640.	29190.	33960.	38920.	44040.	49310.	54710.
2-Methylpropene (Isobutene).	"	0	4082.	4121.	6522.	9414.	12750.	16450.	20490.	24800.	29370.	34170.	39150.	44300.	49590.	55000.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u. With regard to estimated uncertainties for the above compounds, see footnote c on Table 8r (Part 1).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 8u (Part 2) - MONOOLEFINS, C_5

HEAT CONTENT, $(H^o - H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o - H^o_0)$, in cal/mole[c]														
1-Pentene.	C_5H_{10}	0	5358.	5406.	8500.	12230.	16520.	21280.	26440.	31930.	37740.	43820.	50140.	56670.	63360.	70220.
cis-2-Pentene.	"	0	4845.	4887.	7696.	11190.	15280.	19890.	24910.	30310.	36050.	42040.	48290.	54760.	61400.	68220.
trans-2- "	"	0	5149.	5196.	8216.	11880.	16110.	20800.	25910.	31370.	37160.	43210.	49490.	55980.	62650.	69500.
2-Methyl-1-butene. . . .	"	0	5000.	5046.	8080.	11770.	16010.	20740.	25870.	31350.	37150.	43230.	49520.	56040.	62750.	69590.
3- " -1- "	"	0	5137.	5187.	8380.	12210.	16570.	21370.	26560.	32090.	37940.	44040.	50390.	56930.	63620.	70460.
2- " -2- "	"	0	4884.	4929.	7820.	11350.	15460.	20060.	25100.	30480.	36200.	42200.	48440.	54900.	61540.	68360.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

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TABLE 8u (Part 3) - MONOOLEFINS, C_6

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
1-Hexene	C_6H_{12}	0	6381.	6438.	10180.	14680.	19900.	25600.	31800.	38500.	45500.	52800.	60500.	68300.	76400.	84700.
cis-2-Hexene	"	0	5978.	6033.	9510.	13800.	18800.	24400.	30500.	37000.	44000.					
trans-2- "	"	0	6282.	6339.	10030.	14480.	19600.	25300.	31500.	38100.	45100.					
cis-3- "	"	0	5752.	5808.	9220.	13490.	18500.	24100.	30200.	36700.	43700.					
trans-3- "	"	0	6115.	6171.	9860.	14360.	19500.	25200.	31500.	38100.	45100.					
2-Methyl-1-pentene	"	0	6133.	6189.	9890.	14360.	19500.	25200.	31500.	38100.	45100.					
3- " -1- "	"	0	6002.	6063.	9910.	14530.	19800.	25600.	31900.	38600.	45700.					
4- " -1- "	"	0	5853.	5910.	9620.	14160.	19400.	25200.	31500.	38100.	45200.					
2- " -2- "	"	0	5680.	5733.	9210.	13500	18500.	24100.	30200.	36700.	43700.					
cis-3-Methyl-2-pentene . . .	"	0	5680.	5733.	9210.	13500.	18500.	24100.	30200.	36700.	43700.					
trans-3- " -2- " . . .	"	0	5680.	5733.	9210.	13500.	18500.	24100.	30200.	36700.	43700.					
cis-4- " -2- " . . .	"	0	5817.	5874.	9510.	13950.	19050.	24700.	30900.	37500.	44500.					
trans-4- " -2- " . . .	"	0	6062.	6120.	9910.	14460.	19700.	25400.	31600.	38300.	45300.					
2-Ethyl-1-butene	"	0	5907.	5961.	9610.	14070.	19200.	24900.	31100.	37800.	44800.					
2,3-Dimethyl-1-butene . . .	"	0	5972.	6030.	9890.	14520.	19800.	25600.	31900.	38500.	45600.					
3,3- " -1- " . . .	"	0	5579.	5625.	9300.	13790.	19000.	24900.	31300.	38000.	45100.					
2,3- " -2- " . . .	"	0	5698.	5748.	9210.	13450.	18400.	23900.	30000.	36500.	43400.					

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 12u - ACETYLENES, C_2 to C_5

HEAT CONTENT, $(H^\circ - H^\circ_0)$, FOR THE IDEAL GAS STATE, AT 0° TO $1500^\circ K$

April 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^\circ - H^\circ_0)$, in cal/mole[c]														
Ethyne (Acetylene).	C_2H_2	0	2391.5	2410.8	3541.2	4791.0	6127.	7533.	8999.	10520.	12090.	13706.	15362.	17055.	18782.	20541.
Propyne (Methylacetylene) .	C_3H_4	0	3104.	3131.	4728.	6584.	8663.	10935.	13372.	15956.	18670.	21490.	24420.	27430.	30520.	33670.
1-Butyne (Ethylacetylene) .	C_4H_6	0	3820.	3850.	6031.	8610.	11540.	14760.	18240.	21940.	25830.	29890.	34110.	38450.	42910.	47460.
2- " (Dimethylacetylene)	"	0	3961.	3995.	6060.	8513.	11320.	14440.	17830.	21450.	25290.	29300.	33480.	37780.	42210.	46740.
1-Pentyne	C_5H_8	0	4952.	4992.	7840.	11210.	15000.	19300.	23800.	28700.	33700.	39100.	44600.	50300.	56100.	62100.
2- "	"	0	4675.	4716.	7360.	10540.	14200.	18300.	22700.	27400.	32500.	37700.	43200.	48800.	54600.	60500.
3-Methyl-1-butyne	"	0	4583.	4620.	7440.	10820.	14700.	18900.	23500.	28400.	33500.	38800.	44400.	50100.	55900.	61900.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20u - NORMAL PARAFFINS, C_1 TO C_{20}
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$ in cal/mole[c]														
Methane	CH_4	0	2397.	2413.	3323.	4365.	5549.	6871.	8321.	9887.	11560.	13320.	15170.	17100.	19090.	21130.
Ethane	C_2H_6	0	2856.	2879.	4296.	6010.	8016.	10280.	12760.	15440.	18280.	21290.	24420.	27680.	31040.	34500.
Propane	C_3H_8	0	3512.	3546.	5556.	8040.	10930.	14190.	17760.	21600.	25670.	29950.	34420.	39030.	43780.	48650.
n-Butane	C_4H_{10}	0	4645.	4689.	7368.	10635.	14440.	18700.	23340.	28310.	33580.	39120.	44880.	50860.	56990.	63270.
n-Pentane	C_5H_{12}	0	5668.	5721.	9048.	13090.	17780.	23030.	28740.	34860.	41340.	48140.	55210.	62530.	70060.	77760.
n-Hexane	C_6H_{14}	0	6691.	6756.	10732.	15550.	21140.	27380.	34170.	41420.	49110.	57170.	65560.	74230.	83150.	92250.
n-Heptane	C_7H_{16}	0	7713.	7788.	12416.	18005.	24490.	31730.	39580.	47990.	56890.	66210.	75900.	85920.	96220.	106740.
n-Octane	C_8H_{18}	0	8736.	8823.	14100.	20465.	27840.	36080.	45010.	54550.	64660.	75240.	86240.	97620.	109300.	121200.
n-Nonane	C_9H_{20}	0	9759.	9857.	15784.	22924.	31190.	40430.	50430.	61110.	72430.	84250.	96580.	109300.	122400.	135700.
n-Decane	$C_{10}H_{22}$	0	10781.	10891.	17468.	25382.	34540.	44780.	55850.	67680.	80210.	93300.	106900.	121000.	135500.	150200.
n-Undecane	$C_{11}H_{24}$	0	11804.	11925.	19152.	27840.	37900.	49130.	61280.	74240.	87980.	102300.	117300.	132700.	148600.	164700.
n-Dodecane	$C_{12}H_{26}$	0	12827.	12959.	20836.	30299.	41250.	53480.	66700.	80800.	95750.	111400.	127600.	144400.	161600.	179200.
n-Tridecane	$C_{13}H_{28}$	0	13850.	13994.	22520.	32758.	44600.	57830.	72120.	87370.	103520.	120400.	138000.	156100.	174700.	193600.
n-Tetradecane	$C_{14}H_{30}$	0	14872.	15028.	24204.	35216.	47950.	62180.	77540.	93930.	111300.	129400.	148300.	167800.	187800.	208100.
n-Pentadecane	$C_{15}H_{32}$	0	15895.	16062.	25888	37674.	51300.	66520.	82960.	100500.	119070.	138500.	158600.	179500.	200900.	222600.
n-Hexadecane	$C_{16}H_{34}$	0	16918.	17096.	27572.	40133.	54660.	70870.	88380.	107060.	126840.	147500.	169000.	191200.	214000.	237100.
n-Heptadecane	$C_{17}H_{36}$	0	17940.	18130.	29256.	42592.	58010.	75220.	93800.	113620.	134620.	156500.	179300.	202900.	227100.	251600.
n-Octadecane	$C_{18}H_{38}$	0	18963.	19164.	30940.	45050.	61360.	79570.	99230.	120190.	142390.	165600.	189700.	214600.	240200.	266100.
n-Nonadecane	$C_{19}H_{40}$	0	19986.	20198.	32624.	47508.	64710.	83920.	104650.	126750.	150160.	174600.	200000.	226300.	253200.	280600.
n-Eicosane	$C_{20}H_{42}$	0	21008.	21232.	34308.	49967.	68070.	88270.	110070.	133310.	157940.	183600.	210400.	238000.	266300.	295100.
Increment per CH_2 group		0	1022.7	1034.1	1684.0	2458.5	3352.	4349.	5422.	6564.	7773.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u. [b] See footnote b of Table 1u. [c] See footnote c of Table 1u.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21u - NORMAL ALKYL BENZENES, C_6 to C_{22}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Benzene	C_6H_6	0	3401.	3437.	5762.	8750.	12285.	16267.	20612.	25260.	30163,	35280.	40590.	46040.	51640.	57350.
Methylbenzene (Toluene)	C_7H_8	0	4306.	4352.	7269.	10969.	15334.	20247.	25621.	31373.	37449.	43800.	50390.	57180.	64130.	71250.
Ethylbenzene	C_8H_{10}	0	5335.	5391.	8976.	13496.	18799.	24746.	31222.	38144.	45448.	53080.	60980.	69130.	77480.	86020.
n-Propylbenzene	C_9H_{12}	0	6467.	6534.	10790.	16090.	22300.	29250.	36810.	44860.	53360.	62200.	71400.	81000.	90700.	100600.
n-Butylbenzene	$C_{10}H_{14}$	0	7490.	7566.	12470.	18540.	25650.	33590.	42210.	51400.	61120.	71300.	81800.	92600.	103800.	115100.
n-Amylbenzene	$C_{11}H_{16}$	0	8512.	8600.	14150.	21000.	29000.	37940.	47630.	57960.	68900.	80300.	92100.	104300.	116800.	129600.
n-Hexylbenzene	$C_{12}H_{18}$	0	9535.	9634.	15840.	23460.	32350.	42280.	53050.	64530.	76670.	89300.	102500.	116000.	129900.	144100.
n-Heptylbenzene	$C_{13}H_{20}$	0	10558.	10668.	17520.	25920.	35710.	46630.	58470.	71090.	84440.	98400.	112800.	127700.	143000.	158600.
n-Octylbenzene	$C_{14}H_{22}$	0	11581.	11702.	19200.	28380.	39060.	50980.	63890.	77650.	92210.	107400.	123200.	139400.	156100.	173100.
n-Nonylbenzene	$C_{15}H_{24}$	0	12603.	12736.	20890.	30840.	42410.	55330.	69320.	84220.	99980.	116400.	133500.	151100.	169200.	187600.
n-Decylbenzene	$C_{16}H_{26}$	0	13626.	13771.	22570.	33300.	45760.	59680.	74740.	90780.	107760.	125500.	143800.	162800.	182300.	202100.
n-Undecylbenzene	$C_{17}H_{28}$	0	14649.	14805.	24260.	35750.	49120.	64030.	80160.	97340.	115530.	134500.	154200.	174500.	195400.	216600.
n-Dodecylbenzene	$C_{18}H_{30}$	0	15671.	15839.	25940.	38210.	52470.	68380.	85580.	103910.	123300.	143500.	164500.	186200.	208500.	231100.
n-Tridecylbenzene	$C_{19}H_{32}$	0	16694.	16873.	27620.	40670.	55820.	72730.	91000.	110470.	131080.	152600.	174900.	197900.	221600.	245600.
n-Tetradecylbenzene	$C_{20}H_{34}$	0	17717.	17907.	29310.	43130.	59170.	77080.	96420.	117040.	138850.	161600.	185200.	209600.	234700.	260000.
n-Pentadecylbenzene	$C_{21}H_{36}$	0	18740.	18941.	30990.	45590.	62520.	81430.	101850.	123600.	146620.	170600.	195600.	221300.	247700.	274500.
n-Hexadecylbenzene	$C_{22}H_{38}$	0	19762.	19975.	32680.	48050.	65880.	85780.	107270.	130160.	154400.	179700.	205900.	233000.	260800.	289000.
Increment per CH_2 group		0	1022.7	1034.1	1684.	2458.	3352.	4349.	5422.	6564.	7773.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

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National Bureau of Standards — Washington, D. C.

TABLE 22u - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Cyclopentane	C_5H_{10}	0	3599.	3636.	6048.	9260.	13188.	17703.	22720.	28161.	33970.	40110.	46500.	53130.	59960.	66980.
Methylcyclopentane	C_6H_{12}	0	4774.	4827.	7952.	12015.	16902.	22463.	28600.	35235.	42280.	49700.	57440.	65440.	73670.	82110.
Ethylcyclopentane	C_7H_{14}	0	5638.	5703.	9430.	14330.	201 .	26700.	33900.	41700.	50000.	58700.	67800.	77100.	86700.	96600.
n-Propylcyclopentane	C_8H_{16}	0	6661.	6737.	11160.	16790.	23500.	31100.	39400.	48300.	57800.	67700.	78100.	88800.	99800.	111100.
n-Butylcyclopentane	C_9H_{18}	0	7683.	7771.	12850.	19250.	26800.	35400.	44800.	54900.	65500.	76800.	88400.	100500.	112900.	125600.
n-Pentylcyclopentane	$C_{10}H_{20}$	0	8706.	8805.	14530.	21710.	30200.	39800.	50200.	61400.	73300.	85800.	98800.	112200.	126000.	140100.
n-Hexylcyclopentane	$C_{11}H_{22}$	0	9729.	9839.	16220.	24160.	33500.	44100.	55600.	68000.	81100.	94800.	109100.	123900.	139100.	154600.
n-Heptylcyclopentane	$C_{12}H_{24}$	0	10752.	10874.	17900.	26620.	36900.	48500.	61100.	74600.	88900.	103800.	119500.	135600.	152200.	169000.
n-Octylcyclopentane	$C_{13}H_{26}$	0	11774.	11908.	19580.	29080.	40200.	52800.	66500.	81100.	96600.	112900.	129800.	147300.	165300.	183500.
n-Nonylcyclopentane	$C_{14}H_{28}$	0	12797.	12942.	21270.	31540.	43600.	57200.	71900.	87700.	104400.	121900.	140100.	159000.	178400.	198000.
n-Decylcyclopentane	$C_{15}H_{30}$	0	13820.	13976.	22950.	34000.	46900.	61500.	77300.	94300.	112200.	130900.	150500.	170700.	191500.	212500.
n-Undecylcyclopentane	$C_{16}H_{32}$	0	14842.	15010.	24640.	36460.	50300.	65900.	82700.	100800.	120000.	140000.	160800.	182400.	204600.	227000.
n-Dodecylcyclopentane	$C_{17}H_{34}$	0	15865.	16044.	26320.	38920.	53600.	70200.	88200.	107400.	127700.	149000.	171200.	194100.	217600.	241500.
n-Tridecylcyclopentane	$C_{18}H_{36}$	0	16888.	17078.	28000.	41370.	57000.	74600.	93600.	113900.	135500.	158000.	181500.	205800.	230700.	256000.
n-Tetradecylcyclopentane	$C_{19}H_{38}$	0	17910.	18112.	29690.	43830.	60400.	78900.	99000.	120500.	143300.	167000.	191800.	217500.	243800.	270500.
n-Pentadecylcyclopentane	$C_{20}H_{40}$	0	18933.	19146.	31370.	46290.	63700.	83200.	104400.	127100.	151000.	176100.	202200.	229200.	256900.	285000.
n-Hexadecylcyclopentane	$C_{21}H_{42}$	0	19956.	20180.	33060.	48750.	67100.	87600.	109900.	133600.	158800.	185100.	212500.	240900.	270000.	299500.
Increment per CH_2 group		0	1022.7	1034.1	1684.	2458.	3350.	4350.	5420.	6560.	7770.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 23u - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Cyclohexane	C_6H_{12}	0	4237.	4284.	7352.	11435.	16404.	22148.	28536.	35460.	42850.	50600	58680.	67080.	75600.	84450.
Methylcyclohexane	C_7H_{14}	0	5233.	5298.	9136.	14130.	20118.	26971.	34528.	42678.	51330.	60390.	69840.	79560.	89600.	99750.
Ethylcyclohexane	C_8H_{16}	0	6097.	6174.	10680.	16450.	23300.	31200.	39900.	49200.	59100.	69400.	80200.	91300.	102600.	114300.
n-Propylcyclohexane	C_9H_{18}	0	7054.	7143.	12240.	18850.	26600.	35400.	45100.	55600.	66700.	78400.	90500.	103000.	115700.	128800.
n-Butylcyclohexane	$C_{10}H_{20}$	0	8077.	8177.	13920.	21310.	29900.	39800.	50500.	62200.	74500.	87500.	100800.	114700.	128800.	143300.
n-Pentylcyclohexane	$C_{11}H_{22}$	0	9100.	9211.	15610.	23770.	33300.	44100.	56000.	68700.	82200.	96500.	111200.	126400.	141900.	157800.
n-Hexylcyclohexane	$C_{12}H_{24}$	0	10123.	10245.	17290.	26230.	36600.	48500.	61400.	75300.	90000.	105500.	121500.	138100.	155000.	172300.
n-Heptylcyclohexane	$C_{13}H_{26}$	0	11145.	11279.	18980.	28680.	40000.	52800.	66800.	81900.	97800.	114600.	131900.	149800.	168100.	186800.
n-Octylcyclohexane	$C_{14}H_{28}$	0	12168.	12313.	20660.	31140.	43300.	57200.	72200.	88400.	105600.	123600.	142200.	161500.	181200.	201200.
n-Nonylcyclohexane	$C_{15}H_{30}$	0	13191.	13348.	22340.	33600.	46700.	61500.	77700.	95000.	113300.	132600.	152500.	173200.	194200.	215700.
n-Decylcyclohexane	$C_{16}H_{32}$	0	14213.	14382.	24030.	36060.	50000.	65900.	83100.	101600.	121100.	141600.	162900.	184900.	207300.	230200.
n-Undecylcyclohexane	$C_{17}H_{34}$	0	15236.	15416.	25710.	38520.	53400.	70200.	88500.	108100.	128900.	150700.	173200.	196600.	220400.	244700.
n-Dodecylcyclohexane	$C_{18}H_{36}$	0	16259.	16450.	27400.	40980.	56700.	74600.	93900.	114700.	136700.	159700.	183600.	208300.	233500.	259200.
n-Tridecylcyclohexane	$C_{19}H_{38}$	0	17282.	17484.	29080.	43440.	60100.	78900.	99300.	121300.	144400.	168700.	193900.	220000.	246600.	273700.
n-Tetradecylcyclohexane	$C_{20}H_{40}$	0	18304.	18518.	30760.	45890.	63500.	83300.	104800.	127800.	152200.	177800.	204200.	231700.	259700.	288200.
n-Pentadecylcyclohexane	$C_{21}H_{42}$	0	19327.	19552.	32450.	48350.	66800.	87600.	110200.	134400.	160000.	186800.	214600.	243400.	272800.	302700.
n-Hexadecylcyclohexane	$C_{22}H_{44}$	0	20350.	20586.	34130.	50810.	70200.	92000.	115600.	141000.	167700.	195800.	224900.	255100.	285900.	317200.
Increment per CH_2 group		0	1022.7	1034.1	1684.	2458.	3350.	4350.	5420.	6560.	7770.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

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TABLE 24u - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Ethene (Ethylene)	C_2H_4	0	2525.	2544.	3711.	5117.	6732.	8527.	10480.	12560.	14760.	17070.	19470.	21950.	24490.	27100.
Propene (Propylene)	C_3H_6	0	3237.	3265.	4990.	7076.	9492.	12200.	15150.	18320.	21690.	25210.	28880.	32670.	36570.	40570.
1-Butene.	C_4H_8	0	4224.	4263.	6687.	9629.	13010.	16770.	20860.	25220.	29830.	34660.	39670.	44840.	50150.	55590.
1-Pentene	C_5H_{10}	0	5358.	5406.	8500.	12230.	16520.	21280.	26440.	31930.	37740.	43820.	50140.	56670.	63360.	70220.
1-Hexene.	C_6H_{12}	0	6381.	6438.	10180.	14680.	19900.	25600.	31800.	38500.	45500.	52800.	60500.	68300.	76400.	84700.
1-Heptene	C_7H_{14}	0	7403.	7473.	11860.	17140.	23220.	30000.	37300.	45000.	53300.	61900.	70800.	80000.	89500.	99200.
1-Octene.	C_8H_{16}	0	8426.	8507.	13550.	19600.	26570.	34300.	42700.	51600.	61000.	70900.	81200.	91700.	102600.	113700.
1-Nonene.	C_9H_{18}	0	9449.	9541.	15230.	22060.	29920.	38700.	48100.	58200.	68800.	79900.	91500.	103400.	115700.	128200.
1-Decene.	$C_{10}H_{20}$	0	10471.	10575.	16920.	24520.	33280.	43000.	53500.	64700.	76600.	89000.	101800.	115100.	128800.	142700.
1-Undecene.	$C_{11}H_{22}$	0	11494.	11609.	18600.	26970.	36630.	47400.	59000.	71300.	84400.	98000.	112200.	126800.	141900.	157200.
1-Dodecene.	$C_{12}H_{24}$	0	12517.	12644.	20280.	29430.	39980.	51700.	64400.	77900.	92100.	107000.	122500.	138500.	155000.	171600.
1-Tridecene	$C_{13}H_{26}$	0	13539.	13678.	21970.	31890.	43330.	56100.	69800.	84400.	99900.	116200.	132900.	150200.	168000.	186100.
1-Tetradecene	$C_{14}H_{28}$	0	14562.	14712.	23650.	34350.	46690.	60400.	75200.	91000.	107700.	125100.	143200.	161900.	181100.	200600.
1-Pentadecene	$C_{15}H_{30}$	0	15585.	15746.	25340.	36810.	50040.	64800.	80600.	97500.	115500.	134100.	153600.	173600.	194200.	215100.
1-Hexadecene.	$C_{16}H_{32}$	0	16608.	16780.	27020.	39270.	53390.	69100.	86100.	104100.	123200.	143200.	163900.	185300.	207300.	229600.
1-Heptadecene	$C_{17}H_{34}$	0	17630.	17814.	28700.	41730.	56740.	73500.	91500.	110700.	131000.	152200.	174300.	197000.	220400.	244100.
1-Octadecene.	$C_{18}H_{36}$	0	18653.	18848.	30390.	44180.	60090.	77800.	96900.	117200.	138800.	161200.	184600.	208700.	233500.	258600.
1-Nonadecene.	$C_{19}H_{38}$	0	19676.	19882.	32070.	46640.	63450.	82200.	102300.	123800.	146500.	170300.	194900.	220400.	246500.	273100.
1-Eicosene.	$C_{20}H_{40}$	0	20698.	20916.	33760.	49100.	66800.	86500.	107700.	130400.	154300.	179300.	205300.	232100.	259600.	287600.
Increment per CH_2 group . .		0	1022.7	1034.1	1684.	2459.	3352.	4350.	5420.	6560.	7770.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u. [b] See footnote b of Table 1u. [c] See footnote c of Table 1u.

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National Bureau of Standards — Washington, D. C.

TABLE 25u - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Content[b], $(H^o-H^o_0)$, in cal/mole[c]														
Ethyne (Acetylene)	C_2H_2	0	2391.5	2410.8	3541.2	4791.0	6127.	7533.	8999.	10520.	12090.	13706.	15362.	17055.	18782.	20541.
Propyne (Methylacetylene).	C_3H_4	0	3104.	3131.	4728.	6584.	8663.	10935.	13372.	15956.	18670.	21490.	24420.	27430.	30520.	33670.
1-Butyne (Ethylacetylene).	C_4H_6	0	3820.	3850.	6031.	8610.	11540.	14760.	18240.	21940.	25830.	29890.	34110.	38450.	42910.	47460.
1-Pentyne.	C_5H_8	0	4952.	4992.	7840.	11210.	15000.	19300.	23800.	28700.	33700.	39100.	44600.	50300.	56100.	62100.
1-Hexyne	C_6H_{10}	0	5975.	6024.	9520.	13660.	18400.	23600.	29200.	35200.	41500.	48100.	54900.	62000.	69200.	76600.
1-Heptyne.	C_7H_{12}	0	6998.	7059.	11210.	16120.	21700.	28000.	34600.	41800.	49300.	57100.	65200.	73600.	82300.	91100.
1-Octyne	C_8H_{14}	0	8021.	8093.	12890.	18580.	25100.	32300.	40100.	48300.	57000.	66100.	75600.	85300.	95400.	105600.
1-Nonyne	C_9H_{16}	0	9043.	9127.	14580.	21040.	28400.	36600.	45500.	54900.	64800.	75200.	85900.	97000.	108500.	120000.
1-Decyne	$C_{10}H_{18}$	0	10066.	10161.	16260.	23500.	31800.	41000.	50900.	61500.	72600.	84200.	96300.	108700.	121500.	134500.
1-Undecyne	$C_{11}H_{20}$	0	11089.	11195.	17940.	25950.	35100.	45300.	56300.	68000.	80400.	93200.	106600.	120400.	134600.	149000.
1-Dodecyne	$C_{12}H_{22}$	0	12112.	12230.	19630.	28410.	38500.	49700.	61800.	74600.	88100.	102300.	117000.	132100.	147700.	163500.
1-Tridecyne.	$C_{13}H_{24}$	0	13134.	13264.	21310.	30870.	41900.	54000.	67200.	81200.	95900.	111300.	127300.	143800.	160800.	178000.
1-Tetradecyne.	$C_{14}H_{26}$	0	14157.	14298.	23000.	33330.	45200.	58400.	72600.	87700.	103700.	120300.	137700.	155500.	173900.	192500.
1-Pentadecyne.	$C_{15}H_{28}$	0	15180.	15332.	24680.	35790.	48600.	62700.	78000.	94300.	111500.	129400.	148000.	167200.	187000.	207000.
1-Hexadecyne	$C_{16}H_{30}$	0	16202.	16366.	26360.	38250.	51900.	67100.	83400.	100800.	119200.	138400.	158300.	178900.	200100.	221500.
1-Heptadecyne.	$C_{17}H_{32}$	0	17225.	17400.	28050.	40700.	55300.	71400.	88900.	107400.	127000.	147400.	168700.	190600.	213200.	236000.
1-Octadecyne	$C_{18}H_{34}$	0	18248.	18434.	29730.	43160.	58600.	75800.	94300.	114000.	134800.	156500.	179000.	202300.	226200.	250400.
1-Nonadecyne	$C_{19}H_{36}$	0	19270.	19468.	31420.	45620.	62000.	80100.	99700.	120500.	142500.	165500.	189400.	214000.	239300.	264900.
1-Eicosyne	$C_{20}H_{38}$	0	20293.	20502.	33100.	48080.	65300.	84500.	105100.	127100.	150300.	174600.	199700.	225700.	252400.	279400.
Increment per CH_2 group		0	1022.7	1034.1	1684.	2458.	3350.	4350.	5420.	6560.	7770.	9030.	10340.	11700.	13090.	14490.

[a] See footnote a of Table 1u.

[b] See footnote b of Table 1u.

[c] See footnote c of Table 1u.

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TABLE 0u-E - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CONTENT, $(H^o-H_0^o)$, AT -459.69° TO 2200°F

November 30, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °F													
			-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
			Haat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Oxygen	O_2	gas	0	99.51	106.50	112.63	114.38	116.35	121.38	143.47	165.93	188.78	212.04	235.69	259.77	284.22
Hydrogen	H_2	gas	0	1544.4	1652.6	1747.8	1775.0	1805.8	1884.6	2228.6	2574.0	2920.3	3266.7	3613.3	3961.1	4309.9
Hydroxyl	OH	gas	0	191.00	204.35	216.02	219.36	222.76	232.68	274.24	315.72	357.17	398.62	440.10	481.55	523.07
Water	H_2O	gaa	0	202.03	216.18	228.60	232.15	236.15	246.39	291.21	336.59	382.59	429.31	476.82	525.21	574.50
Nitrogen	N_2	gas	0	113.94	121.88	128.84	130.82	133.05	138.77	163.63	188.56	213.61	238.86	264.33	290.10	316.16
Nitric Oxide	NO	gaa	0	113.29	120.85	127.48	129.37	131.53	136.95	160.70	184.59	208.67	232.99	257.59	282.54	307.83
Carbon	C	solid, graphite	0	25.67	30.35	34.81	36.14	37.68	41.72	61.60	84.94	111.43	140.79	172.69	206.79	242.82
Carbon Monoxida	CO	gas	0	113.98	121.93	128.88	130.87	133.11	138.82	163.71	188.72	213.91	239.35	265.07	291.13	317.54
Carbon Dioxida	CO_2	gas	0	76.34	82.53	88.07	89.67	91.48	96.16	117.27	139.56	162.91	187.20	212.34	238.24	264.82

Compound	Formula	Stata	Tamperature in °F													
			900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
			Heat Content, $(H^o-H^o_0)$ in BTU/lb													
Oxygen	O_2	gas	308.97	334.05	359.47	385.12	410.96	436.99	463.20	489.60	516.17	542.89	569.73	596.69	623.77	650.98
hydrogan	H_2	gas	4659.4	5010.0	5361.9	5715.5	6071.3	6429.4	6789.8	7152.8	7518.5	7887.0	8258.3	8632.2	9008.9	9388.4
Hydroxyl	OH	gas	564.79	606.73	648.91	691.40	734.21	777.32	820.75	864.54	908.71	953.30	998.28	1043.6	1089.3	1135.3
Water	H_2O	gas	624.67	675.73	727.70	780.67	834.66	889.45	945.09	1001.8	1059.5	1118.1	1177.4	1237.6	1298.5	1360.3
Nitrogen	N_2	gaa	342.54	369.25	396.27	423.60	451.23	479.15	507.35	535.80	564.47	593.35	622.43	651.67	681.07	710.61
Nitric Oxide	NO	gas	333.44	359.39	385.67	412.24	439.06	466.12	493.39	520.91	548.62	576.47	604.49	632.67	661.00	689.48
Carbon	C	solid, graphite	280.48	319.60	359.99	401.30	443.34	486.16	529.7	573.7	618.4	663.9	710.1	756.7	803.9	851.5
Carbon Monoxida	CO	gas	344.30	371.41	398.85	426.59	454.63	482.95	511.54	540.36	569.41	598.66	628.10	657.72	687.49	717.39
Carbon Dioxida	CO_2	gas	292.03	319.80	348.07	376.80	405.94	435.5	465.4	495.6	526.1	556.9	587.9	619.1	650.6	682.2

[a] Interpolation to other temperatures in the interval 0° to 2200°F may be mada by appropriata graphical or analytical methode. For tamperaturea between -100° and 0°F, values may ba estimated by extrapolating to lower temperaturas the valuas for 0°, 100°, 200° and 300°F.

[b] $(H^o-H^o_0)$ is tha heat content at tha givan temperature less tha haat contant at tha absoluta zero, 0°K or -459.69°F, of tha given substance in its appropriate standard state. The appropriata standard atata ie: (a) for a gaa, tha thermodynamic standard gaseoua state of unit fugacity, (1 atmosphara); and (b) for a solid, the solid (crystallina) form indicated at a prassure of one atmosphera.

[c] The valuas in this tabla are given to more significant figures than ara warranted by the absoluta accuracy of tha individual valuea in ordar to ratain the internal consistancy of the several thermodynamic functione of a single substanca, and also to retain the significanca of tha increments with tamperatura of a given tharmodynamic function.

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TABLE 1u-E - PARAFFINS, C_1 to C_5

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

November 30, 1944

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Methane	CH_4	0	229.5	245.6	259.9	264.1	268.8	281.1	336.8	397.1	461.9	531.7	606.5	686.0	770.2
Ethane	C_2H_6	0	140.22	152.55	163.80	167.10	170.86	180.64	226.6	278.1	335.1	397.5	465.2	537.8	614.8
Propane	C_3H_8	0	115.04	126.30	136.74	139.83	143.27	152.60	196.89	247.4	303.8	365.3	431.8	503.1	578.6
n-Butane	C_4H_{10}	0	114.41	126.16	136.98	140.16	143.76	153.26	198.15	248.8	305.0	366.5	432.9	503.7	578.5
2-Methylpropane (Isobutane)	"	0	104.29	115.41	125.75	128.81	132.34	141.51	185.72	236.4	292.9	354.7	421.4	492.4	567.4
n-Pentane	C_5H_{12}	0	111.82	123.63	134.47	137.66	141.32	150.79	195.73	246.3	302.3	363.5	429.4	499.7	574.0
2-Methylbutane (Isopentane)	"	0	99.97	111.16	121.57	124.65	128.16	137.42	181.80	232.6	289.1	350.8	417.3	488.1	563.0
2,2-Dimethylpropane (Neopentane)	"	0	96.66	108.07	118.67	121.80	125.41	134.78	179.82	231.3	288.7	351.5	419.3	491.4	567.5

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Methane	CH_4	858.8	951.6	1048.4	1149.1	1253.3	1361.	1471.	1584.	1701.	1820.	1942.	2065.	2191.	2318.
Ethane	C_2H_6	695.6	780.4	868.8	960.3	1054.7	1152.	1253.	1356.	1461.	1568.	1678.	1789.	1902.	2017.
Propane	C_3H_8	658.1	741.2	827.6	917.0	1009.3	1104.	1202.	1302.	1404.	1508.	1613.	1721.	1829.	1940.
n-Butane	C_4H_{10}	657.0	738.7	823.6	911.4	1002.0	1095.	1191.	1289.	1389.	1491.	1595.	1700.	1806.	1914.
2-Methylpropane (Isobutane)	"	646.3	728.7	814.2	902.6	993.5	1087.	1183.	1282.	1383.	1485.	1588.	1693.	1800.	1908.
n-Pentane	C_5H_{12}	651.7	732.8	817.0	904.1	993.8	1086.	1181.	1278.	1376.	1477.	1579.	1683.	1789.	1895.
2-Methylbutane (Isopentane)	"	641.4	723.2	808.1	895.8	985.9	1079.	1174.	1272.	1371.	1472.	1574.	1678.	1784.	1890.
2,2-Dimethylpropane (Neopentane)	"	647.4	730.7	816.8	905.8	997.4	1091.	1187.	1286.	1386.	1488.	1592.	1698.	1804.	1912.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

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TABLE 2u-E (Part 1) - PARAFFINS, C_6

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944; November 30, 1946.

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
n-Hexane	C_6H_{14}	0	110.05	121.93	132.83	136.03	139.67	149.21	194.19	244.7	300.6	361.6	427.4	497.4	571.3
2-Methylpentane	"	0	99.93	110.74	120.88	123.90	127.28	136.45	180.54	231.3	287.9	349.0	414.5	484.9	559.4
3- "	"	0	99.53	111.00	121.63	124.77	128.35	137.77	182.76	234.0	290.8	352.8	419.3	489.6	563.8
2,2-Dimethylbutane	"	0	94.16	106.08	116.99	120.19	123.92	133.34	178.15	228.6	284.7	346.8	414.2	484.9	559.4
2,3- "	"	0	98.10	109.51	120.07	123.19	126.73	136.06	180.57	231.3	287.8	349.8	416.8	487.0	560.9

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$ in BTU/lb													
n-Hexane	C_6H_{14}	648.8	729.4	812.9	899.3	988.5	1080.1	1174.1	1270.2	1368.2	1468.1	1569.7	1672.9	1777.4	1882.9
2-Methylpentane	"	636.8	717.7	802.3	889.9	979.8									
3- "	"	642.5	724.3	808.5	895.2	984.2									
2,2-Dimethylbutane	"	638.7	720.9	804.7	891.7	982.7									
2,3- "	"	639.2	721.1	806.1	893.5	982.5									

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

TABLE 2u-E (Part 2) - PARAFFINS, C_7

HEAT CONTENT, $(H^\circ - H^\circ_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^\circ - H^\circ_0)$, in BTU/lb[c,d]													
n-Heptane	C_7H_{16}	0	108.62	120.60	131.57	134.79	138.47	148.03	193.08	243.6	299.3	360.2	425.8	495.7	569.4
2-Methylhexane	"	0	98.36	110.13	120.98	124.17	127.88	137.32	182.47	233.5	290.1	351.9	418.6	489.6	564.4
3- "	"	0	95.58	107.25	117.99	121.15	124.82	134.17	178.84	229.3	285.4	346.8	413.2	484.0	558.6
3-Ethylpentane	"	0	91.90	103.30	113.83	116.93	120.55	129.72	173.77	223.7	279.3	340.2	406.0	476.3	550.6
2,2-Dimethylpentane	"	0	90.80	102.24	112.83	115.96	119.64	128.90	173.69	224.8	281.6	343.9	411.1	482.9	558.8
2,3- "	"	0	90.08	101.53	112.11	115.23	118.88	128.11	172.56	223.1	279.3	341.1	407.8	478.9	553.8
2,4- "	"	0	90.18	101.65	112.27	115.41	119.10	128.38	173.27	224.4	281.4	343.8	411.1	482.9	558.8
3,3- "	"	0	91.08	102.71	113.45	116.61	120.34	129.68	174.70	225.9	282.8	345.4	413.0	485.0	561.0
2,2,3-Trimethylbutane	"	0	88.65	100.21	110.91	114.08	117.82	127.16	172.45	224.1	281.7	344.7	412.9	485.6	562.2

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^\circ - H^\circ_0)$, in BTU/lb													
n-Heptane	C_7H_{16}	646.4	726.6	809.9	896.1	984.8	1076.0	1169.4	1264.9	1362.3	1461.6	1562.5	1664.9	1768.7	1873.7
2-Methylhexane	"	642.5	723.4	806.7	892.6	981.3									
3- "	"	636.9	718.0	801.3	887.2	975.9									
3-Ethylpentane	"	628.3	709.1	792.4	878.0	965.8									
2,2-Dimethylpentane	"	638.0	720.0	804.3	891.2	980.9									
2,3- "	"	631.7	712.8	797.2	883.7	971.5									
2,4- "	"	638.0	720.1	804.4	891.0	979.7									
3,3- "	"	639.9	722.0	807.3	895.0	984.8									
2,2,3 - Trimethylbutane	"	641.5	723.8	809.1	896.8	986.6									

[a] See footnote a of Table 0u-E.

[b] See footnote of Table 0u-E.

[c] See footnote of Table 0u-E.

[d] The uncertainty in the temperature coefficient of the heat content (the heat capacity) for the branched-chain heptanes is of the same order of magnitude as the difference in this quantity between the normal and the branched-chain heptanes (cf. footnote of Table 2v-E (Part 2)).

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TABLE 3u-E (Part 1) - PARAFFINS, C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c,d]													
n-Octane	C_8H_{18}	0	107.72	119.71	130.70	133.92	137.58	147.16	192.23	242.7	298.4	359.2	424.6	494.4	568.0
2-Methylheptane	"	0	98.73	110.53	121.40	124.60	128.28	137.78	182.97	234.0	290.5	352.3	418.9	489.7	564.2
3- "	"	0	97.54	109.18	119.92	123.09	126.73	136.14	181.04	231.9	288.3	350.1	416.6	487.6	562.0
4- "	"	0	96.60	108.09	118.72	121.85	125.47	134.81	179.52	230.3	286.7	348.2	414.4	484.8	558.8
3-Ethylhexane	"	0	91.15	102.07	112.24	115.24	118.69	127.71	171.08	220.8	276.2	336.8	402.1	471.7	545.3
2,2-Dimethylhexane	"	0	93.01	104.52	115.19	118.34	121.99	131.35	176.32	227.5	284.3	346.2	413.0	484.1	559.3
2,3- "	"	0	95.40	106.56	117.03	120.13	123.73	133.06	178.40	230.6	289.0	352.5	420.6	492.8	568.4
2,4- "	"	0	89.44	101.03	111.71	114.85	118.52	127.82	172.42	223.0	279.1	340.7	407.3	478.4	553.2
2,5- "	"	0	91.45	102.82	113.37	116.49	120.11	129.40	174.17	225.2	282.2	344.4	411.4	482.6	557.4

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
n-Octane	C_8H_{18}	644.8	724.8	807.7	893.5	981.9	1072.8	1165.8	1260.8	1357.8	1456.7	1557.2	1659.2	1762.3	1866.5
2-Methylheptane	"	641.4	721.4	803.9	889.5	978.7									
3- "	"	638.6	718.4	801.8	888.2	977.5									
4- "	"	635.4	715.2	798.6	885.1	974.3									
3-Ethylhexane	"	622.4	702.6	785.1	870.4	958.8									
2,2-Dimethylhexane	"	638.3	720.3	804.6	891.5	980.7									
2,3- "	"	647.0	727.8	810.3	895.7	984.9									
2,4- "	"	630.4	710.6	794.0	880.2	968.6									
2,5- "	"	635.0	715.1	797.6	883.2	972.4									

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

[d] The uncertainty in the temperature coefficient of the heat content (the heat capacity) for the branched-chain octanes is of the same order of magnitude as the difference in this quantity between the normal and the branched-chain octanes (cf. footnote d of Table 3v-E).

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3u-E (Part 2) - PARAFFINS, C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c,d]													
3,3-Dimethylhexane	C_8H_{18}	0	89.31	100.88	111.56	114.71	118.38	127.69	172.43	223.2	279.8	341.8	408.8	480.4	556.0
3,4 "	"	0	93.61	105.46	116.40	119.63	123.40	132.96	178.90	231.0	288.8	351.8	419.6	491.4	566.7
2-Methyl-3-ethylpentane	"	0	92.33	103.86	114.55	117.71	121.37	130.77	175.98	227.4	284.6	346.9	413.9	485.0	559.6
3- " -3- "	"	0	88.57	100.50	111.48	114.72	118.52	128.04	173.71	225.2	282.2	344.3	411.1	482.2	557.3
2,2,3-Trimethylpentane	"	0	87.62	98.98	109.53	112.65	116.30	125.59	170.54	221.9	279.2	341.7	409.1	480.9	556.3
2,2,4- "	"	0	87.62	98.98	109.53	112.65	116.30	125.59	170.54	221.9	279.2	341.7	409.1	480.9	556.3
2,3,3- "	"	0	89.59	100.90	111.43	114.55	118.19	127.48	172.58	224.2	281.8	344.8	412.4	484.1	559.4
2,3,4- "	"	0	88.29	99.24	109.53	112.59	116.16	125.35	170.26	222.2	280.2	343.6	411.4	483.3	558.4
2,2,3,3-Tetramethylbutane	"	0	86.80	98.08	108.59	111.71	115.37	124.66	169.87	221.9	280.2	344.3	413.4	487.1	564.3

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
3,3-Dimethylhexane	C_8H_{18}	635.1	717.1	801.5	888.3	977.5									
3,4- "	"	644.4	724.6	807.0	892.8	982.8									
2-Methyl-3-ethylpentane	"	636.8	716.7	799.1	885.0	975.0									
3- " -3- "	"	635.5	717.2	802.3	890.5	981.5									
2,2,3-Trimethylpentane	"	634.4	715.5	799.7	887.0	977.1									
2,2,4- "	"	634.4	715.5	799.7	887.0	977.1									
2,3,3- "	"	637.6	718.4	801.6	888.6	980.4									
2,3,4- "	"	635.4	715.2	798.4	885.4	976.3									
2,2,3,3-Tetramethylbutane	"	644.2	726.7	811.8	899.8	990.8									

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

[d] The uncertainty in the temperature coefficient of the heat content (the heat capacity) for the branched-chain octanes is of the same order of magnitude as the difference in this quantity between the normal and the branched-chain octanes (cf. footnote d of Table 3v-E).

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5u-E (Part 1) - ALKYL BENZENES, C_6 to C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Benzene	C_6H_6	0	60.63	67.60	74.19	76.12	78.[illegible]	84.20	112.94	146.66	184.9	227.2	273.2	322.4	374.5
Methylbenzene (Toluene)	C_7H_8	0	64.85	72.46	79.60	81.69	84.07	90.38	121.01	156.61	196.8	241.1	289.2	340.6	395.1
Ethylbenzene	C_8H_{10}	0	69.[illegible]	77.89	85.60	87.84	90.39	97.15	129.86	167.71	210.3	257.1	307.8	361.9	419.1
1,2-Dimethylbenzene (o-Xylene)	"	0	72.82	81.46	89.48	91.82	94.48	101.48	134.95	173.11	215.6	262.2	312.5	366.1	422.8
1,3- " (m- ")	"	0	69.59	77.80	85.45	87.69	90.24	96.96	129.33	166.57	208.3	254.3	304.0	357.2	413.5
1,4- " (p- ")	"	0	70.20	78.40	86.03	88.25	90.78	97.45	129.57	166.52	208.0	253.6	303.0	355.8	411.9

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Benzene	C_6H_6	429.1	486.1	545.2	606.2	668.9	733.2	799.0	866.1	934.5	1004.	1074.	1146.	1218.	1291.
Methylbenzene (Toluene)	C_7H_8	452.4	512.2	574.1	638.2	704.1	771.7	840.9	911.6	983.6	1057.	1131.	1206.	1283.	1360.
Ethylbenzene	C_8H_{10}	479.1	541.5	606.2	673.1	741.9	812.4	884.5	958.1	1033.	1109.	1187.	1265.	1345.	1425.
1,2-Dimethylbenzene (o-Xylene)	"	482.2	544.2	608.5	675.0	743.4	813.6	885.4	958.7	1033.	1109.	1186.	1265.	1344.	1424.
1,3- " (m- ")	"	472.7	534.5	598.7	665.0	733.3	803.4	875.2	948.4	1023.	1099.	1176.	1254.	1333.	1413.
1,4- " (p- ")	"	470.8	532.3	596.2	662.3	730.4	800.3	871.8	944.9	1019.	1095.	1172.	1250.	1329.	1409.

[a] See footnote a of Table 5u-E.

[b] See footnote b of Table 5u-E.

See footnote c of Table 5u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 5u-E (Part 2) - ALKYL BENZENES, C_9

HEAT CONTENT, $(H^o - H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o - H^o_0)$, in BTU/lb[c]													
n-Propylbenzene	C_9H_{12}	0	74.73	83.51	91.68	94.06	96.79	103.9	138.3	177.7	221.8	270.3	322.7	378.6	437.6
Isopropylbenzene (Cumene)	"	0	69.71	78.25	86.25	88.58	91.26	98.2	132.3	171.7	215.9	264.6	317.2	373.2	432.3
1-Methyl-2-ethylbenzene	"	0	76.13	85.21	93.63	96.07	98.85	106.2	141.1	181.0	225.4	273.9	326.2	381.9	440.8
1- " -3- "	"	0	73.28	81.97	90.07	92.42	95.10	102.2	136.2	175.2	218.9	266.9	318.7	374.1	432.6
1- " -4- "	"	0	73.82	82.50	90.58	92.92	95.58	102.6	136.4	175.2	218.6	266.3	317.8	372.9	431.1
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	75.99	85.14	93.67	96.00	98.63	105.6	139.2	177.7	220.6	267.6	318.4	372.6	430.1
1,2,4- " (Pseudocumene)	"	0	76.09	85.32	93.92	96.26	98.91	106.0	139.7	178.4	221.4	268.6	319.5	373.8	431.4
1,3,5- " (Mesitylene)	"	0	72.70	81.56	89.84	92.11	94.68	101.55	134.56	172.62	215.3	262.2	312.9	367.2	424.7

Compound (gas)	Formula	Temperature[a] in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o - H^o_0)$, in BTU/lb													
n-Propylbenzene	C_9H_{12}	499.4	563.7	630.2	698.9	769.6	842.	916.	992.	1069.	1148.	1228.	1308.	1390.	1473.
Isopropylbenzene (Cumene)	"	494.2	558.8	625.6	694.5	765.5	838.	913.	989.	1066.	1145.	1224.	1305.	1387.	1469.
1-Methyl-2-ethylbenzene	"	502.3	566.4	632.9	701.5	772.2	845.	919.	994.	1071.	1150.	1229.	1310.	1391.	1474.
1- " -3- "	"	493.9	557.8	624.2	692.7	763.3	836.	910.	985.	1062.	1140.	1220.	1300.	1382.	1465.
1- " -4- "	"	492.2	555.9	622.0	690.3	760.6	833.	907.	982.	1059.	1137.	1216.	1297.	1378.	1461.
1,2,3-Trimethylbenzene (Hemimellitene)	"	490.4	553.4	618.7	686.4	756.0	828.	901.	976.	1052.	1130.	1209.	1289.	1371.	1453.
1,2,4- " (Pseudocumene)	"	491.8	554.9	620.4	688.1	757.9	830.	903.	978.	1055.	1132.	1212.	1292.	1373.	1455.
1,3,5- " (Mesitylene)	"	485.1	548.3	613.8	681.6	751.5	823.3	896.8	971.9	1048.	1126.	1206.	1286.	1367.	1449.

[a] See footnote a of Table 5u-E.

[b] See footnote b of Table 5u-E.

[c] See footnote c of Table 5u-E.

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TABLE 8u-E (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Ethene (Ethylene)	C_2H_4	0	135.2	145.9	155.7	158.6	161.9	170.5	211.1	256.6	306.7	361.1	419.4	481.3	546.6
Propene (Propylene)	C_3H_6	0	112.0	122.6	132.3	135.1	138.4	146.8	186.8	231.7	281.2	335.3	393.5	455.6	521.3
1-Butene	C_4H_8	0	108.0	119.0	129.1	132.0	135.4	144.3	186.4	233.9	286.3	343.2	404.2	469.1	537.5
cis-2-Butene	"	0	102.7	112.2	121.0	123.6	126.5	134.3	171.8	214.6	262.7	315.5	372.9	434.2	499.3
trans-2- "	"	0	107.4	118.1	128.1	131.0	134.3	143.0	183.9	229.8	280.4	335.4	394.4	457.5	524.3
2-Methylpropene (Isobutene)	"	0	103.3	114.3	124.5	127.5	130.9	139.7	181.5	228.2	279.8	335.8	396.1	459.9	527.2

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Ethene (Ethylene)	C_2H_4	615.0	686.2	759.8	835.9	914.2	994.9	1078.	1162.	1248.	1336.	1425.	1515.	1607.	1700.
Propene (Propylene)	C_3H_6	590.2	662.0	736.8	814.3	894.3	976.4	1060.	1146.	1234.	1324.	1415.	1507.	1601.	1696.
1-Butene	C_4H_8	609.1	683.7	760.8	840.5	922.6	1007.0	1093.	1182.	1272.	1363.	1456.	1550.	1646.	1743.
cis-2-Butene	"	568.0	639.9	714.7	792.2	872.2	954.6	1039.	1126.	1214.	1304.	1396.	1489.	1584.	1680.
trans-2- "	"	594.1	667.0	743.0	821.5	902.6	985.9	1071.	1159.	1248.	1338.	1430.	1524.	1619.	1715.
2-Methylpropene (Isobutene)	"	598.0	671.6	747.9	826.8	908.2	992.0	1078.	1166.	1255.	1346.	1439.	1533.	1628.	1724.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 8u-E (Part 2) - MONOOLEFINS, C_5
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F
MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
1-Pentene	C_5H_{10}	0	109.0	120.4	130.8	133.9	137.4	146.5	189.5	237.8	291.0	348.7	410.7	476.4	545.6
cis-2-Pentene	"	0	99.5	109.3	118.4	121.1	124.3	132.3	171.2	215.7	265.6	320.2	379.4	442.8	510.0
trans-2- "	"	0	104.6	115.6	125.7	128.6	132.1	140.9	182.8	230.1	282.3	339.2	400.3	465.1	533.3
2-Methyl-1-butene	"	0	100.8	111.8	121.8	124.8	128.2	137.0	179.2	226.8	279.4	336.5	397.7	463.0	531.8
3- " -1- "	"	0	102.5	114.2	125.0	128.1	131.8	141.1	185.6	235.3	289.9	348.9	411.8	478.2	547.9
2- " -2- "	"	0	99.0	109.5	119.2	122.0	125.3	133.7	173.8	219.2	269.5	324.6	384.0	447.3	514.3

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
1-Pentene	C_5H_{10}	618.0	693.2	770.9	851.2	934.0	1019.	1106.	1195.	1286.	1378.	1472.	1567.	1664.	1761.
cis-2-Pentene	"	580.2	653.6	730.1	809.2	891.0	975.	1061.	1149.	1238.	1330.	1423.	1517.	1613.	1710.
trans-2- "	"	604.9	679.5	756.8	836.7	919.2	1004.	1090.	1179.	1269.	1361.	1454.	1549.	1645.	1743.
2-Methyl-1-butene	"	603.7	678.5	756.1	836.3	918.9	1004.	1091.	1180.	1270.	1362.	1456.	1551.	1648.	1745.
3- " -1- "	"	620.7	696.4	774.6	855.6	938.9	1024.	1112.	1201.	1292.	1385.	1479.	1574.	1670.	1768.
2- " -2- "	"	584.9	658.5	734.6	813.5	895.0	979.	1065.	1153.	1242.	1334.	1427.	1521.	1617.	1714.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

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TABLE 8u-E (Part 3; page 1) - MONOOLEFINS, C_6
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F
MAY 31, 1946

Compound (Gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
1-Hexene	C_6H_{12}	0	107.4	119.0	129.6	132.8	136.4	145.6	189.0	237.4	290.9	349.3	412.2	478.0	547.
cis-2-Hexene	"	0	102.0	112.2	121.8	124.6	127.8	136.2	176.3	222.1	273.0	328.8	389.1	453.4	521.
trans-2- "	"	0	106.0	117.3	127.7	130.7	134.3	143.3	186.0	234.0	286.9	344.3	405.9	471.6	541.
cis-3- "	"	0	98.2	108.0	117.2	119.9	123.0	131.2	170.5	215.7	266.4	322.3	382.7	447.0	515.
trans-3- "	"	0	103.3	114.2	124.3	127.2	130.7	139.6	182.2	230.6	284.1	341.9	403.8	469.2	538.
2-Methyl-1-pentene	"	0	102.8	114.1	124.5	127.5	131.1	140.1	183.0	231.1	284.2	341.9	403.8	469.2	538.
3- " -1- "	"	0	98.9	110.7	121.5	124.6	128.3	137.7	182.3	232.3	287.2	346.5	409.9	476.7	547.
4- " -1- "	"	0	97.4	108.4	118.6	121.6	125.1	134.0	176.9	225.6	279.5	338.3	401.4	468.2	538.
2- " -2- "	"	0	95.6	105.8	115.3	118.2	121.4	129.8	169.9	215.8	266.6	322.4	382.7	447.0	515.

Compound (Gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
1-Hexene	C_6H_{12}	619.	695.	774.	855.	938.	1024.	1111.	1201.	1293.	1385.	1479.	1574.	1672.	1770.
cis-2-Hexene	"	593.	667.	743.	823.	906.									
trans-2- "	"	613.	688.	766.	847.	930.									
cis-3- "	"	586.	660.	737.	816.	900.									
trans-3- "	"	612.	688.	766.	847.	930.									
2-Methyl-1-pentene	"	612.	688.	766.	847.	930.									
3- " -1- "	"	621.	697.	776.	858.	942.									
4- " -1- "	"	612.	688.	766.	847.	931.									
2- " -2- "	"	586.	660.	737.	816.	900.									

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8u-E (Part 3; page 2) - MONOOLEFINS, C_6

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
cis-3-Methyl-2-pentene	C_6H_{12}	0	95.6	105.8	115.3	118.2	121.4	129.8	169.9	215.8	266.6	322.4	382.7	447.0	515.
trans-3- " -2- "	"	0	95.6	105.8	115.3	118.2	121.4	129.8	169.9	215.8	266.6	322.4	382.7	447.0	515.
cis-4- " -2- "	"	0	97.2	108.0	118.0	121.0	124.3	133.1	175.2	222.8	275.6	332.9	394.3	459.2	528.
trans-4- " -2- "	"	0	100.3	112.0	122.8	125.9	129.6	138.8	182.8	231.9	286.0	344.8	407.9	473.8	543.
2-Ethyl-1-butene	"	0	99.0	109.8	119.8	122.8	126.3	135.0	177.2	225.0	278.0	335.6	397.4	462.9	532.
2,3-Dimethyl-1-butene	"	0	98.1	109.9	120.7	123.9	127.6	137.0	181.8	231.9	286.9	346.4	409.9	476.8	547.
3,3- " -1- "	"	0	91.3	102.4	112.6	115.6	119.2	127.9	170.4	218.5	271.9	330.0	392.8	460.4	532.
2,3- " -2- "	"	0	95.6	106.0	115.6	118.4	121.8	130.1	170.1	215.5	265.8	321.1	380.7	443.8	511.

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
cis-3-Methyl-2-pentene	C_6H_{12}	586.	660.	737.	816.	900.									
trans-3- " -2- "	"	586.	660.	737.	816.	900.									
cis-4- " -2- "	"	600.	676.	753.	834.	917.									
trans-4- " -2- "	"	615.	691.	770.	851.	934.									
2-Ethyl-1-butene	"	604.	680.	759.	841.	924.									
2,3-Dimethyl-1-butene	"	621.	697.	775.	855.	940.									
3,3- " -1- "	"	607.	684.	763.	845.	929.									
2,3- " -2- "	"	582.	656.	733.	812.	894.									

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

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TABLE 12u-E - ACETYLENES, C_2 to C_5

HEAT CONTENT, $(H^\circ - H^\circ_0)$, FOR THE IDEAL GAS, AT - 459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^\circ - H^\circ_0)$, in BTU/lb[c]													
Ethyne (Acetylene)	C_2H_2	0	135.0	147.3	158.4	161.6	165.2	174.6	217.5	263.1	311.1	361.0	412.6	465.8	520.3
Propyne (Methylacetylene)	C_3H_4	0	112.8	123.5	133.3	136.2	139.4	147.8	186.9	229.7	276.0	325.5	378.0	433.1	490.8
1-Butyne (Ethylacetylene)	C_4H_6	0	100.4	111.0	120.8	123.6	127.0	135.3	174.7	218.4	266.1	317.5	372.3	430.1	490.7
2- " (Dimethylacetylene)	"	0	106.7	116.8	126.0	128.7	131.7	139.7	177.0	218.5	263.8	312.8	365.4	421.2	480.0
1-Pentyne	C_5H_8	0	102.8	114.0	124.2	127.2	130.8	139.4	180.4	225.6	274.9	328.	385.	445.	509.
2- "	"	0	98.2	108.3	117.6	120.3	123.5	131.5	169.4	211.8	258.4	309.	363.	421.	482.
3-Methyl-1-butyne	"	0	94.1	104.8	114.6	117.5	121.0	129.4	169.8	215.0	264.6	318.	376.	436.	499.

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^\circ - H^\circ_0)$, in BTU/lb													
Ethyne (Acetylene)	C_2H_2	576.1	633.1	691.2	750.4	810.7	872.0	934.2	997.2	1061.	1126.	1191.	1257.	1324.	1392.
Propyne (Methylacetylene)	C_3H_4	550.7	612.8	676.9	742.8	810.5	879.7	950.4	1023.	1096.	1171.	1247.	1324.	1401.	1480.
1-Butyne (Ethylacetylene)	C_4H_6	554.0	619.8	687.7	757.7	829.5	903.2	978.6	1056.	1134.	1214.	1295.	1377.	1460.	1544.
2- " (Dimethylacetylene)	"	541.7	605.8	672.2	741.0	811.9	884.7	959.1	1035.	1113.	1192.	1272.	1354.	1437.	1520.
1-Pentyne	C_5H_8	574.	643.	713.	786.	860.	937.	1015.	1095.	1177.	1260.	1345.	1430.	1517.	1604.
2- "	"	546.	613.	682.	753.	827.	902.	980.	1059.	1140.	1222.	1305.	1390.	1476.	1563.
3-Methyl-1-butyne	"	565.	634.	705.	778.	853.	930.	1009.	1089.	1171.	1255.	1339.	1425.	1511.	1598.

[a] See footnote a of Table Ou-E.

[b] See footnote b of Table Ou-E.

[c] See footnote c of Table Ou-E.

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TABLE 20 u-E (Part 1) - NORMAL PARAFFINS, C_1 to C_{10}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Methane	CH_4	0	229.5	245.6	259.9	264.1	268.8	281.1	336.8	397.1	461.9	531.7	606.5	686.0	770.2
Ethane	C_2H_6	0	140.22	152.55	163.80	167.10	170.86	180.64	226.6	278.1	335.1	397.5	465.2	537.8	614.8
Propane	C_3H_8	0	115.04	126.30	136.74	139.83	143.27	152.60	196.89	247.4	303.8	365.3	431.8	503.1	578.6
n-Butane	C_4H_{10}	0	114.41	126.16	136.98	140.16	143.76	153.26	198.15	248.8	305.0	366.5	432.9	503.7	578.5
n-Pentane	C_5H_{12}	0	111.82	123.63	134.47	137.66	141.32	150.79	195.73	246.3	302.3	363.5	429.4	499.7	574.0
n-Hexane	C_6H_{14}	0	110.05	121.93	132.83	136.03	139.67	149.21	194.19	244.7	300.6	361.6	427.4	497.4	571.3
n-Heptane	C_7H_{16}	0	108.62	120.60	131.57	134.79	138.47	148.03	193.08	243.6	299.3	360.2	425.8	495.7	569.4
n-Octane	C_8H_{18}	0	107.72	119.71	130.70	133.92	137.58	147.16	192.23	242.7	298.4	359.2	424.6	494.4	568.0
n-Nonane	C_9H_{20}	0	106.96	118.99	129.99	133.22	136.87	146.43	191.58	242.0	297.7	358.3	423.7	493.4	566.9
n-Decane	$C_{10}H_{22}$	0	106.35	118.40	129.43	132.66	136.31	145.94	191.05	241.5	297.1	357.7	423.0	492.5	565.9

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Methane	CH_4	858.8	951.6	1048.4	1149.1	1253.3	1361.	1471.	1584.	1701.	1820.	1942.	2065.	2191.	2318.
Ethane	C_2H_6	695.6	780.4	868.8	960.3	1054.7	1152.	1253.	1356.	1461.	1568.	1678.	1789.	1902.	2017.
Propane	C_3H_8	658.1	741.2	827.6	917.0	1009.3	1104.	1202.	1302.	1404.	1508.	1613.	1721.	1829.	1940.
n-Butane	C_4H_{10}	657.0	738.7	823.6	911.4	1002.0	1095.	1191.	1289.	1389.	1491.	1595.	1700.	1806.	1914.
n-Pentane	C_5H_{12}	651.7	732.8	817.0	904.1	993.8	1086.	1181.	1278.	1376.	1477.	1579.	1683.	1789.	1895.
n-Hexane	C_6H_{14}	648.8	729.4	812.9	899.3	988.5	1080.	1174.	1270.	1368.	1468.	1570.	1673.	1777.	1883.
n-Heptane	C_7H_{16}	646.4	726.6	809.9	896.1	984.8	1076.	1169.	1265.	1362.	1462.	1562.	1665.	1769.	1874.
n-Octane	C_8H_{18}	644.8	724.8	807.7	893.5	981.9	1073.	1166.	1261.	1358.	1457.	1557.	1659.	1762.	1866.
n-Nonane	C_9H_{20}	643.5	723.3	806.0	891.5	979.7	1070.	1163.	1258.	1354.	1453.	1553.	1655.	1757.	1861.
n-Decane	$C_{10}H_{22}$	642.4	722.1	804.6	889.9	977.9	1068.	1161.	1255.	1352.	1450.	1550.	1651.	1754.	1857.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

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TABLE 20u-E (Part 2) - NORMAL PARAFFINS, C_{11} to C_{20}

HEAT CONTENT, $(H^o - H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
n-Undecane	$C_{11}H_{24}$	0	105.85	117.92	128.96	132.20	135.85	145.49	190.62	241.0	296.6	357.2	422.4	491.9	565.2
n-Dodecane	$C_{12}H_{26}$	0	105.43	117.52	128.57	131.81	135.46	145.11	190.25	240.7	296.2	356.7	421.9	491.3	564.5
n-Tridecane	$C_{13}H_{28}$	0	105.08	117.18	128.24	131.49	135.14	144.80	189.95	240.4	295.9	356.3	421.4	490.8	564.0
n-Tetradecane	$C_{14}H_{30}$	0	104.77	116.89	127.96	131.21	134.85	144.52	189.69	240.1	295.6	356.0	421.1	490.4	563.5
n-Pentadecane	$C_{15}H_{32}$	0	104.51	116.64	127.72	130.96	134.61	144.29	189.46	239.9	295.3	355.7	420.8	490.1	563.1
n-Hexadecane	$C_{16}H_{34}$	0	104.28	116.42	127.50	130.75	134.40	144.08	189.26	239.6	295.1	355.5	420.5	489.8	562.8
n-Heptadecane	$C_{17}H_{36}$	0	104.07	116.22	127.31	130.56	134.21	143.90	189.08	239.5	294.9	355.2	420.2	489.5	562.5
n-Octadecane	$C_{18}H_{38}$	0	103.89	116.05	127.14	130.39	134.04	143.73	188.92	239.3	294.7	355.0	420.0	489.2	562.2
n-Nonadecane	$C_{19}H_{40}$	0	103.73	115.89	126.99	130.24	133.89	143.59	188.78	239.2	294.6	354.9	419.8	489.0	562.0
n-Eicosane	$C_{20}H_{42}$	0	103.58	115.75	126.86	130.11	133.75	143.46	188.66	239.0	294.4	354.7	419.6	488.8	561.8

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
n-Undecane	$C_{11}H_{24}$	641.6	721.1	803.4	888.6	976.4	1067.	1159.	1253.	1349.	1447.	1547.	1648.	1750.	1853.
n-Dodecane	$C_{12}H_{26}$	640.9	720.2	802.4	887.5	975.2	1065.	1157.	1251.	1347.	1445.	1545.	1646.	1748.	1851.
n-Tridecane	$C_{13}H_{28}$	640.2	719.5	801.6	886.6	974.2	1064.	1156.	1250.	1346.	1444.	1543.	1644.	1745.	1848.
n-Tetradecane	$C_{14}H_{30}$	639.7	718.9	800.9	885.8	973.3	1063.	1155.	1249.	1344.	1442.	1541.	1642.	1744.	1846.
n-Pentadecane	$C_{15}H_{32}$	639.3	718.4	800.3	885.1	972.5	1062.	1154.	1248.	1343.	1441.	1540.	1640.	1742.	1844.
n-Hexadecane	$C_{16}H_{34}$	638.9	717.9	799.8	884.5	971.8	1061.	1153.	1247.	1342.	1440.	1538.	1639.	1740.	1842.
n-Heptadecane	$C_{17}H_{36}$	638.5	717.5	799.3	883.9	971.2	1061.	1152.	1246.	1341.	1438.	1537.	1638.	1739.	1841.
n-Octadecane	$C_{18}H_{38}$	638.2	717.1	798.9	883.5	970.7	1060.	1152.	1245.	1340.	1438.	1536.	1637.	1738.	1840.
n-Nonadecane	$C_{19}H_{40}$	637.9	716.8	798.5	883.0	970.2	1060.	1151.	1244.	1340.	1437.	1535.	1636.	1737.	1839.
n-Eicosane	$C_{20}H_{42}$	637.6	716.5	798.2	882.6	969.8	1059.	1150.	1244.	1339.	1436.	1535.	1635.	1736.	1838.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 21u-E (Part 1) - NORMAL ALKYL BENZENES, C_6 to C_{13}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Benzene	C_6H_6	0	60.63	67.60	74.19	76.12	78.33	84.20	112.94	146.66	184.9	227.2	273.2	322.4	374.5
Methylbenzene (Toluene)	C_7H_8	0	64.85	72.46	79.60	81.69	84.07	90.38	121.01	156.61	196.8	241.1	289.2	340.6	395.1
Ethylbenzene	C_8H_{10}	0	69.66	77.89	85.60	87.84	90.39	97.15	129.86	167.71	210.3	257.1	307.8	361.9	419.1
n-Propylbenzene	C_9H_{12}	0	74.73	83.51	91.68	94.06	96.79	103.9	138.3	177.7	221.8	270.3	322.7	378.6	437.6
n-Butylbenzene	$C_{10}H_{14}$	0	77.49	86.61	95.07	97.54	100.39	107.8	143.2	183.8	229.0	278.7	332.3	389.5	449.9
n-Amylbenzene	$C_{11}H_{16}$	0	79.69	89.11	97.83	100.38	103.30	110.9	147.3	188.8	235.0	285.6	340.3	398.6	460.1
n-Hexylbenzene	$C_{12}H_{18}$	0	81.51	91.18	100.12	102.72	105.71	113.5	150.7	192.9	239.9	291.3	346.8	406.0	468.5
n-Heptylbenzene	$C_{13}H_{20}$	0	83.04	92.92	102.04	104.70	107.73	115.7	153.5	196.4	244.0	296.1	352.4	412.3	475.6

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Benzene	C_6H_6	429.1	486.1	545.2	606.2	668.9	733.2	799.0	866.1	934.5	1004.	1074.	1146.	1218.	1291.
Methylbenzene (Toluene)	C_7H_8	452.4	512.2	574.1	638.2	704.1	771.7	840.9	911.6	983.6	1057.	1131.	1206.	1283.	1360.
Ethylbenzene	C_8H_{10}	479.1	541.5	606.2	673.1	741.9	812.4	884.5	958.1	1033.	1109.	1187.	1265.	1345.	1425.
n-Propylbenzene	C_9H_{12}	499.4	563.7	630.2	698.9	769.6	942.	916.	992.	1069.	1148.	1228.	1308.	1390.	1473.
n-Butylbenzene	$C_{10}H_{14}$	513.1	578.8	646.9	717.1	789.5	864.	939.	1017.	1096.	1176.	1258.	1340.	1424.	1509.
n-Amylbenzene	$C_{11}H_{16}$	524.4	591.3	660.6	732.1	805.8	881.	958.	1037.	1118.	1199.	1282.	1367.	1452.	1538.
n-Hexylbenzene	$C_{12}H_{18}$	533.8	601.7	671.9	744.5	819.2	896.	974.	1054.	1136.	1219.	1303.	1388.	1475.	1562.
n-Heptylbenzene	$C_{13}H_{20}$	541.7	610.4	681.4	754.9	830.5	908.	987.	1068.	1151.	1235.	1320.	1407.	1494.	1583.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

TABLE 21u-E (Part 2) - NORMAL ALKYL BENZENES, C_{14} to C_{22}

HEAT CONTENT, $(H^{o}-H^{o}_{0})$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^{o}-H^{o}_{0})$, in BTU/lb[c]													
n-Octylbenzene	$C_{14}H_{22}$	0	84.35	94.40	103.67	106.38	109.46	117.5	155.9	199.3	247.5	300.2	357.1	417.7	481.6
n-Nonylbenzene	$C_{15}H_{24}$	0	85.48	95.68	105.09	107.83	110.95	119.2	158.0	201.9	250.6	303.8	361.1	422.3	486.8
n-Decylbenzene	$C_{16}H_{26}$	0	86.46	96.80	106.32	109.10	112.25	120.6	159.8	204.1	253.2	306.8	364.7	426.4	491.4
n-Undecylbenzene	$C_{17}H_{28}$	0	87.32	97.78	107.40	110.21	113.39	121.8	161.4	206.1	255.5	309.6	367.8	429.9	495.4
n-Dodecylbenzene	$C_{18}H_{30}$	0	88.09	98.65	108.36	111.19	114.40	122.9	162.8	207.8	257.6	312.0	370.6	433.0	498.9
n-Tridecylbenzene	$C_{19}H_{32}$	0	88.77	99.43	109.21	112.07	115.30	123.8	164.1	209.4	259.4	314.1	373.0	435.8	502.1
n-Tetradecylbenzene	$C_{20}H_{34}$	0	89.39	100.12	109.98	112.86	116.11	124.7	165.2	210.7	261.1	316.0	375.2	438.4	504.9
n-Pentadecylbenzene	$C_{21}H_{36}$	0	89.94	100.75	110.68	113.58	116.84	125.5	166.2	212.0	262.6	317.8	377.2	440.6	507.5
n-Hexadecylbenzene	$C_{22}H_{38}$	0	90.44	101.32	111.31	114.22	117.51	126.2	167.2	213.1	263.9	319.3	379.0	442.7	509.8

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^{o}-H^{o}_{0})$, in BTU/lb													
n-Octylbenzene	$C_{14}H_{22}$	548.4	617.8	689.6	763.8	840.2	919.	999.	1080.	1164.	1249.	1335.	1422.	1511.	1600.
n-Nonylbenzene	$C_{15}H_{24}$	554.2	624.2	696.6	771.4	848.5	928.	1008.	1091.	1175.	1260.	1348.	1436.	1525.	1615.
n-Decylbenzene	$C_{16}H_{26}$	559.2	629.7	702.7	778.1	855.8	935.	1017.	1100.	1185.	1271.	1358.	1447.	1537.	1628.
n-Undecylbenzene	$C_{17}H_{28}$	563.7	634.6	708.1	784.0	862.2	942.	1024.	1108.	1193.	1280.	1368.	1458.	1548.	1639.
n-Dodecylbenzene	$C_{18}H_{30}$	567.6	639.0	712.8	789.2	867.8	948.	1031.	1115.	1201.	1288.	1377.	1467.	1558.	1650.
n-Tridecylbenzene	$C_{19}H_{32}$	571.1	642.8	717.1	793.8	872.8	954.	1037.	1121.	1208.	1295.	1384.	1475.	1566.	1659.
n-Tetradecylbenzene	$C_{20}H_{34}$	574.3	646.3	720.9	798.0	877.4	959.	1042.	1127.	1214.	1302.	1391.	1482.	1574.	1667.
n-Pentadecylbenzene	$C_{21}H_{36}$	577.1	649.5	724.3	801.7	881.5	963.	1047.	1132.	1219.	1308.	1398.	1489.	1581.	1674.
n-Hexadecylbenzene	$C_{22}H_{38}$	579.7	652.3	727.5	805.1	885.2	967.	1051.	1137.	1224.	1313.	1403.	1495.	1588.	1681.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 24u-E (Part 1) - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{11}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

March 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Ethene (Ethylene)	C_2H_4	0	135.2	145.9	155.7	158.6	161.9	170.5	211.1	256.6	306.7	361.1	419.4	481.3	546.6
Propene (Propylene)	C_3H_6	0	112.0	122.6	132.3	135.1	138.4	146.8	186.8	231.7	281.2	335.3	393.5	455.6	521.3
1-Butene	C_4H_8	0	108.0	119.0	129.1	132.0	135.4	144.3	186.4	233.9	286.3	343.2	404.2	469.1	537.5
1-Pentene	C_5H_{10}	0	109.0	120.4	130.8	133.9	137.4	146.5	189.5	237.8	291.0	348.7	410.7	476.4	545.6
1-Hexene	C_6H_{12}	0	107.4	119.0	129.6	132.8	136.4	145.6	189.0	237.4	290.9	349.3	412.2	478.0	547.
1-Heptene	C_7H_{14}	0	106.8	118.4	129.0	132.1	135.6	144.9	188.4	237.3	291.0	349.4	412.2	479.0	549.
1-Octene	C_8H_{16}	0	106.0	117.7	128.4	131.5	135.1	144.4	188.2	237.2	291.1	349.7	412.7	479.8	550.
1-Nonene	C_9H_{18}	0	105.4	117.2	127.9	131.0	134.6	144.0	188.0	237.1	291.2	349.9	413.1	480.4	551.
1-Decene	$C_{10}H_{20}$	0	105.0	116.8	127.5	130.7	134.3	143.7	187.8	237.0	291.2	350.1	413.4	480.8	552.
1-Undecene	$C_{11}H_{22}$	0	104.6	116.4	127.2	130.4	134.0	143.4	187.6	237.0	291.3	350.3	413.7	481.2	552.

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Ethene (Ethylene)	C_2H_4	615.0	686.2	759.8	835.9	914.2	994.9	1078.	1162.	1248.	1336.	1425.	1515.	1607.	1700.
Propene (Propylene)	C_3H_6	590.2	662.0	736.8	814.3	894.3	976.4	1060.	1146.	1234.	1324.	1415.	1507.	1601.	1696.
1-Butene	C_4H_8	609.1	683.7	760.8	840.5	922.6	1007.0	1093.	1182.	1272.	1363.	1456.	1550.	1646.	1743.
1-Pentene	C_5H_{10}	618.0	693.2	770.9	851.2	934.0	1019.	1106.	1195.	1286.	1378.	1472.	1567.	1664.	1761.
1-Hexene	C_6H_{12}	619.	695.	774.	855.	938.	1024.	1111.	1201.	1293.	1385.	1479.	1574.	1672.	1770.
1-Heptene	C_7H_{14}	623.	698.	776.	857.	942.	1028.	1116.	1206.	1297.	1390.	1484.	1581.	1679.	1777.
1-Octene	C_8H_{16}	624.	700.	778.	860.	944.	1031.	1119.	1209.	1300.	1394.	1489.	1586.	1684.	1782.
1-Nonene	C_9H_{18}	625.	701.	780.	861.	946.	1033.	1121.	1212.	1303.	1397.	1492.	1589.	1687.	1786.
1-Decene	$C_{10}H_{20}$	626.	702.	781.	863.	948.	1035.	1123.	1214.	1306.	1400.	1495.	1592.	1690.	1790.
1-Undecene	$C_{11}H_{22}$	626.	703.	782.	864.	949.	1036.	1125.	1215.	1308.	1402.	1497.	1594.	1693.	1792.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 24u-E (Part 2) - NORMAL MONOOLEFINS (1-ALKENES), C_{12} to C_{20}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

March 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
1-Dodecene	$C_{12}H_{24}$	0	104.3	116.1	127.0	130.2	133.8	143.2	187.5	237.0	291.3	350.4	413.9	481.6	553.
1-Tridecene	$C_{13}H_{26}$	0	104.0	115.9	126.8	130.0	133.6	143.0	187.4	236.9	291.3	350.5	414.1	481.8	553.
1-Tetradecene	$C_{14}H_{28}$	0	103.8	115.7	126.6	129.8	133.4	142.9	187.3	236.9	291.4	350.6	414.2	482.1	553.
1-Pentadecene	$C_{15}H_{30}$	0	103.6	115.5	126.4	129.6	133.2	142.8	187.3	236.9	291.4	350.6	414.4	482.3	554.
1-Hexadecene	$C_{16}H_{32}$	0	103.4	115.4	126.3	129.5	133.1	142.7	187.2	236.8	291.4	350.7	414.5	482.4	554.
1-Heptadecene	$C_{17}H_{34}$	0	103.2	115.2	126.2	129.4	133.0	142.6	187.1	236.8	291.4	350.8	414.6	482.6	554.
1-Octadecene	$C_{18}H_{36}$	0	103.1	115.1	126.1	129.3	132.9	142.5	187.1	236.8	291.4	350.8	414.7	482.7	554.
1-Nonadecene	$C_{19}H_{38}$	0	103.0	115.0	126.0	129.2	132.8	142.4	187.0	236.8	291.4	350.9	414.8	482.9	555.
1-Eicosene	$C_{20}H_{40}$	0	102.9	114.9	125.9	129.1	132.7	142.3	187.0	236.8	291.5	350.9	414.8	483.0	555.

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
1-Dodecene	$C_{12}H_{24}$	627.	704.	783.	865.	950.	1037.	1126.	1217.	1309.	1403.	1499.	1596.	1695.	1794.
1-Tridecene	$C_{13}H_{26}$	627.	704.	783.	866.	951.	1038.	1127.	1218.	1310.	1405.	1501.	1598.	1697.	1796.
1-Tetradecene	$C_{14}H_{28}$	628.	705.	784.	866.	952.	1039.	1128.	1219.	1312.	1406.	1502.	1600.	1698.	1798.
1-Pentadecene	$C_{15}H_{30}$	628.	705.	784.	867.	952.	1040.	1129.	1220.	1313.	1407.	1503.	1601.	1700.	1799.
1-Hexadecene	$C_{16}H_{32}$	628.	705.	785.	867.	953.	1040.	1130.	1221.	1313.	1408.	1504.	1602.	1701.	1800.
1-Heptadecene	$C_{17}H_{34}$	629.	706.	785.	868.	953.	1041.	1130.	1221.	1314.	1409.	1505.	1603.	1702.	1801.
1-Octadecene	$C_{18}H_{36}$	629.	706.	786.	868.	954.	1041.	1131.	1222.	1315.	1410.	1506.	1604.	1703.	1802.
1-Nonadecene	$C_{19}H_{38}$	629.	706.	786.	869.	954.	1042.	1131.	1222.	1316.	1410.	1506.	1605.	1704.	1803.
1-Eicosene	$C_{20}H_{40}$	629.	706.	786.	869.	955.	1042.	1132.	1223.	1316.	1411.	1507.	1605.	1704.	1804.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25 u-E (Part 1) - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{11}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
Ethyne (Acetylene)	C_2H_2	0	135.0	147.3	158.4	161.6	165.2	174.6	217.5	263.1	311.1	361.0	412.6	465.8	520.3
Propyne (Methylacetylene)	C_3H_4	0	112.8	123.5	133.3	136.2	139.4	147.8	186.9	229.7	276.0	325.5	378.0	433.1	490.8
1-Butyne (Ethylacetylene)	C_4H_6	0	100.4	111.0	120.8	123.6	127.0	135.3	174.7	218.4	266.1	317.5	372.3	430.1	490.7
1-Pentyne	C_5H_8	0	102.8	114.0	124.2	127.2	130.8	139.4	180.4	225.6	274.9	328.	385.	445.	509.
1-Hexyne	C_6H_{10}	0	102.5	113.9	124.2	127.2	130.9	139.6	181.3	227.4	277.7	332.	390.	452.	517.
1-Heptyne	C_7H_{12}	0	102.3	113.8	124.2	127.3	130.9	139.8	182.0	228.7	280.0	335.	394.	457.	523.
1-Octyne	C_8H_{14}	0	102.1	113.7	124.2	127.3	130.9	140.0	182.5	229.7	281.3	337.	397.	460.	527.
1-Nonyne	C_9H_{16}	0	102.0	113.6	124.2	127.3	131.0	140.1	183.0	230.5	282.5	339.	399.	463.	530.
1-Decyne	$C_{10}H_{18}$	0	101.8	113.6	124.2	127.4	131.0	140.2	183.3	231.1	283.4	340.	401.	465.	533.
1-Undecyne	$C_{11}H_{20}$	0	101.7	113.5	124.2	127.4	131.0	140.2	183.6	231.6	284.2	341.	402.	467.	536.

Compound (gas)	Formula	Temperature in °F												
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
Ethyne (Acetylene)	C_2H_2	576.1	633.1	691.2	750.4	810.7	872.0	934.2	997.2	1061.	1126.	1191.	1257.	1324.	1392.
Propyne (Methylacetylene)	C_3H_4	550.7	612.8	676.9	742.8	810.5	879.7	950.4	1023.	1096.	1171.	1247.	1324.	1401.	1480.
1-Butyne (Ethylacetylene)	C_4H_6	554.0	619.8	687.7	757.7	829.5	903.2	978.6	1056.	1134.	1214.	1295.	1377.	1460.	1544.
1-Pentyne	C_5H_8	574.	643.	713.	786.	860.	937.	1015.	1095.	1177.	1260.	1345.	1430.	1517.	1604.
1-Hexyne	C_6H_{10}	584.	654.	726.	801.	877.	956.	1036.	1118.	1202.	1287.	1374.	1462.	1551.	1641.
1-Heptyne	C_7H_{12}	591.	662.	736.	812.	890.	970.	1051.	1135.	1220.	1307.	1395.	1485.	1575.	1666.
1-Octyne	C_8H_{14}	596.	668.	743.	820.	899.	980.	1063.	1147.	1234.	1322.	1411.	1502.	1594.	1686.
1-Nonyne	C_9H_{16}	601.	673.	748.	826.	906.	988.	1071.	1157.	1244.	1333.	1423.	1515.	1608.	1701.
1-Decyne	$C_{10}H_{18}$	604.	677.	753.	831.	912.	994.	1078.	1165.	1252.	1342.	1433.	1525.	1619.	1713.
1-Undecyne	$C_{11}H_{20}$	606.	680.	756.	835.	916.	999.	1084.	1171.	1259.	1349.	1441.	1534.	1628.	1722.

[a] See footnote a of Table Ou-E.

[b] See footnote b of Table Ou-E.

[c] See footnote c of Table Ou-E.

TABLE 25 u-E (Part 2) - NORMAL ACETYLENES (1-ALKYNES), C_{12} to C_{20}
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -459.69° to 2200° F
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Content[b], $(H^o-H^o_0)$, in BTU/lb[c]													
1-Dodecyne	$C_{12}H_{22}$	0	101.6	113.5	124.2	127.4	131.0	140.3	183.8	232.0	284.8	342.	404.	469.	537.
1-Tridecyne	$C_{13}H_{24}$	0	101.6	113.4	124.2	127.4	131.0	140.3	184.0	232.4	285.3	343.	404.	470.	539.
1-Tetradecyne	$C_{14}H_{26}$	0	101.5	113.4	124.2	127.4	131.0	140.4	184.1	232.7	285.8	344.	405.	471.	540.
1-Pentadecyne	$C_{15}H_{28}$	0	101.5	113.4	124.2	127.4	131.0	140.4	184.3	232.9	286.2	344.	406.	472.	541.
1-Hexadecyne	$C_{16}H_{30}$	0	101.4	113.4	124.2	127.4	131.0	140.4	184.4	233.2	286.5	344.	407.	473.	542.
1-Heptadecyne	$C_{17}H_{32}$	0	101.4	113.4	124.2	127.4	131.0	140.5	184.5	233.4	286.8	345.	407.	474.	543.
1-Octadecyne	$C_{18}H_{34}$	0	101.4	113.3	124.2	127.4	131.1	140.5	184.6	233.5	287.1	345.	408.	474.	544.
1-Nonadecyne	$C_{19}H_{36}$	0	101.3	113.3	124.2	127.4	131.1	140.5	184.7	233.7	287.4	346.	408.	475.	545.
1-Eicosyne	$C_{20}H_{38}$	0	101.3	113.3	124.2	127.4	131.1	140.6	184.8	233.8	287.6	346.	409.	475.	546.

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Content, $(H^o-H^o_0)$, in BTU/lb													
1-Dodecyne	$C_{12}H_{22}$	609.	683.	759.	838.	920.	1003.	1089.	1176.	1265.	1356.	1448.	1541.	1635.	1730.
1-Tridecyne	$C_{13}H_{24}$	611.	685.	762.	841.	923.	1007.	1093.	1180.	1270.	1361.	1453.	1547.	1642.	1737.
1-Tetradecyne	$C_{14}H_{26}$	612.	687.	764.	844.	926.	1010.	1096.	1184.	1274.	1365.	1458.	1552.	1647.	1743.
1-Pentadecyne	$C_{15}H_{28}$	614.	688.	766.	846.	928.	1013.	1099.	1187.	1277.	1369.	1462.	1557.	1652.	1748.
1-Hexadecyne	$C_{16}H_{30}$	615.	690.	768.	848.	930.	1015.	1102.	1190.	1280.	1372.	1466.	1560.	1656.	1752.
1-Heptadecyne	$C_{17}H_{32}$	616.	691.	769.	849.	932.	1017.	1104.	1193.	1283.	1375.	1469.	1564.	1660.	1756.
1-Octadecyne	$C_{18}H_{34}$	617.	692.	770.	851.	934.	1019.	1106.	1195.	1286.	1378.	1472.	1567.	1663.	1760.
1-Nonadecyne	$C_{19}H_{36}$	618.	693.	771.	852.	935.	1021.	1108.	1197.	1288.	1380.	1474.	1570.	1666.	1763.
1-Eicosyne	$C_{20}H_{38}$	618.	694.	772.	853.	937.	1022.	1109.	1199.	1290.	1382.	1476.	1572.	1669.	1766.

[a] See footnote a of Table 0u-E.

[b] See footnote b of Table 0u-E.

[c] See footnote c of Table 0u-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE Cu-C - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2
HEAT CONTENT, $(H^o - H^o_0)$, AT -273.16° TO 1200°C
November 30, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °C														
			-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
			Heat Content[b], $(H^o - H^o_0)$ cal/g[c]														
Oxygen	O_2	gas	0	59.206	64.681	81.243	103.923	127.321	151.454	176.201	201.54	227.31	253.41	279.85	306.57	333.52	360.68
Hydrogen	H_2	gas	0	918.71	1003.87	1261.94	1608.05	1954.72	2302.83	2652.56	3004.3	3359.3	3718.4	4081.9	4450.4	4823.9	5202.3
Hydroxyl	OH	gas	0	113.60	123.84	155.22	196.71	238.20	279.70	321.42	363.57	406.25	449.49	493.36	537.94	583.22	629.08
Water	H_2O	gas	0	120.18	131.28	164.90	210.63	257.63	306.16	356.30	408.04	461.59	516.7	573.5	632.1	692.0	753.5
Nitrogen	N_2	gas	0	67.757	73.967	92.623	117.633	142.968	168.782	195.157	222.11	249.61	277.64	306.13	335.02	364.23	393.73
Nitric Oxide	NO	gas	0	67.185	73.120	90.924	114.93	139.35	164.36	189.96	216.16	242.89	270.03	297.58	325.45	353.60	382.02
Carbon	C	solid, graphite	0	16.875	20.946	35.70	60.71	90.90	125.25	162.80	202.86	244.6	287.6	331.8	377.3	423.8	471.2
Carbon Monoxide	CO	gas	0	67.781	73.996	92.675	117.793	143.337	169.456	196.206	223.57	251.49	279.91	308.78	338.03	367.62	397.48
Carbon Dioxide	CO_2	gas	0	45.882	50.855	66.648	89.506	114.086	140.080	167.252	195.40	224.37	254.03	284.31	315.09	346.28	377.84

[a] Interpolation to other temperatures in the interval 0° to 1200°C may be made by appropriate graphical or analytical methods. For temperatures between -100° and 0°C values may be estimated by extrapolating to lower temperatures the values for 0°, 100°, 200° and 300°C.

[b] $(H^o - H_0^o)$ is the heat content at the given temperature less the heat content at the absolute zero, 0°K or -273.16°C, of the given substance in its appropriate standard state. The appropriate standard state is: (a) for a gas, the thermodynamic standard gaseous state of unit fugacity (1 atmosphere); and (b) for a solid, the solid (crystalline) form indicated at a pressure of one atmosphere.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 1u-G - PARAFFINS, C_1 to C_5

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200 °C

November 30, 1944

Compound (Gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$ cal/g[c]														
Methane	CH_4	0	136.51	149.42	191.14	253.82	325.24	405.39	493.70	589.44	692.0	800.3	914.2	1033.2	1156.4	1282.8
Ethane	C_2H_6	0	84.80	94.98	129.25	183.62	247.80	320.92	401.56	488.99	582.0	680.7	783.8	891.1	1002.0	1116.2
Propane	C_3H_8	0	70.21	79.65	112.65	166.25	229.43	301.22	380.41	465.94	556.9	652.7	753.0	856.8	963.7	1073.4
n-Butane	C_4H_{10}	0	70.14	79.92	113.37	166.95	230.05	301.38	379.56	463.61	553.0	647.1	745.2	847.2	952.0	1059.4
2-Methylpropane (Isobutane)	"	0	64.16	73.57	106.44	160.21	223.62	295.13	373.73	458.45	548.2	642.7	741.6	843.6	948.4	1055.7
n-Pentane	C_5H_{12}	0	68.73	78.56	112.02	165.48	228.18	299.01	376.53	459.90	548.4	641.6	738.6	839.2	942.8	1049.0
2-Methylbutane (Isopentane)	"	0	61.80	71.24	104.27	158.09	221.38	292.74	370.93	455.02	544.0	637.7	735.5	836.3	940.0	1046.1
2,2-Dimethylpropane (Neopentane)	"	0	60.08	69.72	103.22	157.83	222.28	294.89	374.55	459.96	550.3	645.0	743.7	845.9	950.8	1057.9

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 2u-G(Part 1) - PARAFFINS, C_6

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

November 30, 1944; November 30, 1946

Compound (Gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, cal/g[c]														
n-Hexane	C_6H_{14}	0	67.78	77.65	111.16	164.53	227.12	297.63	374.82	457.57	545.5	637.9	734.3	834.1	936.9	1042.0
2-Methylpentane.	"	0	61.56	70.76	103.57	157.40	219.97	290.85	368.2	451.8	540.7					
3- "	"	0	61.71	71.35	104.84	159.03	222.52	293.35	371.6	455.2	543.1					
2,2-Dimethylbutane	"	0	58.97	68.89	102.24	155.67	219.52	290.82	369.6	453.0	542.2					
2,3- "	"	0	60.98	70.45	103.59	157.34	221.04	291.81	369.7	453.9	542.2					

[a] See footnote a of Table Ou-G.

[b] See footnote b of Table Ou-G.

[c] See footnote c of Table Ou-G.

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TABLE 2u-G(Part 2) - PARAFFINS, C_7

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

November 30, 1944

Compound (Gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$ cal/g[c]														
n-Heptane	C_7H_{16}	0	67.04	76.98	110.55	163.82	226.25	296.62	373.42	455.92	543.5	635.4	731.2	830.4	932.5	1036.9
2-Methylhexane.	"	0	61.23	71.09	104.67	158.62	222.06	293.54	371.4	454.1	541.5					
3- "	"	0	59.62	69.39	102.62	156.05	219.14	290.37	368.4	451.1	538.5					
3-Ethylpentane.	"	0	57.43	67.02	99.77	152.69	215.19	285.98	363.5	446.1	533.0					
2,2-Dimethylpentane. . . .	"	0	56.84	66.51	99.79	153.91	217.80	290.15	369.1	452.8	541.3					
2,3- "	"	0	56.44	66.09	99.12	152.68	216.05	287.63	365.4	448.9	536.2					
2,4- "	"	0	56.51	66.21	99.56	153.79	217.78	290.16	369.1	452.9	540.7					
3,3- "	"	0	57.10	66.90	100.36	154.57	218.80	291.34	370.1	454.6	543.5					
2,2,3-Trimethylbutane . . .	"	0	55.71	65.50	99.13	153.91	218.65	291.87	371.1	455.6	544.4.					

[a] See footnote a of Table 0u-G.

[b] See footnote b of Table 0u-G.

[c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 3u-G - PARAFFINS, C_8

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
n-Octane	C_8H_{18}	0	66.55	76.48	110.08	163.31	225.6	295.9	372.5	454.6	541.9	633.5	728.8	827.6	929.2	1033.0
2-Methylheptane	"	0	61.45	71.32	104.96	158.89	222.2	293.5	370.7	452.5	540.0					
3- "	"	0	60.70	70.45	103.87	157.68	221.0	292.3	369.0	451.4	539.4					
4- "	"	0	60.09	69.75	103.02	156.75	219.8	290.7	367.2	449.6	537.6					
3-Ethylhexane	"	0	56.74	65.98	98.24	150.95	213.1	283.2	360.1	442.1	529.0					
2,2-Dimethylhexane	"	0	58.11	67.81	101.26	155.39	218.9	290.6	369.2	453.0	541.2					
2,3- "	"	0	59.24	68.79	102.47	157.93	223.0	295.6	373.9	456.1	543.5					
2,4- "	"	0	56.16	65.89	99.05	152.56	215.8	287.3	364.5	447.1	534.5					
2,5- "	"	0	57.16	66.77	100.05	154.21	218.0	289.7	367.1	449.0	536.5					
3,3- "	"	0	56.08	65.81	99.07	152.90	216.6	288.7	367.5	451.3	539.4					
3,4- "	"	0	58.63	68.60	102.76	157.84	222.5	294.7	372.4	454.2	542.3					
2-Methyl-3-ethylpentane	"	0	57.74	67.47	101.09	155.56	219.4	291.0	368.1	449.8	537.9					
3- " -3- "	"	0	55.87	65.89	99.84	154.23	217.9	289.5	367.6	451.8	541.5					
2,2,3-Trimethylpentane	"	0	55.02	64.65	98.05	152.53	216.7	288.9	366.9	450.3	539.1					
2,2,4- "	"	0	55.02	64.65	98.05	152.53	216.7	288.9	366.9	450.3	539.1					
2,3,3- "	"	0	56.09	65.70	99.20	154.01	218.5	290.7	368.7	451.3	540.8					
2,3,4- "	"	0	55.17	64.57	97.92	153.10	217.9	290.2	367.2	449.6	538.6					
2,2,3,3-Tetramethylbutane	"	0	54.52	64.14	97.71	153.06	218.8	292.9	372.6	457.1	546.7					

[a] See footnote a of Table 0u-G.

[b] See footnote b of Table 0u-G.

[c] See footnote c of Table 0u-G.

TABLE 5u-G - ALKYL BENZENES, C_6 to C_9

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Benzene	C_6H_6	0	37.58	43.54	64.89	101.00	144.52	194.1	248.5	307.1	369.0	433.9	501.2	570.6	641.8	714.6
Methylbenzene (Toluene)	C_7H_8	0	40.28	46.74	69.51	107.51	153.08	204.9	262.0	323.4	388.4	456.6	527.5	600.6	675.7	752.4
Ethylbenzene	C_8H_{10}	0	43.30	50.25	74.57	114.92	163.02	217.5	277.3	341.4	409.3	480.4	554.2	630.4	708.6	788.5
1,2-Dimethylbenzene (o-Xylene)	"	0	45.29	52.52	77.43	117.90	165.70	219.7	279.0	342.7	410.2	480.9	554.5	630.4	708.3	788.1
1,3- " (m- ")	"	0	43.25	50.16	74.24	113.87	161.06	214.6	273.6	337.2	404.6	475.3	548.7	624.5	702.4	782.1
1,4- " (p- ")	"	0	43.58	50.47	74.36	113.68	160.54	213.8	272.5	335.8	403.0	473.4	546.7	622.4	700.2	779.8
n-Propylbenzene	C_9H_{12}	0	46.43	53.81	79.36	121.2	171.0	227.3	288.9	354.9	424.7	498.	574.	652.	733.	815.
Isopropylbenzene (Cumene)	"	0	43.50	50.73	76.01	118.0	167.9	224.3	286.1	352.3	422.4	496.	572.	650.	731.	813
1-Methyl-2-ethylbenzene	"	0	47.37	54.95	80.98	123.2	173.0	229.1	290.5	356.4	426.1	499.	575.	653.	734.	816.
1- " -3- "	"	0	45.57	52.87	78.16	119.7	168.9	224.7	285.8	351.5	421.1	494.	570.	648.	728.	811.
1- " -4- "	"	0	45.86	53.14	78.26	119.5	168.4	223.9	284.8	350.3	419.7	492.	568.	646.	726.	808.
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	47.33	54.83	79.82	120.7	168.9	223.5	283.7	348.4	417.2	489.	565.	642.	722.	804.
1,2,4- " (Pseudocumene)	"	0	47.43	54.99	80.12	121.1	169.5	224.2	284.5	349.3	418.2	490.	566.	644.	724.	805.
1,3,5- " (Mesitylene)	"	0	45.34	52.64	77.20	117.70	165.84	220.5	280.8	345.7	414.6	487.0	562.3	640.2	720.2	802.1

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8u-G (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT - 273.16° TO 1200°C

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Ethene (Ethylene).	C_2H_4	0	81.11	90.01	120.2	168.2	223.9	286.2	354.4	427.4	504.7	586.1	670.8	758.5	848.5	940.8
Propene (Propylene). . . .	C_3H_6	0	68.14	76.93	106.7	154.1	209.4	272.0	340.7	414.7	493.6	576.3	662.6	752.0	844.0	938.4
1-Butene.	C_4H_8	0	66.14	75.29	106.6	156.7	215.0	280.3	351.7	428.2	509.2	594.3	682.8	774.2	868.2	964.6
cis-2-Butene.	"	0	62.35	70.33	98.2	143.8	198.2	260.0	328.4	402.4	481.2	564.5	651.3	741.4	834.3	929.7
trans-2 "	"	0	65.71	74.68	105.2	153.6	209.8	273.4	343.1	418.2	498.1	582.1	669.7	760.2	853.4	949.1
2-Methylpropene (Isobutene)	"	0	63.56	72.76	103.9	153.2	210.6	274.9	345.4	421.0	501.2	585.7	673.7	764.7	858.4	954.2

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

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National Bureau of Standards — Washington, D. C.

TABLE 8u-G (Part 2) - MONOOLEFINS, C_5

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT - 273.16° TO 1200°C

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
1-Pentene.	C_5H_{10}	0	66.93	76.40	108.4	159.3	218.4	284.6	356.8	433.8	515.5	601.2	690.5	782.8	877.6	974.8
cis-2-Pentene	"	0	60.76	69.09	98.0	145.3	201.4	265.3	335.4	411.0	491.7	576.2	664.3	755.8	849.9	946.4
trans-2- "	"	0	64.24	73.42	104.6	154.5	212.8	278.0	349.4	425.9	507.3	592.6	681.4	773.1	867.6	964.6
2-Methyl-1-butene	"	0	62.13	71.30	102.6	152.9	211.3	277.0	348.7	425.6	507.1	592.8	681.7	773.8	868.9	966.0
3- " -1- "	"	0	63.48	73.25	106.3	158.6	218.9	285.8	358.4	436.0	518.2	604.3	693.9	786.5	881.4	978.3
2- " -2- "	"	0	60.88	69.64	99.5	147.5	204.0	267.8	338.1	413.6	493.9	578.4	666.5	757.8	851.8	948.4

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8u-G (Part 3) - MONOOLEFINS, C_6

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b] $(H^o-H^o_0)$, in cal/g [c]														
1-Hexene	C_6H_{12}	0	66.16	75.82	108.1	159.2	219.1	285.4	357.5	435.7	518.	604.	694.	786.	882.	980.
cis-2-Hexene	"	0	62.40	71.04	100.9	149.4	206.7	271.4	342.4	418.4	500.					
trans-2- "	"	0	65.22	74.65	106.5	157.0	215.8	281.8	354.0	431.2	513.					
cis-3- "	"	0	60.05	68.35	97.6	145.8	203.1	267.9	338.9	414.8	496.					
trans-3- "	"	0	63.46	72.66	104.4	155.4	214.6	280.6	353.7	431.3	513.					
2-Methyl-1-pentene . . .	"	0	63.44	72.88	104.8	155.5	214.6	280.6	353.7	431.3	513.					
3- " -1- " . . .	"	0	61.53	71.32	104.5	157.1	217.8	285.1	358.5	436.8	520.					
4- " -1- " . . .	"	0	60.27	69.55	101.4	152.9	213.1	280.3	353.8	431.2	514.					
2- " -2- " . . .	"	0	58.84	67.49	97.4	145.9	203.1	267.9	338.9	414.8	496.					
cis-3-Methyl-2-pentene .	"	0	58.84	67.49	97.4	145.9	203.1	267.9	338.9	414.8	496.					
trans-3- " -2- " .	"	0	58.84	67.49	97.4	145.9	203.1	267.9	338.9	414.8	496.					
cis-4- " -2- " .	"	0	60.05	69.12	100.4	150.8	209.4	274.8	346.9	424.1	506.					
trans-4- " -2- " .	"	0	62.28	72.03	104.8	156.5	216.7	283.1	355.1	433.3	516.					
2-Ethyl-1-butene	"	0	61.05	70.19	101.5	152.1	211.1	277.1	349.2	427.3	510.					
2,3-Dimethyl-1-butene. .	"	0	61.08	70.96	104.2	157.0	217.8	285.1	358.5	436.0	518.					
3,3- " -1- " . .	"	0	56.91	66.29	97.8	148.6	208.3	276.4	351.0	429.8	513.					
2,3- " -2- " . .	"	0	58.94	67.71	97.5	145.4	202.1	265.8	336.5	412.5	493.					

[a] See footnote a of Table 0u-G.

[b] See footnote b of Table 0u-G.

[c] See footnote c of Table 0u-G.

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SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 12u-G - ACETYLENES, C_2 to C_5

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Ethyne (Acetylene)	C_2H_2	0	81.89	91.85	123.9	170.8	221.3	274.6	330.3	388.2	448.0	509.6	572.8	637.5	703.4	770.7
Propyne (Methylacetylene) .	C_3H_4	0	68.67	77.48	106.6	151.3	201.8	257.3	317.1	380.6	447.5	517.2	589.7	664.3	741.0	819.2
1-Butyne (Ethylacetylene) .	C_4H_6	0	61.72	70.63	99.9	145.7	198.2	256.4	319.5	386.9	457.9	532.2	609.4	689.1	771.0	854.8
2- " (Dimethylacetylene)	"	0	64.92	73.23	101.1	144.6	194.8	251.0	312.4	378.2	448.2	521.5	598.0	676.9	758.2	841.5
1-Pentyne	C_5H_8	0	63.39	72.70	103.2	150.6	205.	266.	331.	401.	475.	552.	632.	715.	801.	888.
2- "	"	0	60.22	68.64	96.9	141.5	193.	251.	315.	384.	456.	533.	612.	694.	779.	865.
3-Methyl-1-butyne	"	0	58.27	67.28	97.3	144.8	200.	260.	326.	397.	471.	549.	629.	712.	798.	885.

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

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TABLE 20u-G - NORMAL PARAFFINS, C_1 to C_{20}

HEAT CONTENT, $-(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Methane	CH_4	0	136.51	149.42	191.14	253.82	325.24	405.39	493.70	589.44	692.0	800.3	914.2	1033.2	1156.4	1282.8
Ethane	C_2H_6	0	84.80	94.98	129.25	183.62	247.80	320.92	401.56	488.99	582.0	680.7	783.8	891.1	1002.0	1116.2
Propane	C_3H_8	0	70.21	79.65	112.65	166.25	229.43	301.22	380.41	465.94	556.9	652.7	753.0	856.8	963.7	1073.4
n-Butane	C_4H_{10}	0	70.14	79.92	113.37	166.95	230.05	301.38	379.56	463.61	553.0	647.1	745.2	847.2	952.0	1059.4
n-Pentane	C_5H_{12}	0	68.73	78.56	112.02	165.48	228.18	299.01	376.53	459.90	548.4	641.6	738.6	839.2	942.8	1049.0
n-Hexane	C_6H_{14}	0	67.78	77.65	111.16	164.53	227.12	297.63	374.82	457.57	545.5	637.9	734.3	834.1	936.9	1042.0
n-Heptane	C_7H_{16}	0	67.04	76.98	110.55	163.82	226.25	296.62	373.42	455.92	543.5	635.4	731.2	830.4	932.5	1036.9
n-Octane	C_8H_{18}	0	66.55	76.48	110.08	163.31	225.6	295.9	372.5	454.6	541.9	633.5	728.8	827.6	929.2	1033.0
n-Nonane	C_9H_{20}	0	66.15	76.09	109.71	162.91	225.1	295.2	371.8	453.7	540.6	632.0	727.0	825.4	926.7	1030.0
n-Decane	$C_{10}H_{22}$	0	65.82	75.78	109.42	162.58	224.7	294.8	371.1	452.9	539.7	630.7	725.5	823.7	924.7	1027.7
n-Undecane	$C_{11}H_{24}$	0	65.56	75.52	109.18	162.32	224.4	294.4	370.6	452.2	538.9	629.7	724.3	822.3	923.0	1025.8
n-Dodecane	$C_{12}H_{26}$	0	65.33	75.31	108.98	162.09	224.1	294.0	370.2	451.7	538.2	628.9	723.3	821.1	921.6	1024.2
n-Tridecane	$C_{13}H_{28}$	0	65.14	75.12	108.81	161.90	223.9	293.8	369.8	451.2	537.6	628.2	722.5	820.0	920.5	1022.8
n-Tetradecane	$C_{14}H_{30}$	0	64.98	74.97	108.66	161.74	223.7	293.5	369.5	450.8	537.1	627.6	721.7	819.2	919.5	1021.6
n-Pentadecane	$C_{15}H_{32}$	0	64.84	74.83	108.53	161.60	223.5	293.3	369.3	450.5	536.7	627.1	721.1	818.4	918.6	1020.6
n-Hexadecane	$C_{16}H_{34}$	0	64.72	74.71	108.42	161.48	223.4	293.1	369.0	450.2	536.3	626.6	720.5	817.8	917.8	1019.7
n-Heptadecane	$C_{17}H_{36}$	0	64.61	74.61	108.32	161.37	223.2	293.0	368.8	449.9	536.0	626.2	720.0	817.2	917.2	1018.9
n-Octadecane	$C_{18}H_{38}$	0	64.51	74.52	108.24	161.27	223.1	292.8	368.6	449.7	535.7	625.8	719.6	816.6	916.5	1018.2
n-Nonadecane	$C_{19}H_{40}$	0	64.43	74.43	108.16	161.19	223.0	292.7	368.5	449.5	535.4	625.5	719.2	816.2	916.0	1017.6
n-Eicosane	$C_{20}H_{42}$	0	64.35	74.36	108.09	161.11	222.9	292.6	368.3	449.3	535.2	625.2	718.9	815.8	915.5	1017.0

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

TABLE 21u-G - NORMAL ALKYL BENZENES, C_6 to C_{22}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Benzene	C_6H_6	0	37.58	43.54	64.89	101.00	144.52	194.1	248.5	307.1	369.0	433.9	501.2	570.6	641.8	714.6
Methylbenzene (Toluene)	C_7H_8	0	40.28	46.74	69.51	107.51	153.08	204.9	262.0	323.4	388.4	456.6	527.5	600.6	675.7	752.4
Ethylbenzene	C_8H_{10}	0	43.30	50.25	74.57	114.92	163.02	217.5	277.3	341.4	409.3	480.4	554.2	630.4	708.6	788.5
n-Propylbenzene	C_9H_{12}	0	46.43	53.81	79.36	121.2	171.0	227.3	288.9	354.9	424.7	498.	574.	652.	733.	815.
n-Butylbenzene	$C_{10}H_{14}$	0	48.15	55.81	82.19	125.2	176.2	233.8	296.8	364.2	435.6	510.	588.	668.	751.	835.
n-Amylbenzene	$C_{11}H_{16}$	0	49.54	57.43	84.51	128.5	180.4	239.2	303.3	371.9	444.6	521.	600.	681.	765.	851.
n-Hexylbenzene	$C_{12}H_{18}$	0	50.69	58.76	86.43	131.2	184.0	243.6	308.7	378.3	452.1	529.	609.	692.	778.	865.
n-Heptylbenzene	$C_{13}H_{20}$	0	51.66	59.89	88.05	133.4	186.9	247.3	313.2	383.7	458.3	536.	618.	702.	788.	876.
n-Octylbenzene	$C_{14}H_{22}$	0	52.48	60.85	89.42	135.4	189.4	250.5	317.0	388.2	463.6	543.	625.	709.	797.	885.
n-Nonylbenzene	$C_{15}H_{24}$	0	53.19	61.68	90.61	137.0	191.6	253.2	320.4	392.2	468.2	548.	631.	716.	804.	894.
n-Decylbenzene	$C_{16}H_{26}$	0	53.81	62.40	91.65	138.5	193.5	255.6	323.3	395.6	472.2	552.	636.	722.	811.	901.
n-Undecylbenzene	$C_{17}H_{28}$	0	54.36	63.04	92.56	139.8	195.2	257.7	325.8	398.6	475.8	557.	640.	727.	816.	907.
n-Dodecylbenzene	$C_{18}H_{30}$	0	54.84	63.60	93.37	140.9	196.6	259.6	328.1	401.3	478.9	560.	645.	732.	822.	913.
n-Tridecylbenzene	$C_{19}H_{32}$	0	55.27	64.10	94.09	141.9	198.0	261.2	330.1	403.7	481.7	563.	648.	736.	826.	918.
n-Tetradecylbenzene	$C_{20}H_{34}$	0	55.66	64.55	94.73	142.8	199.2	262.7	331.9	405.8	484.2	566.	651.	740.	830.	922.
n-Pentadecylbenzene	$C_{21}H_{36}$	0	56.01	64.96	95.32	143.6	200.2	264.1	333.5	407.8	486.4	569.	654.	743.	834.	927.
n-Hexadecylbenzene	$C_{22}H_{38}$	0	56.33	65.32	95.85	144.4	201.2	265.3	335.0	409.5	488.5	571.	657.	746.	837.	930.

[a] See footnote a of Table 0u-G. [b] See footnote b of Table 0u-G. [c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 24u-G - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

March 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Ethene (Ethylene)	C_2H_4	0	81.11	90.01	120.2	168.2	223.9	286.2	354.4	427.4	504.7	586.1	670.8	758.5	848.5	940.8
Propene (Propylene)	C_3H_6	0	68.14	76.93	106.7	154.1	209.4	272.0	340.7	414.7	493.6	576.3	662.6	752.0	844.0	938.4
1-Butene	C_4H_8	0	66.14	75.29	106.6	156.7	215.0	280.3	351.7	428.2	509.2	594.3	682.8	774.2	868.2	964.6
1-Pentene	C_5H_{10}	0	66.93	76.40	108.4	159.3	218.4	284.6	356.8	433.8	515.5	601.2	690.5	782.8	877.6	974.8
1-Hexene	C_6H_{12}	0	66.16	75.82	108.1	159.2	219.1	285.4	357.5	435.7	518.	604.	694.	786.	882.	980.
1-Heptene	C_7H_{14}	0	65.79	75.40	107.9	159.3	219.1	286.4	359.5	436.8	520.	607.	696.	789.	885.	984.
1-Octene	C_8H_{16}	0	65.42	75.09	107.7	159.3	219.4	286.9	360.2	437.9	521.	608.	698.	792.	888.	986.
1-Nonene	C_9H_{18}	0	65.14	74.85	107.6	159.4	219.6	287.3	360.8	438.7	522.	610.	700.	793.	890.	989.
1-Decene	$C_{10}H_{20}$	0	64.91	74.66	107.5	159.4	219.7	287.6	361.3	439.4	523.	610.	701.	795.	892.	990.
1-Undecene	$C_{11}H_{22}$	0	64.72	74.50	107.5	159.4	219.9	287.9	361.7	440.0	524.	611.	702.	796.	893.	992.
1-Dodecene	$C_{12}H_{24}$	0	64.57	74.36	107.4	159.4	220.0	288.1	362.0	440.5	524.	612.	703.	797.	894.	993.
1-Tridecene	$C_{13}H_{26}$	0	64.44	74.25	107.4	159.4	220.1	288.2	362.3	440.9	525.	613.	704.	798.	895.	994.
1-Tetradecene	$C_{14}H_{28}$	0	64.32	74.16	107.3	159.5	220.1	288.4	362.5	441.2	525.	613.	704.	798.	896.	995.
1-Pentadecene	$C_{15}H_{30}$	0	64.22	74.08	107.3	159.5	220.2	288.5	362.7	441.5	526.	614.	705.	799.	896.	996.
1-Hexadecene	$C_{16}H_{32}$	0	64.14	74.00	107.2	159.5	220.3	288.6	362.9	441.8	526.	614.	705.	800.	897.	996.
1-Heptadecene	$C_{17}H_{34}$	0	64.06	73.94	107.2	159.5	220.3	288.7	363.0	442.0	526.	614.	706.	800.	898.	997.
1-Octadecene	$C_{18}H_{36}$	0	64.00	73.88	107.2	159.5	220.4	288.8	363.2	442.2	526.	615.	706.	801.	898.	998.
1-Nonadecene	$C_{19}H_{38}$	0	63.94	73.83	107.2	159.5	220.4	288.9	363.3	442.4	527.	615.	706.	801.	898.	998.
1-Eicoeene	$C_{20}H_{40}$	0	63.88	73.78	107.1	159.5	220.4	289.0	363.4	442.5	527.	615.	707.	801.	899.	998.

[a] See footnote a of Table 0u-G.

[b] See footnote b of Table 0u-G.

[c] See footnote c of Table 0u-G.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25u-G - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}
HEAT CONTENT, $(H^o-H^o_0)$, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Content[b], $(H^o-H^o_0)$, in cal/g[c]														
Ethyne (Acetylene)	C_2H_2	0	81.89	91.85	123.9	170.8	221.3	274.6	330.3	388.2	448.0	509.6	572.8	637.5	703.4	770.7
Propyne (Methylacetylene).	C_3H_4	0	68.67	77.48	106.6	151.3	201.8	257.3	317.1	380.6	447.5	517.2	589.7	664.3	741.0	819.2
1-Butyne (Ethylacetylene).	C_4H_6	0	61.72	70.63	99.9	145.7	198.2	256.4	319.5	386.9	457.9	532.2	609.4	689.1	771.0	854.8
1-Pentyne.	C_5H_8	0	63.39	72.70	103.2	150.6	205.	266.	331.	401.	475.	552.	632.	715.	801.	888.
1-Hexyne	C_6H_{10}	0	63.30	72.74	103.7	152.1	208.	270.	337.	409.	484.	564.	646.	731.	819.	908.
1-Heptyne.	C_7H_{12}	0	63.25	72.77	104.2	153.2	210.	273.	341.	414.	491.	572.	656.	742.	831.	922.
1-Octyne	C_8H_{14}	0	63.20	72.79	104.5	154.0	211.	275.	344.	418.	496.	578.	664.	750.	841.	933.
1-Nonyne	C_9H_{16}	0	63.16	72.80	104.8	154.6	212.	277.	347.	421.	500.	582.	669.	757.	848.	941.
1-Decyne	$C_{10}H_{18}$	0	63.13	72.81	105.0	155.1	213.	278.	349.	424.	503.	586.	673.	762.	854.	948.
1-Undecyne	$C_{11}H_{20}$	0	63.10	72.82	105.1	155.5	214.	279.	350.	426.	506.	589.	677.	766.	859.	953.
1-Dodecyne	$C_{12}H_{22}$	0	63.08	72.83	105.2	155.9	214.	280.	351.	427.	508.	592.	680.	770.	863.	958.
1-Tridecyne.	$C_{13}H_{24}$	0	63.06	72.84	105.4	156.2	215.	281.	352.	429.	510.	594.	682.	773.	866.	962.
1-Tetradecyne.	$C_{14}H_{26}$	0	63.05	72.84	105.5	156.4	216.	282.	353.	430.	511.	596.	684.	775.	869.	965.
1-Pentadecyne.	$C_{15}H_{28}$	0	63.04	72.85	105.6	156.6	216.	282.	354.	431.	512.	598.	686.	778.	872.	968.
1-Hexadecyne	$C_{16}H_{30}$	0	63.02	72.85	105.6	156.8	216.	283.	355.	432.	513.	599.	688.	779.	874.	970.
1-Heptadecyne.	$C_{17}H_{32}$	0	63.01	72.86	105.7	157.0	216.	283.	356.	433.	514.	600.	689.	781.	876.	972.
1-Octadecyne	$C_{18}H_{34}$	0	63.00	72.86	105.8	157.1	217.	284.	356.	434.	515.	601.	691.	783.	878.	974.
1-Nonadecyne	$C_{19}H_{36}$	0	63.00	72.86	105.8	157.3	217.	284.	357.	434.	516.	602.	692.	784.	879.	976.
1-Eicosyne	$C_{20}H_{38}$	0	62.99	72.86	105.8	157.4	217.	284.	357.	435.	517.	603.	693.	785.	880.	977.

[a] See footnote a of Table 0u-G.

[b] See footnote b of Table 0u-G.

[c] See footnote c of Table 0u-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 00v - O, H, N, C

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° to 4000°K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Oxygen	O	0	5.236	5.234	5.134	5.080	5.049	5.028	5.015	5.006	4.999	4.994	4.989	4.986	4.984	4.982
Hydrogen	H	0	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968
Nitrogen	N	0	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968
Carbon	C	0	4.980	4.980	4.975	4.972	4.971	4.970	4.970	4.969	4.969	4.969	4.970	4.970	4.972	4.975

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Heat Capacity, C_p^o, in cal/deg mole														
Oxygen	O	4.999	4.988	4.982	4.979	4.978	4.979	4.983	4.992	5.004	5.041	5.092				
Hydrogen	H	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968	4.968				
Nitrogen	N	4.968	4.968	4.968	4.968	4.969	4.972	4.978	4.990	5.011	5.086	5.214				
Carbon	C	4.969	4.970	4.975	4.986	5.008	5.038	5.077	5.121	5.168	5.261	5.344				

[a] Interpolation to other temperatures in the interval 298.16° to 4000°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500°, and 600°K.

[b] C_p^o is the heat capacity at constant pressure of the given substance in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere) at the temperature indicated.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE Ov - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CAPACITY, C_p^o, AT 0° TO 4000°K

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °K												
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Heat Capacity[b], C_p^o, in cal/deg mole[c]													
Oxygen	O_2	gas	0	6.963	6.963		6.962	6.970	7.017	7.019	7.194	7.429	7.670	7.885	8.064	8.212
Hydrogen	H_2	gas	0	9.072	6.729	6.348	6.561	6.775	6.892	6.895	6.974	6.993	7.008	7.035	7.078	7.139
Hydroxyl	OH	gas	0						7.141	7.139	7.074	7.048	7.053	7.087	7.150	7.234
Water	H_2O	gas	0						8.025	8.026	8.185	8.415	8.677	8.959	9.254	9.559
Nitrogen	N_2	gae	0	6.956	6.956	6.956	6.957	6.959	6.960	6.961	6.991	7.070	7.197	7.351	7.512	7.671
Nitric Oxide	NO	gae	0	7.562	7.714	7.451	7.278	7.183	7.137	7.134	7.162	7.289	7.468	7.657	7.833	7.990
Carbon	C	solid, graphite	0		0.394	0.767	1.190	1.632	2.066	2.083	2.851	3.496	4.03	4.43	4.75	4.98
Carbon Monoxide	CO	gas	0	6.955	6.955	6.955	6.956	6.958	6.965	6.965	7.013	7.120	7.276	7.451	7.624	7.787
Carbon Dioxide	CO_2	gae	0						8.874	8.894	9.871	10.662	11.311	11.850	12.300	12.678

Compound	Formula	State	Temperature in °K												
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Heat Capacity, C_p^o, in cal/deg mole													
Oxygen	O_2	gas	8.335	8.440	8.530	8.608	8.676	8.739	8.885	9.024	9.166	9.305	9.418	9.518	9.711	9.879
Hydrogen	H_2	gae	7.217	7.308	7.404	7.505	7.610	7.713	7.957	8.175	8.363	8.526	8.668	8.791	8.993	9.151
Hydroxyl	OH	gae	7.333	7.440	7.551	7.663	7.772	7.875	8.109	8.306	8.474	8.614	8.735	8.840	9.014	9.162
Water	H_2O	gae	9.869	10.172	10.467	10.749	11.015	11.263	11.80	12.24	12.6	12.9	13.1	13.3		
Nitrogen	N_2	gae	7.816	7.947	8.063	8.165	8.253	8.330	8.486	8.602	8.690	8.759	8.816	8.862	8.934	8.989
Nitric Oxide	NO	gas	8.126	8.243	8.342	8.426	8.498	8.560	8.683	8.772	8.840	8.895	8.941	8.981	9.049	9.107
Carbon	C	solid, graphite	5.14	5.27	5.42	5.57	5.67	5.76								
Carbon Monoxide	CO	gae	7.932	8.058	8.167	8.265	8.349	8.419	8.561	8.665	8.744	8.806	8.856	8.899	8.963	9.015
Carbon Dioxide	CO_2	gae	12.995	13.26	13.49	13.68	13.85	13.99	14.3	14.5	14.7	14.8	14.9	15.0	15.2	

[a] Interpolation to other temperatures in the interval 50° to 4000°K may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table OOv.

[c] See footnote c of Table OOv.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1v - PARAFFINS, C_1 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

August 31, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o cal/deg mole[c]														
Methane	CH_4	0	8.536	8.552	9.736	11.133	12.546	13.88	15.10	16.21	17.21	18.09	18.88	19.57	20.18	20.71
Ethane	C_2H_6	0	12.585	12.648	15.68	18.66	21.35	23.72	25.83	27.69	29.33	30.77	32.02	33.11	34.07	34.90
Propane	C_3H_8	0	17.57	17.66	22.54	27.04	30.88	34.20	37.08	39.61	41.83	43.75	45.42	46.89	48.16	49.26
n-Butane	C_4H_{10}	0	23.61	23.77	29.80	35.54	40.42	44.61	48.23	51.42	54.20	56.60	58.72	60.55	62.15	63.51
2-Methylpropane (Isobutane)	"	0	23.14	23.25	29.77	35.62	40.62	44.85	48.49	51.65	54.40	56.81	58.89	60.71	62.29	63.67
n-Pentane	C_5H_{12}	0	29.30	29.51	36.91	43.96	49.88	54.98	59.37	63.21	66.57	69.46	72.01	74.22	76.14	77.76
2-Methylbutane (Isopentane)	"	0	28.83	28.97	37.05	44.23	50.28	55.41	59.80	63.60	66.90	69.80	72.29	74.47	76.37	78.01
2,2-Dimethylpropane (Neopentane)	"	0	29.07	29.21	37.55	45.00	51.21	56.40	60.78	64.55	67.80	70.62	73.04	75.15	76.99	78.60

[a] Interpolation to other temperatures in the interval 298.16° to 1500°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500°, and 600°K.

[b] C_p^o is the heat capacity at constant pressure of the given hydrocarbon in the thermodynamic standard gaseous state of unit fugacity (1 atmosphere).

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 2v (Part 1) - PARAFFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o cal/deg mole[c]														
n - Hexane	C_6H_{14}	0	35.06	35.32	44.04	52.39	59.38	65.35	70.51	75.01	78.94	82.32	85.30	87.89	90.12	92.02
2 - Methylpentane. .	"	0	34.46	34.63	44.0	52.5	59.6	65.7	70.8	75.3	79.2					
3 - " . .	"	0	35.14	35.31	44.6	52.9	59.9	65.9	71.0	75.4	79.3					
2,2 - Dimethylbutane	"	0	34.25	34.43	44.2	53.0	60.4	66.5	71.7	75.9	79.9					
2,3 - "	"	0	34.64	34.84	44.3	52.8	60.0	65.9	71.1	75.5	79.4					

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 2v (Part 2) - PARAFFINS, C_7

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

September 30,1944

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o cal/deg mole[c]														
n - Heptane	C_7H_{16}	0	40.82	41.13	51.18	60.83	68.83	75.71	81.65	86.80	91.31	95.18	98.59	101.56	104.11	106.27
2 - Methylhexane. . . .	"	0	d	d	d	d	d	d	d	d	d					
3 -	"	0	d	d	d	d	d	d	d	d	d					
3 - Ethylpentane. . . .	"	0	d	d	d	d	d	d	d	d	d					
2,2 - Dimethylpentane .	"	0	d	d	d	d	d	d	d	d	d					
2,3 - "	"	0	d	d	d	d	d	d	d	d	d					
2,4 - "	"	0	d	d	d	d	d	d	d	d	d					
3,3 - "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3-Trimethylbutane .	"	0	d	d	d	d	d	d	d	d	d					

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

[d] Until more data become available, the heat capacity of any branched-chain heptane may be taken as equal to that of the normal heptane. The meager data now available indicate that the difference in heat capacity between normal heptane and any of its isomers is not likely to exceed 3 percent.

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TABLE 3v - PARAFFINS, C_8

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

October 31, 1944

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o cal/deg mole[c]														
n-Octane	C_8H_{18}	0	46.58	46.94	58.31	69.27	78.28	86.08	92.79	98.59	103.68	108.04	111.88	115.23	118.10	120.52
2-Methylheptane	"	0	d	d	d	d	d	d	d	d	d					
3- "	"	0	d	d	d	d	d	d	d	d	d					
4- "	"	0	d	d	d	d	d	d	d	d	d					
3-Ethylhexane	"	0	d	d	d	d	d	d	d	d	d					
2,2-Dimethylhexane	"	0	d	d	d	d	d	d	d	d	d					
2,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,5- "	"	0	d	d	d	d	d	d	d	d	d					
3,3- "	"	0	d	d	d	d	d	d	d	d	d					
3,4- "	"	0	d	d	d	d	d	d	d	d	d					
2-Methyl-3-ethylpentane	"	0	d	d	d	d	d	d	d	d	d					
3- " -3- "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3-Trimethylpentane	"	0	d	d	d	d	d	d	d	d	d					
2,2,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,3,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,3,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3,3-Tetramethylbutane	"	0	d	d	d	d	d	d	d	d	d					

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

[d] Until more data become available, the heat capacity of any branched-chain octane may be taken as equal to that of normal octane. The meager data now available indicate that the difference in heat capacity between normal octane and any of its isomers is not likely to exceed 3 percent.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5v - ALKYL BENZENES, C_6 to C_9

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Benzene	C_6H_6	0	19.52	19.65	26.74	32.80	37.74	41.75	45.06	47.83	50.16	52.16	53.86	55.32	56.58	57.67
Methylbenzene (Toluene)	C_7H_8	0	24.80	24.95	33.25	40.54	46.58	51.57	55.72	59.22	62.19	64.73	66.90	68.77	70.38	71.78
Ethylbenzene	C_8H_{10}	0	30.69	30.88	40.76	49.35	56.44	62.28	67.15	71.27	74.77	77.77	80.35	82.57	84.49	86.16
1,2-Dimethylbenzene (o-Xylene)	"	0	31.85	32.02	41.03	49.11	55.98	61.76	66.64	70.80	74.35	77.40	80.02	82.28	84.24	85.93
1,3- " (m- ")	"	0	30.49	30.66	40.03	48.43	55.51	61.43	66.41	70.63	74.23	77.31	79.95	82.22	84.19	85.89
1,4- " (p- ")	"	0	30.32	30.49	39.70	48.06	55.16	61.12	66.14	70.39	74.02	77.13	79.80	82.09	84.07	85.79
n-Propylbenzene	C_9H_{12}	0	36.73	36.99	48.0	57.8	66.0	72.7	78.3	83.1	87.1	90.6	93.6	96.2	98.5	100.4
Isopropylbenzene (Cumene)	"	0	36.26	36.47	48.0	57.9	66.2	72.9	78.6	83.3	87.3	90.8	93.8	96.4	98.6	100.6
1-Methyl-2-ethylbenzene	"	0	37.74	37.94	48.5	57.9	65.8	72.5	78.1	82.8	86.9	90.4	93.5	96.1	98.3	100.3
1- " -3- "	"	0	36.38	36.59	47.5	57.2	65.4	72.1	77.8	82.7	86.8	90.4	93.4	96.0	98.3	100.3
1- " -4- "	"	0	36.22	36.42	47.2	56.9	65.0	71.8	77.6	82.4	86.6	90.2	93.2	95.9	98.2	100.2
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	36.85	37.04	46.9	56.1	64.0	70.9	76.7	81.6	85.9	89.5	92.7	95.4	97.8	99.8
1,2,4- " (Pseudocumene)	"	0	37.10	37.28	47.1	56.2	64.2	71.0	76.8	81.7	86.0	89.6	92.8	95.5	97.8	99.8
1,3,5- " (Mesitylene)	"	0	35.91	36.10	46.41	55.92	64.08	70.99	76.84	81.81	86.07	89.72	92.86	95.56	97.89	99.91

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

TABLE 7v - ALKYL CYCLOHEXANES, C_6 to C_8
HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
April 30, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	25.40	25.58	35.82	45.47	53.83	60.87	66.76	71.68	75.80	79.3	82.2	84.7	86.8	88.6
Methylcyclohexane	C_7H_{14}	0	32.27	32.51	44.35	55.21	64.46	72.23	78.74	84.20	88.79	92.7	96.0	98.8	101.2	103.2
Ethylcyclohexane	C_8H_{16}	0	37.9	38.2	51.6	63.8	74.1	82.8	90.1	96.2	101.3	105.7	109.4	112.5	115.3	117.6
1,1-Dimethylcyclohexane	"	0	36.9	37.2	50.7	63.3	74.1	83.2	90.7	97.0	102.2	106.6	110.3	113.5	116.2	118.4
cis-1,2- "	"	0	37.4	37.7	51.1	63.5	74.0	82.8	90.1	96.3	101.4	105.8	109.5	112.7	115.4	117.7
trans-1,2- "	"	0	38.0	38.3	51.9	64.2	74.6	83.3	90.5	96.6	101.7	106.0	109.7	112.8	115.5	117.8
cis-1,3-[d] "	"	0	37.6	37.9	51.2	63.6	74.2	83.1	90.5	96.7	102.0	106.4	110.1	113.3	116.0	118.3
trans-1,3-[e] "	"	0	37.6	37.9	51.1	63.4	73.8	82.5	89.8	95.9	101.1	105.5	109.2	112.4	115.2	117.5
cis-1,4- "	"	0	37.6	37.9	51.1	63.4	73.8	82.5	89.8	95.9	101.1	105.5	109.2	112.4	115.2	117.5
trans-1,4- "	"	0	37.7	38.0	51.6	64.0	74.6	83.3	90.6	96.8	101.9	106.2	109.9	113.0	115.7	118.0

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8v (Part 1) - MONOOLEFINS, C_2 to C_4
HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c,d]														
Ethene (Ethylene)	C_2H_4	0	10.41	10.45	12.90	15.16	17.10	18.76	20.20	21.46	22.57	23.54	24.39	25.14	25.79	26.36
Propene (Propylene)	C_3H_6	0	15.27	15.34	19.10	22.62	25.70	28.37	30.68	32.70	34.46	35.99	37.32	38.49	39.51	40.39
1-Butene.	C_4H_8	0	21.35	21.45	26.94	31.75	35.82	39.31	42.33	44.95	47.24	49.23	50.96	52.47	53.79	54.93
cis-2-Butene.	"	0	18.86	18.96	24.33	29.39	33.80	37.60	40.87	43.70	46.15	48.28	50.13	51.74	53.13	54.35
trans-2- "	"	0	20.99	21.08	26.02	30.68	34.80	38.38	41.50	44.20	46.58	48.65	50.44	52.00	53.36	54.55
2-Methylpropene (Isobutene).	"	0	21.30	21.39	26.57	31.24	35.30	38.81	41.86	44.53	46.85	48.88	50.63	52.17	53.51	54.68

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

[d] With regard to estimated uncertainties for the above compounds, see footnote c on Tables 8r, 8s, and 8t.

TABLE 8v (Part 2) - MONOOLEFINS, C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
1-Pentene	C_5H_{10}	0	27.39	27.56	34.20	40.25	45.36	49.72	53.48	56.76	59.61	62.08	64.26	66.13	67.78	69.18
cis-2-Pentene	"	0	24.32	24.45	31.57	38.05	43.62	48.25	52.29	55.76	58.78	61.38	63.66	65.61	67.32	68.81
trans-2- "	"	0	26.80	26.92	33.57	39.57	44.70	49.14	52.98	56.31	59.23	61.75	63.96	65.87	67.54	68.98
2-Methyl-1-butene	"	0	26.69	26.82	33.71	39.81	44.97	49.40	53.23	56.54	59.44	61.93	64.13	66.02	67.68	69.12
3- " -1- "	"	0	28.35	28.47	35.26	40.97	45.90	50.15	53.85	57.03	59.83	62.28	64.42	66.28	67.89	69.32
2- " -2- "	"	0	25.49	25.62	32.22	38.33	43.64	48.23	52.22	55.67	58.68	61.28	63.56	65.52	67.23	68.71

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

TABLE 8v (Part 3) - MONOOLEFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
1-Hexene	C_6H_{12}	0	33.08	33.30	41.3	46.7	54.8	60.1	64.6	68.6	72.0	74.9	77.6	79.8	81.8	83.4
cis-2-Hexene	"	0	30.36	30.56	38.8	46.6	53.2	58.7	63.4	67.6	71.2					
trans-2- "	"	0	32.84	33.03	40.8	48.1	54.2	59.6	64.1	68.1	71.6					
cis-3- "	"	0	29.55	29.71	38.5	46.4	53.2	58.7	63.5	67.6	71.2					
trans-3- "	"	0	32.63	32.78	41.1	48.4	54.6	59.8	64.4	68.3	71.8					
2-Methyl-1-pentene	"	0	32.73	32.93	41.0	48.3	54.5	59.8	64.4	68.4	71.8					
3- " -1- "	"	0	34.04	34.19	42.5	49.6	55.6	60.7	65.2	69.0	72.3					
4- " -1- "	"	0	32.61	32.76	41.5	48.9	55.2	60.5	65.1	68.9	72.3					
2- " -2- "	"	0	30.26	30.42	39.0	46.6	53.2	58.6	63.4	67.5	71.1					
cis-3-Methyl-2-pentene	"	0	30.26	30.42	39.0	46.6	53.2	58.6	63.4	67.5	71.1					
trans-3- " -2- "	"	0	30.26	30.42	39.0	46.6	53.2	58.6	63.4	67.5	71.1					
cis-4- " -2- "	"	0	31.92	32.07	40.5	47.8	54.1	59.4	64.0	68.0	71.5					
trans-4- " -2- "	"	0	33.80	33.94	41.9	48.8	54.8	60.0	64.5	68.4	71.8					
2-Ethyl-1-butene	"	0	31.92	32.08	40.7	48.2	54.5	59.8	64.4	68.4	71.9					
2,3-Dimethyl-1-butene	"	0	34.29	34.44	42.6	49.5	55.4	60.5	65.0	68.8	72.2					
3,3- " -1- "	"	0	31.72	31.87	40.6	48.4	55.0	60.6	65.3	69.2	72.7					
2,3- " -2- "	"	0	30.48	30.63	38.6	46.1	52.5	58.0	62.9	67.0	70.7					

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

American Petroleum Institute Research Project 44

National Bureau of Standards

Washington, D. C.

TABLE 12v - ACETYLENES, C_2 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

April 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Ethyne (Acetylene).	C_2H_2	0	10.499	10.532	11.973	12.967	13.728	14.366	14.933	15.449	15.922	16.353	16.744	17.099	17.418	17.704
Propyne (Methylacetylene) .	C_3H_4	0	14.50	14.55	17.33	19.74	21.80	23.58	25.14	26.51	27.71	28.77	29.69	30.50	31.21	31.84
1-Butyne (Ethylacetylene) .	C_4H_6	0	19.46	19.54	23.87	27.63	30.83	33.57	35.95	38.02	39.84	41.42	42.80	44.01	45.06	45.98
2- " (Dimethylacetylene)	"	0	18.63	18.70	22.62	26.36	29.68	32.59	35.14	37.36	39.29	40.98	42.44	43.71	44.82	45.78
1-Pentyne	C_5H_8	0	25.50	25.65	31.1	36.1	40.4	44.0	47.1	49.8	52.2	54.3	56.1	57.7	59.1	60.2
2- "	"	0	23.59	23.69	29.2	34.3	38.7	42.6	45.9	48.9	51.4	53.6	55.6	57.2	58.7	59.9
3-Methyl-1-butyne	"	0	25.02	25.13	31.1	36.2	40.6	44.2	47.4	50.1	52.4	54.5	56.3	57.8	59.2	60.4

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

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SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20v - NORMAL PARAFFINS, C_1 TO C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature [a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Methane	CH_4	0	8.536	8.552	9.736	11.133	12.546	13.88	15.10	16.21	17.21	18.09	18.88	19.57	20.18	20.71
Ethane	C_2H_6	0	12.585	12.648	15.68	18.66	21.35	23.72	25.83	27.69	29.33	30.77	32.02	33.11	34.07	34.90
Propane	C_3H_8	0	17.57	17.66	22.54	27.04	30.88	34.20	37.08	39.61	41.83	43.75	45.42	46.89	48.16	49.26
n-Butane	C_4H_{10}	0	23.61	23.77	29.80	35.54	40.42	44.61	48.23	51.42	54.20	56.60	58.72	60.55	62.15	63.51
n-Pentane	C_5H_{12}	0	29.30	29.51	36.91	43.96	49.88	54.98	59.37	63.21	66.57	69.46	72.01	74.22	76.14	77.76
n-Hexane	C_6H_{14}	0	35.06	35.32	44.04	52.39	59.38	65.35	70.51	75.01	78.94	82.32	85.30	87.89	90.12	92.02
n-Heptane	C_7H_{16}	0	40.82	41.13	51.18	60.83	68.83	75.71	81.65	86.80	91.31	95.18	98.59	101.56	104.11	106.27
n-Octane	C_8H_{18}	0	46.58	46.94	58.31	69.27	78.28	86.08	92.79	98.59	103.68	108.04	111.88	115.23	118.10	120.52
n-Nonane	C_9H_{20}	0	52.34	52.75	65.44	77.71	87.75	96.45	103.93	110.38	116.05	120.90	125.17	128.90	132.09	134.77
n-Decane	$C_{10}H_{22}$	0	58.10	58.56	72.58	86.14	97.21	106.81	115.07	122.18	128.42	133.76	138.46	142.57	146.07	149.03
n-Undecane	$C_{11}H_{24}$	0	63.86	64.37	79.71	94.58	106.68	117.18	126.21	133.97	140.79	146.62	151.75	156.24	160.06	163.28
n-Dodecane	$C_{12}H_{26}$	0	69.62	70.18	86.84	103.02	116.15	127.55	137.35	145.76	153.16	159.48	165.04	169.91	174.05	177.53
n-Tridecane	$C_{13}H_{28}$	0	75.38	75.99	93.98	111.46	125.62	137.92	148.49	157.56	165.53	172.34	178.33	183.58	188.04	191.78
n-Tetradecane	$C_{14}H_{30}$	0	81.14	81.80	101.11	119.89	135.08	148.28	159.63	169.35	177.90	185.20	191.62	197.25	202.02	206.04
n-Pentadecane	$C_{15}H_{32}$	0	86.90	87.61	108.24	128.33	144.55	158.65	170.77	181.14	190.27	198.06	204.91	210.92	216.01	220.29
n-Hexadecane	$C_{16}H_{34}$	0	92.66	93.42	115.37	136.77	154.02	169.02	181.91	192.93	202.64	210.92	218.20	224.59	230.00	234.54
n-Heptedecane	$C_{17}H_{36}$	0	98.42	99.23	122.51	145.20	163.48	179.38	193.05	204.73	215.01	223.78	231.49	238.26	243.98	248.80
n-Octadecane	$C_{18}H_{38}$	0	104.18	105.04	129.64	153.64	172.95	189.75	204.19	216.52	227.38	236.64	244.78	251.93	257.97	263.05
n-Nonadecane	$C_{19}H_{40}$	0	109.94	110.85	136.77	162.08	182.42	200.12	215.33	228.31	239.75	249.50	258.07	265.60	271.96	277.30
n-Eicosane	$C_{20}H_{42}$	0	115.70	116.66	143.91	170.51	191.88	210.48	226.47	240.11	252.12	262.36	271.36	279.27	285.94	291.56
Increment per CH_2 group		0	5.760	5.810	7.133	8.437	9.467	10.367	11.140	11.793	12.370	12.860	13.290	13.670	13.987	14.253

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21v - NORMAL ALKYL BENZENES, C_6 TO C_{22}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Benzene	C_6H_6	0	19.52	19.65	26.74	32.80	37.74	41.75	45.06	47.83	50.16	52.16	53.86	55.32	56.58	57.67
Methylbenzene (Toluene) . .	C_7H_8	0	24.80	24.95	33.25	40.54	46.58	51.57	55.72	59.22	62.19	64.73	66.90	68.77	70.38	71.78
Ethylbenzene.	C_8H_{10}	0	30.69	30.88	40.76	49.35	56.44	62.28	67.15	71.27	74.77	77.77	80.35	82.57	84.49	86.16
n-Propylbenzene	C_9H_{12}	0	36.73	36.99	48.0	57.8	66.0	72.7	78.3	83.1	87.1	90.6	93.6	96.2	98.5	100.4
n-Butylbenzene.	$C_{10}H_{14}$	0	42.42	42.73	55.1	66.3	75.4	83.1	89.4	94.9	99.5	103.5	106.9	109.9	112.5	114.7
n-Amylbenzene	$C_{11}H_{16}$	0	48.18	48.54	62.3	74.7	84.9	93.4	100.6	106.7	111.9	116.3	120.2	123.6	126.5	128.9
n-Hexylbenzene.	$C_{12}H_{18}$	0	53.94	54.35	69.4	83.2	94.4	103.8	111.7	118.4	124.2	129.2	133.5	137.2	140.4	143.2
n-Heptylbenzene	$C_{13}H_{20}$	0	59.70	60.16	76.5	91.6	103.8	114.2	122.9	130.2	136.6	142.1	146.8	150.9	154.4	157.4
n-Octylbenzene.	$C_{14}H_{22}$	0	65.46	65.97	83.6	100.0	113.3	124.5	134.0	142.0	149.0	154.9	160.1	164.6	168.4	171.7
n-Nonylbenzene.	$C_{15}H_{24}$	0	71.22	71.78	90.8	108.5	122.8	134.9	145.1	153.8	161.4	167.8	173.4	178.2	182.4	185.9
n-Decylbenzene.	$C_{16}H_{26}$	0	76.98	77.59	97.9	116.9	132.2	145.3	156.3	165.6	173.7	180.6	186.7	191.9	196.4	200.2
n-Undecylbenzene.	$C_{17}H_{28}$	0	82.74	83.40	105.1	125.3	141.7	155.6	167.4	177.4	186.1	193.5	200.0	205.6	210.4	214.4
n-Dodecylbenzene.	$C_{18}H_{30}$	0	88.50	89.21	112.2	133.8	151.2	166.0	178.6	189.2	198.5	206.4	213.3	219.3	224.4	228.7
n-Tridecylbenzene	$C_{19}H_{32}$	0	94.26	95.02	119.3	142.2	160.6	176.4	189.7	201.0	210.8	219.2	226.6	232.9	238.4	242.9
n-Tetradecylbenzene	$C_{20}H_{34}$	0	100.02	100.83	126.5	150.6	170.1	186.7	200.8	212.8	223.2	232.1	239.8	246.6	252.3	257.2
n-Pentadecylbenzene	$C_{21}H_{36}$	0	105.78	106.64	133.6	159.1	179.6	197.1	212.0	224.6	235.6	244.9	253.1	260.3	266.3	271.4
n-Hexadecylbenzene	$C_{22}H_{38}$	0	111.54	112.45	140.7	167.5	189.0	207.5	223.1	236.4	248.0	257.8	266.4	273.9	280.3	285.7
Increment per CH_2 group		0	5.760	5.810	7.13	8.44	9.47	10.37	11.14	11.79	12.37	12.86	13.29	13.67	13.99	14.25

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 22v - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}
HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Cyclopentane	C_5H_{10}	0	19.82	19.98	28.24	35.86	42.36	47.81	52.44	56.37	59.75	62.68	65.18	67.36	69.24	70.89
Methylcyclopentane	C_6H_{12}	0	26.24	26.46	36.11	44.94	52.43	58.68	64.00	68.53	72.44	75.82	78.72	81.24	83.43	85.35
Ethylcyclopentane.	C_7H_{14}	0	31.93	32.18	43.39	53.55	62.09	69.24	75.31	80.43	84.94	88.81	92.13	95.00	97.51	99.69
n-Propylcyclopentane . . .	C_8H_{16}	0	37.69	37.99	50.5	62.0	71.6	79.6	86.4	92.3	97.3	101.7	105.4	108.7	111.5	113.9
n-Butylcyclopentane. . . .	C_9H_{18}	0	43.45	43.80	57.7	70.4	81.0	90.0	97.6	104.1	109.7	114.5	118.7	122.3	125.5	128.2
n-Pentylcyclopentane . . .	$C_{10}H_{20}$	0	49.21	49.61	64.8	78.9	90.5	100.3	108.7	115.9	122.0	127.4	132.0	136.0	139.5	142.4
n-Hexylcyclopentane. . . .	$C_{11}H_{22}$	0	54.97	55.42	71.9	87.3	100.0	110.7	119.9	127.6	134.4	140.2	145.3	149.7	153.5	156.7
n-Heptylcyclopentane . . .	$C_{12}H_{24}$	0	60.73	61.23	79.1	95.7	109.4	121.1	131.0	139.4	146.8	153.1	158.6	163.4	167.4	171.0
n-Octylcyclopentane. . . .	$C_{13}H_{26}$	0	66.49	67.04	86.2	104.2	118.9	131.4	142.2	151.2	159.2	166.0	171.9	177.0	181.4	185.2
n-Nonylcyclopentane. . . .	$C_{14}H_{28}$	0	72.25	72.85	93.3	112.6	128.4	141.8	153.3	163.0	171.5	178.8	185.2	190.7	195.4	199.5
n-Decylcyclopentane. . . .	$C_{15}H_{30}$	0	78.01	78.66	100.4	121.0	137.8	152.2	164.4	174.8	183.9	191.7	198.4	204.4	209.4	213.7
n-Undecylcyclopentane. . .	$C_{16}H_{32}$	0	83.77	84.47	107.6	129.5	147.3	162.5	175.6	186.6	196.3	204.6	211.7	218.0	223.4	228.0
n-Dodecylcyclopentane. . .	$C_{17}H_{34}$	0	89.53	90.28	114.7	137.9	156.8	172.9	186.7	198.4	208.6	217.4	225.0	231.7	237.4	242.2
n-Tridecylcyclopentane . .	$C_{18}H_{36}$	0	95.29	96.09	121.8	146.4	166.2	183.3	197.8	210.2	221.0	230.3	238.3	245.4	251.4	256.5
n-Tetradecylcyclopentane .	$C_{19}H_{38}$	0	101.05	101.90	129.0	154.8	175.7	193.6	209.0	222.0	233.4	243.1	251.6	259.0	265.4	270.7
n-Pentadecylcyclopentane .	$C_{20}H_{40}$	0	106.81	107.71	136.1	163.2	185.2	204.0	220.1	233.8	245.8	256.0	264.9	272.7	279.3	285.0
n-Hexadecylcyclopentane. .	$C_{21}H_{42}$	0	112.57	113.52	143.2	171.7	194.6	214.4	231.3	245.6	258.1	268.8	278.2	286.4	293.3	299.2
Increment per CH_2 group		0	5.760	5.810	7.13	8.44	9.47	10.37	11.14	11.79	12.37	12.86	13.29	13.67	13.99	14.25

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D C.

TABLE 23v - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Cyclohexane	C_6H_{12}	0	25.40	25.58	35.82	45.47	53.83	60.87	66.76	71.68	75.80	79.3	82.2	84.7	86.8	88.6
Methylcyclohexane	C_7H_{14}	0	32.27	32.51	44.35	55.31	64.46	72.23	78.74	84.20	88.79	92.7	96.0	98.8	101.2	103.2
Ethylcyclohexane	C_8H_{16}	0	37.96	38.23	51.6	63.8	74.1	82.8	90.1	96.2	101.3	105.7	109.4	112.5	115.3	117.6
n-Propylcyclohexane	C_9H_{18}	0	43.59	43.89	58.6	72.1	83.5	93.1	101.1	107.9	113.6	118.6	122.7	126.2	129.3	131.9
n-Butylcyclohexane	$C_{10}H_{20}$	0	49.35	49.70	65.7	80.5	93.0	103.5	112.2	119.7	126.0	131.4	136.0	139.8	143.3	146.1
n-Pentylcyclohexane	$C_{11}H_{22}$	0	55.11	55.51	72.9	89.0	102.4	113.8	123.4	131.5	138.3	144.3	149.3	153.5	157.3	160.4
n-Hexylcyclohexane	$C_{12}H_{24}$	0	60.87	61.32	80.0	97.4	111.9	124.2	134.5	143.3	150.7	157.1	162.6	167.2	171.2	174.6
n-Heptylcyclohexane	$C_{13}H_{26}$	0	66.63	67.13	87.1	105.8	121.4	134.6	145.7	155.1	163.1	170.0	175.8	180.8	185.2	188.9
n-Octylcyclohexane	$C_{14}H_{28}$	0	72.39	72.94	94.3	114.3	130.8	144.9	156.8	166.9	175.4	182.9	189.1	194.5	199.2	203.1
n-Nonylcyclohexane	$C_{15}H_{30}$	0	78.15	78.75	101.4	122.7	140.3	155.3	167.9	178.7	187.8	195.7	202.4	208.2	213.2	217.4
n-Decylcyclohexane	$C_{16}H_{32}$	0	83.91	84.56	108.5	131.2	149.8	165.7	179.1	190.5	200.2	208.6	215.7	221.9	227.2	231.6
n-Undecylcyclohexane	$C_{17}H_{34}$	0	89.67	90.37	115.7	139.6	159.2	176.0	190.2	202.2	212.6	221.4	229.0	235.5	241.2	245.9
n-Dodecylcyclohexane	$C_{18}H_{36}$	0	95.43	96.18	122.8	148.0	168.7	186.4	201.4	214.0	224.9	234.3	242.3	249.2	255.2	260.1
n-Tridecylcyclohexane	$C_{19}H_{38}$	0	101.19	101.99	129.9	156.5	178.2	196.8	212.5	225.8	237.3	247.2	255.6	262.9	269.2	274.4
n-Tetradecylcyclohexane	$C_{20}H_{40}$	0	106.95	107.80	137.1	164.9	187.6	207.1	223.6	237.6	249.7	260.0	268.9	276.5	283.1	288.6
n-Pentadecylcyclohexane	$C_{21}H_{42}$	0	112.71	113.61	144.2	173.3	197.1	217.5	234.8	249.4	262.0	272.9	282.2	290.2	297.1	302.9
n-Hexadecylcyclohexane	$C_{22}H_{44}$	0	118.47	119.42	151.3	181.8	206.6	227.9	245.9	261.2	274.4	285.7	295.5	303.9	311.1	317.1
Increment per CH_2 group		0	5.760	5.813	7.13	8.44	9.47	10.37	11.14	11.79	12.37	12.86	13.29	13.67	13.99	14.25

[a] See footnote a of Table 1v. [b] See footnote b of Table 1v. [c] See footnote c of Table 1v.

TABLE 24v - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Ethene (Ethylene)	C_2H_4	0	10.41	10.45	12.90	15.16	17.10	18.76	20.20	21.46	22.57	23.54	24.39	25.14	25.79	26.36
Propene (Propylene)	C_3H_6	0	15.27	15.34	19.10	22.62	25.70	28.37	30.68	32.70	34.46	35.99	37.32	38.49	39.51	40.39
1-Butene.	C_4H_8	0	21.35	21.45	26.94	31.75	35.82	39.31	42.33	44.95	47.24	49.23	50.96	52.47	53.79	54.93
1-Pentene	C_5H_{10}	0	27.39	27.56	34.20	40.25	45.36	49.72	53.48	56.76	59.61	62.08	64.26	66.13	67.78	69.18
1-Hexene.	C_6H_{12}	0	33.08	33.30	41.3	48.7	54.8	60.1	64.6	68.6	72.0	74.9	77.6	79.8	81.8	83.4
1-Heptene	C_7H_{14}	0	38.84	39.11	48.4	57.1	64.3	70.5	75.8	80.4	84.4	87.8	90.8	93.5	95.8	97.7
1-Octene.	C_8H_{16}	0	44.60	44.92	55.6	65.5	73.8	80.8	86.9	92.1	96.7	100.7	104.1	107.1	109.7	111.9
1-Nonene.	C_9H_{18}	0	50.36	50.73	62.7	74.0	83.3	91.2	98.0	103.9	109.1	113.5	117.4	120.8	123.7	126.2
1-Decene.	$C_{10}H_{20}$	0	56.12	56.54	69.8	82.4	92.7	101.6	109.2	115.7	121.5	126.4	130.7	134.5	137.7	140.4
1-Undecene.	$C_{11}H_{22}$	0	61.88	62.35	77.0	90.9	102.2	111.9	120.3	127.5	133.8	139.2	144.0	148.2	151.7	154.7
1-Dodecene.	$C_{12}H_{24}$	0	67.64	68.16	84.1	99.3	111.7	122.3	131.5	139.3	146.2	152.1	157.3	161.8	165.7	168.9
1-Tridecene	$C_{13}H_{26}$	0	73.40	73.97	91.2	107.7	121.1	132.7	142.6	151.1	158.6	165.0	170.6	175.5	179.7	183.2
1-Tetradecene	$C_{14}H_{28}$	0	79.16	79.78	98.4	116.2	130.6	143.0	153.7	162.9	170.9	177.8	183.9	189.2	193.7	197.4
1-Pentadecene	$C_{15}H_{30}$	0	84.92	85.59	105.5	124.6	140.1	153.4	164.9	174.7	183.3	190.7	197.2	202.8	207.7	211.7
1-Hexadecene.	$C_{16}H_{32}$	0	90.68	91.40	112.6	133.0	149.5	163.8	176.0	186.5	195.7	203.5	210.5	216.5	221.7	225.9
1-Heptadecene	$C_{17}H_{34}$	0	96.44	97.21	119.8	141.5	159.0	174.1	187.2	198.3	208.1	216.4	223.7	230.2	235.7	240.2
1-Octadecene.	$C_{18}H_{36}$	0	102.20	103.02	126.9	149.9	168.5	184.5	198.3	210.1	220.4	229.3	237.0	243.8	249.6	254.5
1-Nonadecene.	$C_{19}H_{38}$	0	107.96	108.83	134.0	158.3	177.9	194.9	209.4	221.9	232.8	242.1	250.3	257.5	263.6	268.7
1-Eicosene.	$C_{20}H_{40}$	0	113.72	114.64	141.2	166.8	187.4	205.2	220.6	233.7	245.2	255.0	263.6	271.2	277.6	283.0
Increment per CH_2 group . .		0	5.760	5.810	7.13	8.44	9.47	10.37	11.14	11.79	12.37	12.86	13.29	13.67	13.99	14.25

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

TABLE 25v - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT 0° TO 1500°K

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat Capacity[b], C_p^o, in cal/deg mole[c]														
Ethyne (Acetylene)	C_2H_2	0	10.499	10.532	11.973	12.967	13.728	14.366	14.933	15.449	15.922	16.353	16.744	17.099	17.418	17.704
Propyne (Methylacetylene).	C_3H_4	0	14.50	14.55	17.33	19.74	21.80	23.58	25.14	26.51	27.71	28.77	29.69	30.50	31.21	31.84
1-Butyne (Ethylacetylene).	C_4H_6	0	19.46	19.54	23.87	27.63	30.83	33.57	35.95	38.02	39.84	41.42	42.80	44.01	45.06	45.98
1-Pentyne.	C_5H_8	0	25.50	25.65	31.1	36.1	40.4	44.0	47.1	49.8	52.2	54.3	56.1	57.7	59.1	60.2
1-Hexyne	C_6H_{10}	0	31.19	31.39	38.2	44.6	49.8	54.4	58.2	61.6	64.6	67.1	69.4	71.3	73.0	74.5
1-Heptyne.	C_7H_{12}	0	36.95	37.20	45.4	53.0	59.3	64.7	69.4	73.4	77.0	80.0	82.7	85.0	87.0	88.7
1-Octyne	C_8H_{14}	0	42.71	43.01	52.5	61.4	68.8	75.1	80.5	85.2	89.3	92.8	96.0	98.7	101.0	103.0
1-Nonyne	C_9H_{16}	0	48.47	48.82	59.6	69.8	78.3	85.4	91.7	97.0	101.7	105.7	109.3	112.3	115.0	117.2
1-Decyne	$C_{10}H_{18}$	0	54.23	54.63	66.8	78.3	87.7	95.8	102.8	108.8	114.1	118.6	122.6	126.0	129.0	131.5
1-Undecyne	$C_{11}H_{20}$	0	59.99	60.44	73.9	86.7	97.2	106.2	113.9	120.6	126.4	131.4	135.8	139.7	143.0	145.8
1-Dodecyne	$C_{12}H_{22}$	0	65.75	66.25	81.0	95.2	106.7	116.6	125.1	132.4	138.8	144.3	149.1	153.4	157.0	160.0
1-Tridecyne.	$C_{13}H_{24}$	0	71.51	72.06	88.2	103.6	116.1	126.9	136.2	144.2	151.2	157.2	162.4	167.0	170.9	174.3
1-Tetradecyne.	$C_{14}H_{26}$	0	77.27	77.87	95.3	112.0	125.6	137.3	147.4	156.0	163.5	170.0	175.7	180.7	184.9	188.5
1-Pentadecyne.	$C_{15}H_{28}$	0	83.03	83.68	102.4	120.5	135.1	147.7	158.5	167.8	175.9	182.9	189.0	194.4	198.9	202.8
1-Hexadecyne	$C_{16}H_{30}$	0	88.79	89.49	109.6	128.9	144.5	158.0	169.6	179.6	188.3	195.7	202.3	208.0	212.9	217.0
1-Heptadecyne.	$C_{17}H_{32}$	0	94.55	95.30	116.7	137.4	154.0	168.4	180.8	191.4	200.6	208.6	215.6	221.7	226.9	231.3
1-Octadecyne	$C_{18}H_{34}$	0	100.31	101.11	123.8	145.8	163.5	178.8	191.9	203.1	213.0	221.4	228.9	235.4	240.9	245.5
1-Nonadecyne	$C_{19}H_{36}$	0	106.07	106.92	131.0	154.2	172.9	189.1	203.1	214.9	225.4	234.3	242.2	249.0	254.9	259.8
1-Eicosyne	$C_{20}H_{38}$	0	111.83	112.73	138.1	162.7	182.4	199.5	214.2	226.7	237.8	247.2	255.4	262.7	268.8	274.0
Increment per CH_2 group		0	5.760	5.810	7.13	8.44	9.47	10.37	11.14	11.79	12.37	12.86	13.29	13.67	13.99	14.25

[a] See footnote a of Table 1v.

[b] See footnote b of Table 1v.

[c] See footnote c of Table 1v.

TABLE Ov-E - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CAPACITY, C_p^o, AT -459.69° TO 2200°F

November 30, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °F													
			-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
			Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Oxygen	O_2	gas	0	0.2178	0.2182	0.2188	0.2189	0.2191	0.2197	0.2225	0.2262	0.2303	0.2345	0.2387	0.2426	0.2462
Hydrogen	H_2	gas	0	3.364	3.390	3.408	3.412	3.416	3.425	3.449	3.461	3.466	3.469	3.473	3.479	3.487
Hydroxyl	OH	gas	0	0.4220	0.4209	0.4201	0.4198	0.4196	0.4189	0.4166	0.4151	0.4143	0.4140	0.4143	0.4151	0.4164
Water	H_2O	gas	0	0.4431	0.4438	0.4446	0.4448	0.4452	0.4459	0.4505	0.4566	0.4637	0.4714	0.4796	0.4881	0.4969
Nitrogen	N_2	gas	0	0.2481	0.2482	0.2482	0.2483	0.2483	0.2483	0.2488	0.2498	0.2514	0.2535	0.2561	0.2591	0.2622
Nitric Oxide	NO	gas	0	0.2386	0.2381	0.2378	0.2377	0.2377	0.2375	0.2378	0.2392	0.2416	0.2446	0.2480	0.2515	0.2550
Carbon	C	solid, graphite	0	0.1398	0.1531	0.1648	0.1681	0.1719	0.1809	0.2170	0.2499	0.2797	0.3068	0.331	0.351	0.369
Carbon Monoxide	CO	gas	0	0.2482	0.2483	0.2484	0.2484	0.2485	0.2486	0.2494	0.2509	0.2530	0.2557	0.2589	0.2623	0.2658
Carbon Dioxide	CO_2	gas	0	0.1904	0.1952	0.1991	0.2003	0.2015	0.2046	0.2172	0.2284	0.2384	0.2473	0.2553	0.2625	0.2690

Compound	Formula	State	Temperature in °F													
			900	1000	1100	1200	1300	1400	1500	1600	1700	1688	1900	2000	2100	2200
			Heat Capacity, C_p^o, in BTU/lb deg F													
Oxygen	O_2	gas	0.2495	0.2524	0.2550	0.2574	0.2595	0.2614	0.2632	0.2649	0.2664	0.2678	0.2691	0.2703	0.2714	0.2725
Hydrogen	H_2	gas	3.498	3.512	3.528	3.547	3.568	3.592	3.617	3.643	3.670	3.698	3.726	3.755	3.784	3.812
Hydroxyl	OH	gas	0.4183	0.4206	0.4233	0.4263	0.4295	0.4329	0.4364	0.4400	0.4437	0.4473	0.4510	0.4546	0.4580	0.4614
Water	H_2O	gas	0.5059	0.5152	0.5245	0.5340	0.5436	0.5531	0.5624	0.5716	0.5806	0.5894	0.5979	0.6062	0.6141	0.6218
Nitrogen	N_2	gas	0.2654	0.2686	0.2718	0.2748	0.2777	0.2804	0.2830	0.2854	0.2876	0.2897	0.2916	0.2934	0.2950	0.2966
Nitric Oxide	NO	gas	0.2583	0.2615	0.2644	0.2671	0.2697	0.2720	0.2741	0.2760	0.2778	0.2794	0.2809	0.2822	0.2835	0.2846
Carbon	C	solid, graphite	0.384	0.398	0.409	0.418	0.425	0.431	0.437	0.444	0.451	0.458	0.465	0.469	0.473	0.478
Carbon Monoxide	CO	gas	0.2693	0.2727	0.2759	0.2790	0.2819	0.2846	0.2870	0.2893	0.2914	0.2934	0.2952	0.2969	0.2985	0.2999
Carbon Dioxide	CO_2	gas	0.2750	0.2803	0.2852	0.2896	0.2936	0.2972	0.3005	0.3035	0.3063	0.3088	0.3111	0.3133	0.3153	0.3170

[a] Interpolation to other temperatures in the interval 0° to 2200°F may be made by appropriate graphical or analytical methods. For temperatures between -100° and 0°F, values may be estimated by extrapolating to lower temperatures the values for 0°, 100°, 200° and 300°F.

[b] C_p^o is the heat capacity at constant pressure of the given substance in its appropriate standard state at the temperature indicated. The appropriate standard state is: (a) for a gas, the thermodynamic standard gaseous state of unit fugacity (1 atmosphere); and (b) for a solid, the solid (crystalline) form indicated at the pressure of one atmosphere.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 1v-E - PARAFFINS, C_1 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

November 30, 1944

Compound (Gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Methane	CH_4	0	0.5074	0.5168	0.5258	0.5285	0.5318	0.5398	0.5737	0.6250	0.6735	0.7229	0.7718	0.8191	0.8645
Ethane	C_2H_6	0	0.3769	0.3940	0.4092	0.4136	0.4183	0.4312	0.4872	0.5434	0.5986	0.6510	0.7000	0.7457	0.7882
Propane	C_3H_8	0	0.3498	0.3699	0.3875	0.3925	0.3982	0.4126	0.4744	0.5343	0.5911	0.6432	0.6907	0.7345	0.7750
n-Butane	C_4H_{10}	0	0.3634	0.3813	0.3971	0.4017	0.4060	0.4200	0.4777	0.5349	0.5899	0.6404	0.6862	0.7282	0.7669
2-Methylpropane (Isobutane)	"	0	0.3468	0.3681	0.3865	0.3918	0.3979	0.4125	0.4754	0.5352	0.5911	0.6425	0.6894	0.7321	0.7711
n-Pentane	C_5H_{12}	0	0.3643	0.3818	0.3974	0.4019	0.4059	0.4199	0.4769	0.5336	0.5880	0.6376	0.6823	0.7235	0.7615
2-Methylbutane (Isopentane)	"	0	0.3482	0.3695	0.3880	0.3933	0.3993	0.4140	0.4769	0.5363	0.5916	0.6420	0.6877	0.7294	0.7674
2,2-Dimethylpropane (Neopentane)	"	0	0.3504	0.3721	0.3910	0.3964	0.4027	0.4177	0.4826	0.5441	0.6015	0.6536	0.7004	0.7427	0.7811

Compound (Gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Methane	CH_4	0.9076	0.9486	0.9874	1.024	1.059	1.091	1.121	1.149	1.176	1.201	1.224	1.245	1.265	1.283
Ethane	C_2H_6	0.8282	0.8656	0.9005	0.9329	0.9632	0.9914	1.018	1.042	1.064	1.085	1.104	1.122	1.139	1.154
Propane	C_3H_8	0.8124	0.8470	0.8793	0.9094	0.9374	0.9632	0.9869	1.009	1.029	1.048	1.066	1.082	1.097	1.111
n-Butane	C_4H_{10}	0.8026	0.8357	0.8666	0.8953	0.9218	0.9463	0.9688	0.9900	1.010	1.028	1.044	1.060	1.074	1.087
2-Methylpropane (Isobutane)	"	0.8070	0.8401	0.8707	0.8991	0.9253	0.9498	0.9724	0.9933	1.013	1.030	1.047	1.062	1.077	1.090
n-Pentane	C_5H_{12}	0.7963	0.8286	0.8585	0.8864	0.9123	0.9360	0.9579	0.9784	0.9974	1.015	1.031	1.046	1.060	1.072
2-Methylbutane (Isopentane)	"	0.8023	0.8345	0.8642	0.8916	0.9170	0.9406	0.9626	0.9827	1.001	1.019	1.035	1.049	1.063	1.076
2,2-Dimethylpropane (Neopentane)	"	0.8161	0.8480	0.8775	0.9046	0.9296	0.9527	0.9741	0.9937	1.012	1.028	1.044	1.058	1.072	1.084

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2v-E (Part 1) - PARAFFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69°F TO 2200°F

December 31, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
n-Hexane	C_6H_{14}	0	0.3661	0.3832	0.3984	0.4028	0.4066	0.4205	0.4768	0.5329	0.5868	0.6360	0.6802	0.7206	0.7578
2-Methylpentane	"	0	0.3515	0.3716	0.389	0.394	0.400	0.414	0.475	0.533	0.588	0.638	0.683	0.724	0.762
3- "	"	0	0.3587	0.3791	0.397	0.402	0.408	0.422	0.482	0.540	0.593	0.642	0.686	0.727	0.764
2,2-Dimethylbutane	"	0	0.3464	0.3676	0.386	0.391	0.397	0.412	0.476	0.536	0.593	0.645	0.692	0.733	0.771
2,3- "	"	0	0.3526	0.3732	0.391	0.396	0.402	0.416	0.478	0.537	0.592	0.642	0.687	0.728	0.764

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Hexane	C_6H_{14}	0.7921	0.8238	0.8532	0.8805	0.9058	0.9291	0.9505	0.9705	0.9892	1.006	1.022	1.037	1.050	1.063
2-Methylpentane	"	0.796	0.827	0.857	0.884	0.909									
3- "	"	0.798	0.829	0.858	0.885	0.910									
2,2-Dimethylbutane	"	0.806	0.837	0.865	0.890	0.916									
2,3- "	"	0.799	0.830	0.859	0.886	0.911									

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

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TABLE 2v-E (Part 2) - PARAFFINS, C_7

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
n-Heptane	C_7H_{16}	0	0.3675	0.3842	0.3992	0.4035	0.4071	0.4210	0.4767	0.5325	0.5861	0.6347	0.6781	0.7181	0.7550
2-Methylhexane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3-Ethylpentane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2-Dimethylpentane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3,3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2,3-Trimethylbutane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Heptane	C_7H_{16}	0.7890	0.8203	0.8493	0.8762	0.9012	0.9241	0.9452	0.9649	0.9833	1.000	1.016	1.030	1.043	1.055
2-Methylhexane	"	d	d	d	d	d									
3- "	"	d	d	d	d	d									
3-Ethylpentane	"	d	d	d	d	d									
2,2-Dimethylpentane	"	d	d	d	d	d									
2,3- "	"	d	d	d	d	d									
2,4- "	"	d	d	d	d	d									
3,3- "	"	d	d	d	d	d									
2,2,3-Trimethylbutane	"	d	d	d	d	d									

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

[d] Until more data become available, the heat capacity of any branched-chain heptane may be taken as equal to that of normal heptane. The meager data now available indicate that the difference in heat capacity between normal heptane and any of its isomers is not likely to exceed 3 percent.

TABLE 3v-E - PARAFFINS, C_8

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
n-Octane	C_8H_{18}	0	0.3687	0.3851	0.3998	0.4041	0.4075	0.4213	0.4765	0.5321	0.5856	0.6338	0.6766	0.7163	0.7530
2-Methylheptane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3-Ethylhexane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2-Dimethylhexane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,5- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3,3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3,4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2-Methyl-3-ethylpentane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
3- " -3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2,3-Trimethylpentane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2,4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,3,3- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,3,4- "	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d
2,2,3,3-Tetramethylbutane	"	0	d	d	d	d	d	d	d	d	d	d	d	d	d

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Octane	C_8H_{18}	0.7867	0.8177	0.8463	0.8729	0.8977	0.9204	0.9412	0.9607	0.9788	0.9956	1.011	1.025	1.038	1.050
2-Methylheptane	"	d	d	d	d	d									
3- "	"	d	d	d	d	d									
4- "	"	d	d	d	d	d									
3-Ethylhexane	"	d	d	d	d	d									
2,2-Dimethylhexane	"	d	d	d	d	d									
2,3- "	"	d	d	d	d	d									
2,4- "	"	d	d	d	d	d									
2,5- "	"	d	d	d	d	d									
3,3- "	"	d	d	d	d	d									
3,4- "	"	d	d	d	d	d									
2-Methyl-3-ethylpentane	"	d	d	d	d	d									
3- " -3- "	"	d	d	d	d	d									
2,2,3-Trimethylpentane	"	d	d	d	d	d									
2,2,4- "	"	d	d	d	d	d									
2,3,3- "	"	d	d	d	d	d									
2,3,4- "	"	d	d	d	d	d									
2,2,3,3-Tetramethylbutane	"	d	d	d	d	d									

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

[d] Until more data become available, the heat capacity of any branched-chain octane may be taken as equal to that of normal octane. The meager data now available indicate that the difference in heat capacity between normal octane and any of its isomers is not likely to exceed 3 percent.

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National Bureau of Standards — Washington, D. C.

TABLE 5v-E (Part 1) - ALKYL BENZENES, C_6 to C_8

HEAT CAPACITY, C_p^o FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Benzene	C_6H_6	0	0.2101	0.2265	0.2404	0.2448	0.2487	0.2619	0.3131	0.3604	0.4035	0.4421	0.4764	0.5068	0.5341
Methylbenzene (Toluene)	C_7H_8	0	0.2300	0.2461	0.2599	0.2641	0.2690	0.2809	0.3316	0.3791	0.4231	0.4628	0.4984	0.5304	0.5592
Ethylbenzene	C_8H_{10}	0	0.2487	0.2654	0.2795	0.2839	0.2889	0.3014	0.3538	0.4026	0.4476	0.4882	0.5244	0.5569	0.5862
1,2-Dimethylbenzene (o-Xylene)	"	0	0.2628	0.2781	0.2914	0.2953	0.2998	0.3110	0.358	0.4039	0.4462	0.4850	0.5202	0.5522	0.5813
1,3- " (m- ")	"	0	0.2491	0.2647	0.2782	0.2823	0.2870	0.2986	0.3482	0.3952	0.4392	0.4793	0.5156	0.5485	0.5782
1,4- " (p- ")	"	0	0.2488	0.2639	0.2769	0.2809	0.2855	0.2968	0.3454	0.3919	0.4357	0.4758	0.5123	0.5453	0.5753

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Benzene	C_6H_6	0.5586	0.5807	0.6008	0.6190	0.6356	0.6507	0.6646	0.6774	0.6890	0.6998	0.7096	0.7187	0.7271	0.7348
Methylbenzene (Toluene)	C_7H_8	0.5853	0.6089	0.6304	0.6499	0.6678	0.6842	0.6992	0.7130	0.7256	0.7373	0.7480	0.7578	0.7669	0.7754
Ethylbenzene	C_8H_{10}	0.6126	0.6366	0.6586	0.6786	0.6969	0.7137	0.7291	0.7433	0.7563	0.7683	0.7794	0.7896	0.7990	0.8077
1,2-Dimethylbenzene (o-Xylene)	"	0.6078	0.6319	0.6540	0.6743	0.6929	0.7099	0.7256	0.7400	0.7533	0.7655	0.7767	0.7871	0.7967	0.8055
1,3- " (m- ")	"	0.6052	0.6298	0.6523	0.6728	0.6916	0.7089	0.7247	0.7392	0.7526	0.7649	0.7762	0.7866	0.7962	0.8051
1,4- " (p- ")	"	0.6025	0.6273	0.6500	0.6707	0.6896	0.7070	0.7230	0.7377	0.7512	0.7636	0.7750	0.7855	0.7952	0.8042

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5v-E (Part 2) - ALKYL BENZENES, C_9

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o in BTU/lb deg F[c]													
n-Propylbenzene	C_9H_{12}	0	0.2671	0.2830	0.2968	0.3010	0.3054	0.3180	0.369	0.418	0.464	0.505	0.542	0.575	0.604
Isopropylbenzene (Cumene)	"	0	0.2591	0.2767	0.2917	0.2962	0.3015	0.3143	0.368	0.418	0.464	0.506	0.543	0.576	0.606
1-Methyl-2-ethylbenzene	"	0	0.2755	0.2914	0.3050	0.3091	0.3138	0.3256	0.375	0.422	0.465	0.505	0.541	0.573	0.602
1- " -3- "	"	0	0.2634	0.2796	0.2934	0.2977	0.3025	0.3146	0.366	0.414	0.459	0.500	0.537	0.570	0.600
1- " -4- "	"	0	0.2632	0.2788	0.2923	0.2964	0.3012	0.3130	0.363	0.411	0.456	0.497	0.534	0.567	0.597
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	0.2710	0.2857	0.2986	0.3023	0.3064	0.3171	0.363	0.407	0.450	0.489	0.526	0.559	0.589
1,2,4- " (Pseudocumene)	"	0	0.2735	0.2880	0.3007	0.3044	0.3085	0.3190	0.365	0.409	0.451	0.491	0.527	0.560	0.590
1,3,5- " (Mesitylene)	"	0	0.2616	0.2769	0.2903	0.2942	0.2986	0.3097	0.3577	0.4040	0.4481	0.4887	0.5257	0.5595	0.5902

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Propylbenzene	C_9H_{12}	0.631	0.656	0.678	0.699	0.717	0.735	0.750	0.765	0.779	0.791	0.802	0.813	0.823	0.832
Isopropylbenzene (Cumene)	"	0.633	0.658	0.680	0.701	0.719	0.736	0.752	0.767	0.780	0.792	0.804	0.814	0.824	0.833
1-Methyl-2-ethylbenzene	"	0.629	0.654	0.676	0.697	0.716	0.733	0.749	0.764	0.777	0.790	0.801	0.812	0.822	0.831
1- " -3- "	"	0.627	0.652	0.675	0.695	0.715	0.732	0.748	0.763	0.777	0.789	0.801	0.811	0.821	0.830
1- " -4- "	"	0.625	0.650	0.673	0.694	0.713	0.730	0.747	0.762	0.775	0.788	0.800	0.810	0.820	0.829
1,2,3-Trimethylbenzene (Hemimellitene)	"	0.617	0.642	0.666	0.687	0.707	0.725	0.741	0.757	0.771	0.784	0.796	0.807	0.817	0.826
1,2,4- " (Pseudocumene)	"	0.618	0.643	0.667	0.688	0.708	0.726	0.742	0.757	0.771	0.784	0.796	0.807	0.817	0.827
1,3,5- " (Mesitylene)	"	0.6182	0.5438	0.6671	0.6886	0.7082	0.7262	0.7428	0.7581	0.7721	0.7850	0.7968	0.8078	0.8179	0.8272

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

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National Bureau of Standards — Washington, D. C.

TABLE 8v-E (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Ethene (Ethylene)	C_2H_4	0	0.3324	0.3483	0.3622	0.3662	0.3708	0.3820	0.4308	0.4780	0.5229	0.5642	0.6019	0.6365	0.6682
Propene (Propylene)	C_3H_6	0	0.3239	0.3400	0.3541	0.3581	0.3627	0.3742	0.4241	0.4727	0.5192	0.5626	0.6026	0.6396	0.6737
1-Butene	C_4H_8	0	0.3348	0.3539	0.3703	0.3750	0.3803	0.3933	0.4484	0.4998	0.5475	0.5909	0.6304	0.6667	0.7001
cis-2-Butene	"	0	0.2948	0.3119	0.3269	0.3311	0.3359	0.3483	0.4016	0.4539	0.5041	0.5508	0.5938	0.6333	0.6696
trans-2- "	"	0	0.3358	0.3516	0.3654	0.3694	0.3739	0.3852	0.4343	0.4824	0.5286	0.5719	0.6121	0.6492	0.6835
2-Methylpropene (Isobutene)	"	0	0.3374	0.3549	0.3701	0.3744	0.3794	0.3915	0.4433	0.4925	0.5387	0.5816	0.6211	0.6576	0.6912

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Ethene (Ethylene)	C_2H_4	0.6976	0.7248	0.7501	0.7737	0.7956	0.8160	0.8349	0.8525	0.8688	0.8841	0.8983	0.9114	0.9235	0.9347
Propene (Propylene)	C_3H_6	0.7051	0.7342	0.7613	0.7863	0.8096	0.8310	0.8509	0.8693	0.8863	0.9022	0.9170	0.9306	0.9432	0.9549
1-Butene	C_4H_8	0.7310	0.7594	0.7857	0.8101	0.8328	0.8538	0.8731	0.8911	0.9077	0.9231	0.9373	0.9506	0.9629	0.9742
cis-2-Butene	"	0.7031	0.7339	0.7623	0.7886	0.8128	0.8352	0.8560	0.8751	0.8929	0.9093	0.9245	0.9385	0.9514	0.9634
trans-2- "	"	0.7154	0.7448	0.7719	0.7971	0.8207	0.8425	0.8627	0.8812	0.8984	0.9143	0.9291	0.9427	0.9554	0.9672
2-Methylpropene (Isobutene)	"	0.7223	0.7512	0.7780	0.8028	0.8257	0.8471	0.8668	0.8850	0.9018	0.9175	0.9320	0.9455	0.9580	0.9695

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8v-E (Part 2) - MONOOLEFINS, C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature [a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity [b], C_p^o, in BTU/lb deg F [c]													
1-Pentene	C_5H_{10}	0	0.3491	0.3665	0.3817	0.3861	0.3903	0.4033	0.4563	0.5072	0.5552	0.5990	0.6387	0.6751	0.7084
cis-2-Pentene	"	0	0.3012	0.3201	0.3366	0.3412	0.3466	0.3598	0.4167	0.4711	0.5225	0.5700	0.6133	0.6522	0.6875
trans-2- "	"	0	0.3392	0.3570	0.3725	0.3769	0.3820	0.3943	0.4475	0.4981	0.5457	0.5894	0.6293	0.6661	0.7001
2-Methyl-1-butene	"	0	0.3353	0.3542	0.3705	0.3751	0.3803	0.3934	0.4486	0.5006	0.5489	0.5930	0.6331	0.6699	0.7038
3- " -1- "	"	0	0.3564	0.3766	0.3936	0.3984	0.4040	0.4172	0.4720	0.5216	0.5667	0.6083	0.6467	0.6820	0.7145
2- " -2- "	"	0	0.3220	0.3392	0.3542	0.3585	0.3632	0.3756	0.4282	0.4791	0.5275	0.5725	0.6139	0.6520	0.6872

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
1-Pentene	C_5H_{10}	0.7391	0.7675	0.7939	0.8163	0.8408	0.8616	0.8809	0.8989	0.9156	0.9309	0.9451	0.9584	0.9706	0.9817
cis-2-Pentene	"	0.7205	0.7509	0.7788	0.8046	0.8285	0.8505	0.8707	0.8896	0.9071	0.9230	0.9378	0.9515	0.9642	0.9760
trans-2- "	"	0.7315	0.7605	0.7872	0.8121	0.8352	0.8565	0.8761	0.8944	0.9114	0.9270	0.9414	0.9548	0.9672	0.9786
2-Methyl-1-butene	"	0.7352	0.7640	0.7906	0.8153	0.8383	0.8593	0.8787	0.8969	0.9138	0.9292	0.9435	0.9569	0.9692	0.9806
3- " -1- "	"	0.7448	0.7726	0.7982	0.8219	0.8441	0.8647	0.8838	0.9015	0.9179	0.9331	0.9472	0.9601	0.9721	0.9834
2- " -2- "	"	0.7198	0.7499	0.7776	0.8033	0.8271	0.8490	0.8693	0.8882	0.9057	0.9217	0.9365	0.9502	0.9629	0.9746

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

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TABLE 8v-E (Part 3; page 1) - MONOOLEFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
1-Hexene	C_6H_{12}	0	0.3529	0.3698	0.3846	0.3889	0.3928	0.4059	0.4590	0.511	0.560	0.604	0.643	0.680	0.714
cis-2-Hexene	"	0	0.3199	0.3369	0.3519	0.3562	0.3605	0.3736	0.4281	0.482	0.534	0.581	0.624	0.662	0.697
trans-2- "	"	0	0.3515	0.3676	0.3818	0.3859	0.3900	0.4023	0.4538	0.504	0.553	0.596	0.636	0.673	0.708
cis-3- "	"	0	0.3035	0.3231	0.3405	0.3454	0.3509	0.3646	0.4233	0.479	0.531	0.579	0.623	0.662	0.697
trans-3- "	"	0	0.3415	0.3608	0.3774	0.3821	0.3875	0.4006	0.4563	0.508	0.556	0.600	0.641	0.677	0.710
2-Methyl-1-pentene	"	0	0.3464	0.3643	0.3798	0.3842	0.3887	0.4018	0.4556	0.507	0.555	0.599	0.640	0.676	0.710
3- " -1- "	"	0	0.3570	0.3769	0.3939	0.3987	0.4042	0.4175	0.4733	0.524	0.571	0.614	0.653	0.688	0.721
4- " -1- "	"	0	0.3368	0.3581	0.3762	0.3813	0.3872	0.4012	0.4600	0.514	0.562	0.607	0.648	0.685	0.718
2- " -2- "	"	0	0.3121	0.3319	0.3490	0.3538	0.3593	0.3729	0.4303	0.484	0.534	0.581	0.624	0.661	0.696

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
1-Hexene	C_6H_{12}	0.744	0.773	0.799	0.824	0.847	0.867	0.886	0.904	0.921	0.936	0.950	0.964	0.976	0.987
cis-2-Hexene	"	0.729	0.759	0.787	0.813	0.837									
trans-2- "	"	0.738	0.767	0.794	0.818	0.842									
cis-3- "	"	0.730	0.760	0.787	0.813	0.836									
trans-3- "	"	0.741	0.770	0.796	0.821	0.844									
2-Methyl-1-pentene	"	0.741	0.770	0.797	0.822	0.844									
3- " -1- "	"	0.751	0.780	0.805	0.828	0.850									
4- " -1- "	"	0.750	0.778	0.804	0.827	0.850									
2- " -2- "	"	0.728	0.759	0.786	0.811	0.835									

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8v-E (Part 3: page 2) - MONOOLEFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
cis-3-Methyl-2-pentene.	C_6H_{12}	0	0.3121	0.3319	0.3490	0.3538	0.3593	0.3729	0.4303	0.484	0.534	0.581	0.624	0.661	0.696
trans-3- " -2- "	"	0	0.3121	0.3319	0.3490	0.3538	0.3593	0.3729	0.4303	0.484	0.534	0.581	0.624	0.661	0.696
cis-4- " -2- "	"	0	0.3314	0.3515	0.3686	0.3734	0.3790	0.3925	0.4490	0.501	0.549	0.594	0.635	0.672	0.705
trans-4- " -2- "	"	0	0.3563	0.3753	0.3915	0.3961	0.4014	0.4140	0.4674	0.517	0.562	0.604	0.643	0.679	0.712
2-Ethyl-1-butene	"	0	0.3312	0.3513	0.3686	0.3735	0.3790	0.3928	0.4504	0.504	0.554	0.599	0.639	0.676	0.710
2,3-Dimethyl-1-butene	"	0	0.3601	0.3800	0.3970	0.4017	0.4072	0.4204	0.4752	0.525	0.571	0.612	0.650	0.686	0.718
3,3- " -1- "	"	0	0.3295	0.3492	0.3662	0.3710	0.3767	0.3902	0.4485	0.504	0.555	0.602	0.645	0.684	0.720
2,3- " -2- "	"	0	0.3217	0.3383	0.3530	0.3572	0.3620	0.3741	0.4269	0.479	0.528	0.574	0.616	0.654	0.689

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
cis-3-Methyl-2-pentene.	C_6H_{12}	0.728	0.759	0.786	0.811	0.835									
trans-3- " -2- "	"	0.728	0.759	0.786	0.811	0.835									
cis-4- " -2- "	"	0.737	0.766	0.792	0.817	0.840									
trans-4- " -2- "	"	0.743	0.771	0.797	0.822	0.844									
2-Ethyl-1-butene.	"	0.741	0.770	0.797	0.822	0.845									
2,3-Dimethyl-1-butene	"	0.749	0.777	0.803	0.826	0.849									
3,3- " -1- "	"	0.752	0.781	0.807	0.831	0.854									
2,3- " -2- "	"	0.722	0.753	0.780	0.806	0.830									

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

TABLE 12v-E - ACETYLENES, C_2 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Ethyne (Acetylene)	C_2H_2	0	0.3719	0.3854	0.3966	0.3996	0.4030	0.4114	0.4434	0.4692	0.4902	0.5082	0.5239	0.5382	5514
Propyne (Methylacetylene)	C_3H_4	0	0.3290	0.3427	0.3545	0.3578	0.3616	0.3710	0.4100	0.4462	0.4797	0.5103	0.5384	0.5642	0.5882
1-Butyne (Ethylacetylene)	C_4H_6	0	0.3218	0.3377	0.3513	0.3552	0.3595	0.3703	0.4155	0.4573	0.4959	0.5311	0.5633	0.5929	0.6202
2- " (Dimethylacetylene)	"	0	0.3130	0.3259	0.3372	0.3404	0.3441	0.3534	0.3939	0.4337	0.4721	0.5082	0.5419	0.5731	0.6021
1-Pentyne	C_5H_8	0	0.3393	0.3541	0.3670	0.3707	0.3741	0.385	0.430	0.474	0.514	0.552	0.586	0.617	0.645
2- "	"	0	0.3107	0.3254	0.3383	0.3419	0.3461	0.357	0.402	0.445	0.486	0.525	0.561	0.594	0.625
3-Methyl-1-butyne	"	0	0.3251	0.3428	0.3579	0.3622	0.3671	0.379	0.428	0.474	0.515	0.554	0.589	0.620	0.649

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Ethyne (Acetylene)	C_2H_2	0.5638	0.5754	0.5865	0.5971	0.6072	0.6168	0.6259	0.6345	0.6426	0.6504	0.6577	0.6646	0.6711	0.6772
Propyne (Methylacetylene)	C_3H_4	0.6104	0.6310	0.6503	0.6682	0.6849	0.7004	0.7148	0.7282	0.7407	0.7522	0.7630	0.7730	0.7822	0.7908
1-Butyne (Ethylacetylene)	C_4H_6	0.6453	0.6686	0.6902	0.7103	0.7289	0.7462	0.7622	0.7770	0.7908	0.8035	0.8153	0.8263	0.8364	0.8459
2- " (Dimethylacetylene)	"	0.6290	0.6540	0.6771	0.6985	0.7184	0.7368	0.7538	0.7695	0.7841	0.7975	0.8100	0.8215	0.8321	0.8420
1-Pentyne	C_5H_8	0.671	0.696	0.718	0.739	0.759	0.776	0.793	0.809	0.823	0.836	0.848	0.860	0.870	0.880
2- "	"	0.653	0.679	0.703	0.726	0.746	0.766	0.783	0.800	0.815	0.829	0.842	0.854	0.865	0.875
3-Methyl-1-butyne	"	0.675	0.699	0.722	0.742	0.761	0.779	0.796	0.811	0.826	0.839	0.851	0.862	0.873	0.882

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

TABLE 20v-E (Part 1) - NORMAL PARAFFINS, C_1 to C_{10}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Methane	CH_4	0	0.5074	0.5168	0.5258	0.5285	0.5318	0.5398	0.5797	0.6250	0.6735	0.7229	0.7718	0.8191	0.8645
Ethane	C_2H_6	0	0.3769	0.3940	0.4092	0.4136	0.4183	0.4312	0.4872	0.5434	0.5986	0.6510	0.7000	0.7457	0.7882
Propane	C_3H_8	0	0.3498	0.3699	0.3875	0.3925	0.3982	0.4126	0.4744	0.5343	0.5911	0.6432	0.6907	0.7345	0.7750
n-Butane	C_4H_{10}	0	0.3634	0.3813	0.3971	0.4017	0.4060	0.4200	0.4777	0.5349	0.5899	0.6404	0.6862	0.7282	0.7669
n-Pentane	C_5H_{12}	0	0.3643	0.3818	0.3974	0.4019	0.4059	0.4199	0.4769	0.5336	0.5880	0.6376	0.6823	0.7235	0.7615
n-Hexane	C_6H_{14}	0	0.3661	0.3832	0.3984	0.4028	0.4066	0.4205	0.4768	0.5329	0.5868	0.6360	0.6802	0.7206	0.7578
n-Heptane	C_7H_{16}	0	0.3675	0.3842	0.3992	0.4035	0.4071	0.4210	0.4767	0.5325	0.5861	0.6347	0.6781	0.7181	0.7550
n-Octane	C_8H_{18}	0	0.3687	0.3851	0.3998	0.4041	0.4075	0.4213	0.4765	0.5321	0.5856	0.6338	0.6766	0.7163	0.7530
n-Nonane	C_9H_{20}	0	0.3695	0.3857	0.4003	0.4045	0.4078	0.4216	0.4765	0.5318	0.5851	0.6330	0.6756	0.7150	0.7514
n-Decane	$C_{10}H_{22}$	0	0.3702	0.3862	0.4006	0.4048	0.4081	0.4218	0.4764	0.5316	0.5847	0.6324	0.6747	0.7139	0.7502

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Methane	CH_4	0.9076	0.9486	0.9874	1.024	1.059	1.091	1.121	1.149	1.176	1.201	1.224	1.245	1.265	1.283
Ethane	C_2H_6	0.8282	0.8656	0.9005	0.9329	0.9632	0.9914	1.018	1.042	1.064	1.085	1.104	1.122	1.139	1.154
Propane	C_3H_8	0.8124	0.8470	0.8793	0.9094	0.9374	0.9632	0.9869	1.009	1.029	1.048	1.066	1.082	1.097	1.111
n-Butane	C_4H_{10}	0.8026	0.8357	0.8666	0.8953	0.9218	0.9463	0.9688	0.9900	1.010	1.028	1.044	1.060	1.074	1.087
n-Pentane	C_5H_{12}	0.7963	0.8286	0.8585	0.8864	0.9123	0.9360	0.9579	0.9784	0.9974	1.015	1.031	1.046	1.060	1.072
n-Hexane	C_6H_{14}	0.7921	0.8238	0.8532	0.8805	0.9058	0.9291	0.9505	0.9705	0.9892	1.006	1.022	1.037	1.050	1.063
n-Heptane	C_7H_{16}	0.7890	0.8203	0.8493	0.8762	0.9012	0.9241	0.9452	0.9649	0.9833	1.000	1.016	1.030	1.043	1.055
n-Octane	C_8H_{18}	0.7867	0.8177	0.8463	0.8729	0.8977	0.9204	0.9412	0.9607	0.9788	0.9956	1.011	1.025	1.038	1.050
n-Nonane	C_9H_{20}	0.7849	0.8157	0.8440	0.8704	0.8949	0.9174	0.9381	0.9573	0.9753	0.9920	1.007	1.021	1.034	1.046
n-Decane	$C_{10}H_{22}$	0.7834	0.8141	0.8422	0.8684	0.8927	0.9151	0.9356	0.9547	0.9725	0.9890	1.004	1.018	1.031	1.042

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

TABLE 20v-E (Part 2) - NORMAL PARAFFINS, C_{11} to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
n-Undecane	$C_{11}H_{24}$	0	0.3707	0.3866	0.4010	0.4051	0.4083	0.4220	0.4764	0.5314	0.5844	0.6320	0.6740	0.7130	0.7491
n-Dodecane	$C_{12}H_{26}$	0	0.3712	0.3870	0.4012	0.4054	0.4085	0.4221	0.4763	0.5312	0.5842	0.6316	0.6734	0.7123	0.7482
n-Tridecane	$C_{13}H_{28}$	0	0.3716	0.3873	0.4014	0.4055	0.4086	0.4222	0.4763	0.5311	0.5840	0.6312	0.6729	0.7116	0.7475
n-Tetradecane	$C_{14}H_{30}$	0	0.3719	0.3875	0.4016	0.4057	0.4087	0.4224	0.4763	0.5310	0.5838	0.6309	0.6725	0.7111	0.7469
n-Pentadecane	$C_{15}H_{32}$	0	0.3722	0.3877	0.4018	0.4059	0.4088	0.4225	0.4762	0.5309	0.5836	0.6307	0.6721	0.7106	0.7463
n-Hexadecane	$C_{16}H_{34}$	0	0.3724	0.3879	0.4019	0.4060	0.4089	0.4225	0.4762	0.5308	0.5835	0.6305	0.6718	0.7102	0.7458
n-Heptadecane	$C_{17}H_{36}$	0	0.3726	0.3881	0.4020	0.4061	0.4090	0.4226	0.4762	0.5307	0.5834	0.6303	0.6715	0.7099	0.7454
n-Octadecane	$C_{18}H_{38}$	0	0.3728	0.3882	0.4021	0.4062	0.4091	0.4227	0.4762	0.5306	0.5833	0.6301	0.6713	0.7096	0.7450
n-Nonadecane	$C_{19}H_{40}$	0	0.3730	0.3884	0.4022	0.4063	0.4092	0.4227	0.4762	0.5306	0.5832	0.6299	0.6710	0.7093	0.7447
n-Eicosane	$C_{20}H_{42}$	0	0.3732	0.3885	0.4023	0.4064	0.4092	0.4228	0.4762	0.5305	0.5831	0.6298	0.6708	0.7090	0.7444

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Undecane	$C_{11}H_{24}$	0.7823	0.8127	0.8407	0.8667	0.8909	0.9131	0.9335	0.9525	0.9702	0.9866	1.002	1.016	1.028	1.040
n-Dodecane	$C_{12}H_{26}$	0.7813	0.8116	0.8394	0.8653	0.8894	0.9115	0.9318	0.9507	0.9683	0.9847	0.9998	1.014	1.026	1.037
n-Tridecane	$C_{13}H_{28}$	0.7804	0.8107	0.8384	0.8641	0.8882	0.9102	0.9303	0.9491	0.9666	0.9830	0.9980	1.012	1.024	1.035
n-Tetradecane	$C_{14}H_{30}$	0.7797	0.8098	0.8375	0.8631	0.8871	0.9090	0.9291	0.9478	0.9652	0.9815	0.9965	1.010	1.022	1.034
n-Pentadecane	$C_{15}H_{32}$	0.7791	0.8091	0.8367	0.8622	0.8861	0.9080	0.9280	0.9466	0.9640	0.9802	0.9952	1.009	1.021	1.032
n-Hexadecane	$C_{16}H_{34}$	0.7785	0.8085	0.8360	0.8615	0.8853	0.9071	0.9270	0.9456	0.9630	0.9791	0.9940	1.008	1.020	1.031
n-Heptadecane	$C_{17}H_{36}$	0.7780	0.8080	0.8354	0.8608	0.8845	0.9063	0.9262	0.9447	0.9620	0.9782	0.9930	1.007	1.019	1.030
n-Octadecane	$C_{18}H_{38}$	0.7776	0.8075	0.8348	0.8602	0.8839	0.9056	0.9254	0.9439	0.9612	0.9773	0.9921	1.006	1.018	1.029
n-Nonadecane	$C_{19}H_{40}$	0.7772	0.8071	0.8343	0.8596	0.8833	0.9049	0.9248	0.9432	0.9604	0.9765	0.9913	1.005	1.017	1.028
n-Eicosane	$C_{20}H_{42}$	0.7769	0.8067	0.8339	0.8592	0.8828	0.9044	0.9242	0.9426	0.9598	0.9758	0.9906	1.004	1.016	1.027

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21v-E (Part 1)- NORMAL ALKYL BENZENES, C_6 to C_{13}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Benzene	C_6H_6	0	0.2101	0.2265	0.2404	0.2448	0.2497	0.2619	0.3131	0.3604	0.4035	0.4421	0.4764	0.5068	0.5341
Methylbenzene (Toluene)	C_7H_8	0	0.2300	0.2461	0.2599	0.2641	0.2690	0.2809	0.3316	0.3791	0.4231	0.4628	0.4984	0.5304	0.5592
Ethylbenzene	C_8H_{10}	0	0.2487	0.2654	0.2795	0.2839	0.2889	0.3014	0.3538	0.4026	0.4476	0.4882	0.5244	0.5569	0.5862
n-Propylbenzene	C_9H_{12}	0	0.2671	0.2830	0.2968	0.3010	0.3054	0.3180	0.369	0.418	0.464	0.505	0.542	0.575	0.604
n-Butylbenzene	$C_{10}H_{14}$	0	0.2776	0.2936	0.3074	0.3116	0.3159	0.3286	0.380	0.430	0.476	0.518	0.555	0.588	0.618
n-Amylbenzene	$C_{11}H_{16}$	0	0.2870	0.3028	0.3165	0.3208	0.3248	0.3376	0.389	0.439	0.486	0.528	0.565	0.599	0.630
n-Hexylbenzene	$C_{12}H_{18}$	0	0.2947	0.3104	0.3241	0.3283	0.3322	0.3450	0.397	0.447	0.494	0.536	0.574	0.608	0.639
n-Heptylbenzene	$C_{13}H_{20}$	0	0.3012	0.3168	0.3304	0.3346	0.3384	0.3513	0.403	0.454	0.501	0.544	0.581	0.616	0.647

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Benzene	C_6H_6	0.5586	0.5807	0.6008	0.6190	0.6356	0.6507	0.6646	0.6774	0.6890	0.6998	0.7096	0.7187	0.7271	0.7348
Methylbenzene (Toluene)	C_7H_8	0.5853	0.6089	0.6304	0.6499	0.6678	0.6842	0.6992	0.7130	0.7256	0.7373	0.7480	0.7578	0.7669	0.7754
Ethylbenzene	C_8H_{10}	0.6126	0.6366	0.6586	0.6786	0.6969	0.7137	0.7291	0.7433	0.7563	0.7683	0.7794	0.7896	0.7990	0.8077
n-Propylbenzene	C_9H_{12}	0.631	0.656	0.678	0.699	0.717	0.735	0.750	0.765	0.779	0.791	0.802	0.813	0.823	0.832
n-Butylbenzene	$C_{10}H_{14}$	0.646	0.671	0.694	0.714	0.734	0.751	0.767	0.782	0.796	0.809	0.821	0.831	0.841	0.850
n-Amylbenzene	$C_{11}H_{16}$	0.658	0.683	0.706	0.727	0.747	0.765	0.781	0.796	0.810	0.823	0.835	0.846	0.856	0.866
n-Hexylbenzene	$C_{12}H_{18}$	0.667	0.693	0.716	0.738	0.758	0.776	0.792	0.808	0.822	0.835	0.848	0.859	0.869	0.878
n-Heptylbenzene	$C_{13}H_{20}$	0.675	0.701	0.725	0.747	0.767	0.785	0.802	0.818	0.832	0.846	0.858	0.869	0.879	0.889

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

TABLE 21v-E (Part 2) - NORMAL ALKYL BENZENES, C_{14} to C_{22}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
n-Octylbenzene	$C_{14}H_{22}$	0	0.3067	0.3222	0.3359	0.3400	0.3437	0.3566	0.409	0.459	0.507	0.550	0.588	0.622	0.654
n-Nonylbenzene	$C_{15}H_{24}$	0	0.3115	0.3270	0.3406	0.3447	0.3483	0.3612	0.413	0.464	0.512	0.555	0.593	0.628	0.660
n-Decylbenzene	$C_{16}H_{26}$	0	0.3156	0.3310	0.3446	0.3488	0.3523	0.3653	0.417	0.468	0.517	0.560	0.598	0.633	0.665
n-Undecylbenzene	$C_{17}H_{28}$	0	0.3193	0.3346	0.3482	0.3523	0.3558	0.3688	0.421	0.472	0.520	0.564	0.602	0.637	0.669
n-Dodecylbenzene	$C_{18}H_{30}$	0	0.3226	0.3378	0.3514	0.3555	0.3589	0.3719	0.424	0.475	0.524	0.567	0.606	0.641	0.673
n-Tridecylbenzene	$C_{19}H_{32}$	0	0.3254	0.3407	0.3542	0.3583	0.3617	0.3747	0.427	0.478	0.527	0.571	0.609	0.644	0.677
n-Tetradecylbenzene	$C_{20}H_{34}$	0	0.3280	0.3433	0.3568	0.3608	0.3642	0.3772	0.429	0.481	0.530	0.574	0.612	0.647	0.680
n-Pentadecylbenzene	$C_{21}H_{36}$	0	0.3304	0.3456	0.3591	0.3631	0.3664	0.3795	0.431	0.483	0.532	0.576	0.615	0.650	0.683
n-Hexadecylbenzene	$C_{22}H_{38}$	0	0.3325	0.3477	0.3612	0.3652	0.3685	0.3815	0.434	0.485	0.535	0.579	0.617	0.653	0.685

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
n-Octylbenzene	$C_{14}H_{22}$	0.682	0.709	0.732	0.754	0.775	0.793	0.810	0.826	0.841	0.854	0.867	0.878	0.888	0.898
n-Nonylbenzene	$C_{15}H_{24}$	0.688	0.715	0.739	0.761	0.781	0.800	0.817	0.833	0.848	0.862	0.874	0.886	0.896	0.906
n-Decylbenzene	$C_{16}H_{26}$	0.694	0.720	0.744	0.767	0.787	0.806	0.823	0.839	0.854	0.868	0.881	0.892	0.903	0.912
n-Undecylbenzene	$C_{17}H_{28}$	0.698	0.725	0.749	0.772	0.792	0.811	0.829	0.845	0.860	0.874	0.886	0.898	0.909	0.918
n-Dodecylbenzene	$C_{18}H_{30}$	0.702	0.729	0.754	0.776	0.797	0.816	0.834	0.850	0.865	0.879	0.892	0.903	0.914	0.924
n-Tridecylbenzene	$C_{19}H_{32}$	0.706	0.733	0.757	0.780	0.801	0.820	0.838	0.854	0.869	0.883	0.896	0.908	0.919	0.928
n-Tetradecylbenzene	$C_{20}H_{34}$	0.709	0.736	0.761	0.784	0.805	0.824	0.842	0.858	0.873	0.887	0.900	0.912	0.923	0.933
n-Pentadecylbenzene	$C_{21}H_{36}$	0.712	0.739	0.764	0.787	0.808	0.827	0.845	0.862	0.877	0.891	0.904	0.916	0.927	0.937
n-Hexadecylbenzene	$C_{22}H_{38}$	0.715	0.742	0.767	0.790	0.811	0.830	0.848	0.865	0.880	0.894	0.907	0.919	0.930	0.940

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 24v-E (Part 1) - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{11}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200°F

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °F: -459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Ethene (Ethylene)	C_2H_4	0	0.3324	0.3483	0.3622	0.3662	0.3708	0.3820	0.4308	0.4780	0.5229	0.5642	0.6019	0.6365	0.6682
Propene (Propylene)	C_3H_6	0	0.3239	0.3400	0.3541	0.3581	0.3627	0.3742	0.4241	0.4727	0.5192	0.5626	0.6026	0.6396	0.6737
1-Butene	C_4H_8	0	0.3348	0.3539	0.3703	0.3750	0.3803	0.3933	0.4484	0.4998	0.5475	0.5909	0.6304	0.6667	0.7001
1-Pentene	C_5H_{10}	0	0.3491	0.3665	0.3817	0.3861	0.3903	0.4033	0.4563	0.5072	0.5552	0.5990	0.6387	0.6751	0.7084
1-Hexene	C_6H_{12}	0	0.3529	0.3698	0.3846	0.3889	0.3928	0.4059	0.4590	0.511	0.560	0.604	0.643	0.680	0.714
1-Heptene	C_7H_{14}	0	0.3564	0.3729	0.3874	0.3916	0.3953	0.4084	0.4612	0.513	0.562	0.607	0.647	0.681	0.718
1-Octene	C_8H_{16}	0	0.3589	0.3751	0.3895	0.3937	0.3972	0.4104	0.4630	0.515	0.565	0.609	0.649	0.686	0.720
1-Nonene	C_9H_{18}	0	0.3608	0.3768	0.3911	0.3952	0.3987	0.4118	0.4644	0.517	0.567	0.611	0.651	0.688	0.722
1-Decene	$C_{10}H_{20}$	0	0.3624	0.3782	0.3924	0.3965	0.3998	0.4130	0.4656	0.518	0.568	0.613	0.653	0.690	0.724
1-Undecene	$C_{11}H_{22}$	0	0.3636	0.3794	0.3935	0.3976	0.4008	0.4140	0.4665	0.519	0.569	0.614	0.654	0.691	0.725

Compound (gas)	Formula	Temperature in °F: 900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Ethene (Ethylene)	C_2H_4	0.6976	0.7248	0.7501	0.7737	0.7956	0.8160	0.8349	0.8525	0.8688	0.8841	0.8983	0.9114	0.9235	0.9347
Propene (Propylene)	C_3H_6	0.7051	0.7342	0.7613	0.7863	0.8096	0.8310	0.8509	0.8693	0.8863	0.9022	0.9170	0.9306	0.9432	0.9549
1-Butene	C_4H_8	0.7310	0.7594	0.7857	0.8101	0.8328	0.8538	0.8731	0.8911	0.9077	0.9231	0.9373	0.9506	0.9629	0.9742
1-Pentene	C_5H_{10}	0.7391	0.7675	0.7939	0.8183	0.8408	0.8616	0.8809	0.8989	0.9156	0.9309	0.9451	0.9584	0.9706	0.9817
1-Hexene	C_6H_{12}	0.744	0.773	0.799	0.824	0.847	0.867	0.886	0.904	0.921	0.936	0.950	0.964	0.976	0.987
1-Heptene	C_7H_{14}	0.748	0.777	0.803	0.828	0.850	0.871	0.890	0.908	0.924	0.940	0.954	0.968	0.980	0.990
1-Octene	C_8H_{16}	0.751	0.780	0.806	0.831	0.853	0.874	0.893	0.910	0.927	0.943	0.957	0.970	0.982	0.993
1-Nonene	C_9H_{18}	0.753	0.782	0.808	0.833	0.856	0.876	0.895	0.913	0.929	0.945	0.959	0.972	0.984	0.995
1-Decene	$C_{10}H_{20}$	0.755	0.784	0.810	0.834	0.857	0.878	0.897	0.914	0.931	0.947	0.961	0.974	0.986	0.997
1-Undecene	$C_{11}H_{22}$	0.756	0.785	0.811	0.836	0.859	0.879	0.898	0.916	0.932	0.948	0.962	0.976	0.988	0.998

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

TABLE 24v-E (Part 2) - NORMAL MONOOLEFINS (1-ALKENES), C_{12} to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 459.69° TO 2200° F

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
1-Dodecene	$C_{12}H_{24}$	0	0.3647	0.3803	0.3944	0.3984	0.4016	0.4148	0.4673	0.520	0.570	0.615	0.655	0.692	0.726
1-Tridecene	$C_{13}H_{26}$	0	0.3656	0.3811	0.3951	0.3992	0.4023	0.4155	0.4680	0.521	0.571	0.616	0.656	0.693	0.727
1-Tetradecene	$C_{14}H_{28}$	0	0.3663	0.3818	0.3957	0.3998	0.4029	0.4161	0.4685	0.521	0.572	0.617	0.657	0.694	0.728
1-Pentadecene	$C_{15}H_{30}$	0	0.3670	0.3824	0.3963	0.4003	0.4034	0.4166	0.4690	0.522	0.572	0.618	0.658	0.694	0.729
1-Hexadecene	$C_{16}H_{32}$	0	0.3676	0.3829	0.3968	0.4008	0.4038	0.4171	0.4694	0.522	0.573	0.618	0.658	0.695	0.729
1-Heptadecene	$C_{17}H_{34}$	0	0.3681	0.3834	0.3972	0.4012	0.4042	0.4175	0.4698	0.523	0.574	0.619	0.659	0.696	0.730
1-Octadecene	$C_{18}H_{36}$	0	0.3685	0.3838	0.3976	0.4016	0.4045	0.4178	0.4702	0.523	0.574	0.619	0.659	0.696	0.730
1-Nonadecene	$C_{19}H_{38}$	0	0.3689	0.3842	0.3979	0.4019	0.4048	0.4181	0.4705	0.523	0.574	0.620	0.660	0.697	0.731
1-Eicosene	$C_{20}H_{40}$	0	0.3693	0.3845	0.3982	0.4022	0.4051	0.4184	0.4707	0.524	0.575	0.620	0.660	0.697	0.731

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
1-Dodecene	$C_{12}H_{24}$	0.758	0.786	0.812	0.837	0.860	0.880	0.899	0.917	0.934	0.949	0.964	0.977	0.989	0.999
1-Tridecene	$C_{13}H_{26}$	0.758	0.787	0.814	0.838	0.861	0.881	0.900	0.918	0.935	0.950	0.965	0.978	0.990	1.000
1-Tetradecene	$C_{14}H_{28}$	0.759	0.788	0.814	0.839	0.862	0.882	0.901	0.919	0.936	0.951	0.966	0.979	0.990	1.001
1-Pentadecene	$C_{15}H_{30}$	0.760	0.789	0.815	0.840	0.862	0.883	0.902	0.920	0.936	0.952	0.966	0.979	0.991	1.002
1-Hexadecene	$C_{16}H_{32}$	0.761	0.790	0.816	0.840	0.863	0.884	0.903	0.920	0.937	0.953	0.967	0.980	0.992	1.002
1-Heptadecene	$C_{17}H_{34}$	0.761	0.790	0.816	0.841	0.864	0.884	0.903	0.921	0.938	0.953	0.968	0.980	0.992	1.003
1-Octadecene	$C_{18}H_{36}$	0.762	0.791	0.817	0.841	0.864	0.885	0.904	0.922	0.938	0.954	0.968	0.981	0.993	1.003
1-Nonadecene	$C_{19}H_{38}$	0.762	0.791	0.817	0.842	0.864	0.885	0.904	0.922	0.938	0.954	0.968	0.981	0.993	1.004
1-Eicosene	$C_{20}H_{40}$	0.763	0.791	0.818	0.842	0.865	0.886	0.905	0.922	0.939	0.954	0.969	0.982	0.994	1.004

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25v-E (Part 1) - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{11}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
Ethyne (Acetylene)	C_2H_2	0	0.3719	0.3854	0.3966	0.3996	0.4030	0.4114	0.4434	0.4692	0.4902	0.5082	0.5239	0.5382	0.5514
Propyne (Methylacetylene)	C_3H_4	0	0.3290	0.3427	0.3545	0.3578	0.3616	0.3710	0.4100	0.4462	0.4797	0.5103	0.5384	0.5642	0.5882
1-Butyne (Ethylacetylene)	C_4H_6	0	0.3218	0.3377	0.3513	0.3552	0.3595	0.3703	0.4155	0.4573	0.4959	0.5311	0.5633	0.5929	0.6202
1-Pentyne	C_5H_8	0	0.3393	0.3541	0.3670	0.3707	0.3741	0.385	0.430	0.474	0.514	0.552	0.586	0.617	0.645
1-Hexyne	C_6H_{10}	0	0.3442	0.3592	0.3724	0.3761	0.3795	0.391	0.438	0.483	0.526	0.565	0.600	0.632	0.661
1-Heptyne	C_7H_{12}	0	0.3487	0.3637	0.3770	0.3807	0.3840	0.396	0.443	0.490	0.534	0.574	0.610	0.642	0.672
1-Octyne	C_8H_{14}	0	0.3522	0.3672	0.3804	0.3842	0.3873	0.399	0.447	0.495	0.540	0.581	0.617	0.650	0.681
1-Nonyne	C_9H_{16}	0	0.3549	0.3698	0.3861	0.3869	0.3900	0.402	0.451	0.499	0.544	0.586	0.623	0.656	0.687
1-Decyne	$C_{10}H_{18}$	0	0.3571	0.3720	0.3852	0.3890	0.3920	0.404	0.453	0.502	0.548	0.590	0.627	0.661	0.693
1-Undecyne	$C_{11}H_{20}$	0	0.3589	0.3737	0.3869	0.3908	0.3937	0.406	0.455	0.504	0.551	0.593	0.631	0.665	0.697

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
Ethyne (Acetylene)	C_2H_2	0.5638	0.5754	0.5865	0.5971	0.6072	0.6168	0.6259	0.6345	0.6426	0.6504	0.6577	0.6646	0.6711	0.6772
Propyne (Methylacetylene)	C_3H_4	0.6104	0.6310	0.6503	0.6682	0.6849	0.7004	0.7148	0.7282	0.7407	0.7522	0.7630	0.7730	0.7822	0.7908
1-Butyne (Ethylacetylene)	C_4H_6	0.6453	0.6686	0.6902	0.7103	0.7289	0.7462	0.7622	0.7770	0.7908	0.8035	0.8153	0.8263	0.8364	0.8459
1-Pentyne	C_5H_8	0.671	0.696	0.718	0.739	0.759	0.776	0.793	0.809	0.823	0.836	0.848	0.860	0.870	0.880
1-Hexyne	C_6H_{10}	0.688	0.713	0.737	0.758	0.778	0.796	0.813	0.829	0.844	0.858	0.870	0.882	0.893	0.903
1-Heptyne	C_7H_{12}	0.700	0.726	0.750	0.772	0.792	0.811	0.828	0.844	0.859	0.873	0.886	0.898	0.909	0.918
1-Octyne	C_8H_{14}	0.709	0.735	0.759	0.781	0.802	0.821	0.839	0.855	0.870	0.884	0.897	0.909	0.920	0.930
1-Nonyne	C_9H_{16}	0.716	0.742	0.767	0.789	0.810	0.829	0.847	0.864	0.879	0.893	0.906	0.918	0.929	0.939
1-Decyne	$C_{10}H_{18}$	0.722	0.748	0.773	0.795	0.816	0.836	0.854	0.870	0.886	0.900	0.913	0.926	0.937	0.947
1-Undecyne	$C_{11}H_{20}$	0.726	0.753	0.778	0.800	0.822	0.841	0.859	0.876	0.891	0.906	0.919	0.931	0.943	0.953

[a] See footnote a of Table 0v-E.

[b] See footnote b of Table 0v-E.

[c] See footnote c of Table 0v-E.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25 v-E (Part 2) - NORMAL ACETYLENES (1-ALKYNES), C_{12} to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -459.69° TO 2200°F

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °F													
		-459.69	0	32	60	68	77	100	200	300	400	500	600	700	800
		Heat Capacity[b], C_p^o, in BTU/lb deg F[c]													
1-Dodecyne	$C_{12}H_{22}$	0	0.3603	0.3751	0.3884	0.3922	0.3951	0.408	0.457	0.506	0.554	0.596	0.634	0.668	0.700
1-Tridecyne	$C_{13}H_{24}$	0	0.3616	0.3764	0.3896	0.3934	0.3963	0.409	0.459	0.508	0.556	0.599	0.636	0.671	0.703
1-Tetradecyne	$C_{14}H_{26}$	0	0.3626	0.3774	0.3906	0.3945	0.3973	0.410	0.460	0.510	0.558	0.601	0.639	0.674	0.706
1-Pentadecyne	$C_{15}H_{28}$	0	0.3635	0.3783	0.3915	0.3954	0.3982	0.411	0.461	0.511	0.559	0.602	0.640	0.676	0.708
1-Hexadecyne	$C_{16}H_{30}$	0	0.3644	0.3791	0.3923	0.3962	0.3990	0.412	0.462	0.512	0.561	0.604	0.642	0.677	0.710
1-Heptadecyne	$C_{17}H_{32}$	0	0.3650	0.3798	0.3930	0.3969	0.3996	0.412	0.463	0.513	0.562	0.605	0.644	0.679	0.712
1-Octadecyne	$C_{18}H_{34}$	0	0.3657	0.3804	0.3936	0.3975	0.4002	0.413	0.463	0.514	0.563	0.607	0.645	0.680	0.713
1-Nonadecyne	$C_{19}H_{36}$	0	0.3662	0.3809	0.3942	0.3980	0.4008	0.414	0.464	0.515	0.564	0.608	0.646	0.682	0.715
1-Eicosyne	$C_{20}H_{38}$	0	0.3667	0.3814	0.3947	0.3985	0.4013	0.414	0.465	0.516	0.565	0.609	0.647	0.683	0.716

Compound (gas)	Formula	Temperature in °F													
		900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		Heat Capacity, C_p^o, in BTU/lb deg F													
1-Dodecyne	$C_{12}H_{22}$	0.730	0.757	0.782	0.805	0.826	0.846	0.864	0.880	0.896	0.911	0.924	0.936	0.948	0.958
1-Tridecyne	$C_{13}H_{24}$	0.733	0.760	0.785	0.808	0.830	0.849	0.867	0.884	0.900	0.915	0.928	0.940	0.952	0.962
1-Tetradecyne	$C_{14}H_{26}$	0.736	0.763	0.788	0.811	0.833	0.852	0.871	0.888	0.903	0.918	0.932	0.944	0.955	0.965
1-Pentadecyne	$C_{15}H_{28}$	0.738	0.765	0.790	0.814	0.835	0.855	0.873	0.891	0.906	0.921	0.935	0.947	0.958	0.969
1-Hexadecyne	$C_{16}H_{30}$	0.740	0.767	0.793	0.816	0.838	0.856	0.876	0.893	0.909	0.924	0.937	0.950	0.961	0.971
1-Heptadecyne	$C_{17}H_{32}$	0.742	0.769	0.795	0.818	0.840	0.860	0.878	0.895	0.911	0.926	0.940	0.952	0.963	0.974
1-Octadecyne	$C_{18}H_{34}$	0.743	0.771	0.796	0.820	0.842	0.862	0.880	0.897	0.913	0.928	0.942	0.954	0.966	0.976
1-Nonadecyne	$C_{19}H_{36}$	0.745	0.773	0.798	0.821	0.843	0.863	0.882	0.899	0.915	0.930	0.944	0.956	0.967	0.978
1-Eicosyne	$C_{20}H_{38}$	0.746	0.774	0.799	0.823	0.845	0.865	0.883	0.901	0.917	0.932	0.945	0.958	0.969	0.979

[a] See footnote a of Table Ov-E.

[b] See footnote b of Table Ov-E.

[c] See footnote c of Table Ov-E.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE Ov-G - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT CAPACITY, C_p^o, AT -273.16° TO 1200°C

November 30, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °C													
			-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
			Heat Capacity[b], C_p^o cal/g deg C[c]														
Oxygen	O_2	gas	0	0.2184	0.2193	0.2231	0.2301	0.2377	0.2447	0.2506	0.2555	0.2595	0.2629	0.2658	0.2684	0.2706	0.2726
Hydrogen	H_2	gas	0	3.392	3.419	3.453	3.468	3.474	3.485	3.504	3.532	3.569	3.613	3.660	3.709	3.761	3.812
Hydroxyl	OH	gas	0	0.4212	0.4199	0.4167	0.4146	0.4144	0.4160	0.4193	0.4239	0.4295	0.4357	0.4422	0.4488	0.4553	0.4614
Water	H_2O	gas	0	0.4441	0.4454	0.4515	0.4634	0.4776	0.4930	0.5092	0.5260	0.5432	0.5601	0.5766	0.5925	0.6075	0.6216
Nitrogen	N_2	gas	0	0.2484	0.2484	0.2491	0.2514	0.2555	0.2609	0.2666	0.2723	0.2776	0.2825	0.2867	0.2905	0.2938	0.2966
Nitric Oxide	NO	gas	0	0.2382	0.2378	0.2380	0.2415	0.2472	0.2535	0.2595	0.2649	0.2696	0.2737	0.2772	0.2801	0.2826	0.2847
Carbon	C	solid, graphite	0	0.1532	0.1720	0.2213	0.2776	0.325	0.361	0.389	0.410	0.425	0.436	0.448	0.461	0.470	0.478
Carbon Monoxide	CO	gas	0	0.2485	0.2487	0.2497	0.2530	0.2582	0.2643	0.2706	0.2765	0.2819	0.2865	0.2906	0.2942	0.2973	0.2999
Carbon Dioxide	CO_2	gas	0	0.1953	0.2016	0.2188	0.2378	0.2533	0.2662	0.2769	0.2859	0.2935	0.2998	0.3052	0.3097	0.3137	0.3171

[a] Interpolation to other temperatures in the interval 0° to 1200°C may be made by appropriate graphical or analytical methods. For temperatures between -100° and 0°C values may be estimated by extrapolating to lower temperatures the values for 0°, 100°, 200° and 300°C.

[b] C_p^o is the heat capacity at constant pressure of the given substance in its appropriate standard state at the temperature indicated. The appropriate standard state is: (a) for a gas, the thermodynamic standard gaseous state of unit fugacity (1 atmosphere); and (b) for a solid, the solid (crystalline) form indicated at a pressure of one atmosphere.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1v-G - PARAFFINS, C_1 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

November 30, 1944

Compound (Gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o cal/g deg C[c]														
Methane	CH_4	0	0.5171	0.5321	0.5853	0.6700	0.7587	0.8435	0.9216	0.9926	1.057	1.114	1.164	1.209	1.248	1.283
Ethane	C_2H_6	0	0.3943	0.4186	0.4943	0.5946	0.6870	0.7687	0.8411	0.9051	0.961	1.011	1.054	1.092	1.125	1.154
Propane	C_3H_8	0	0.3702	0.3985	0.4821	0.5870	0.6782	0.7565	0.8243	0.8836	0.936	0.981	1.020	1.055	1.085	1.111
n-Butane	C_4H_{10}	0	0.3815	0.4062	0.4850	0.5860	0.6742	0.7492	0.8139	0.8707	0.920	0.963	1.001	1.034	1.062	1.087
2-Methylpropane (Isobutane)	"	0	0.3684	0.3981	0.4831	0.5872	0.6772	0.7533	0.8184	0.8748	0.924	0.967	1.004	1.037	1.065	1.089
n-Pentane	C_5H_{12}	0	0.3821	0.4061	0.4841	0.5842	0.6706	0.7441	0.8074	0.8625	0.911	0.953	0.989	1.021	1.049	1.072
2-Methylbutane (Isopentane)	"	0	0.3698	0.3996	0.4846	0.5878	0.6758	0.7500	0.8134	0.8681	0.916	0.957	0.993	1.025	1.052	1.076
2,2-Dimethylpropane (Neopentane)	"	0	0.3724	0.4029	0.4904	0.5975	0.6882	0.7637	0.8271	0.8814	0.928	0.969	1.004	1.034	1.061	1.084

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2v-G(Part 1) - PARAFFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

November 30, 1944; November 30, 1946

Compound (Gas)	Formula	Temperature[a] in °C													
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o cal/g deg C[c]														
n-Hexane	C_6H_{14}	0	0.3835	0.4069	0.4839	0.5830	0.6686	0.7408	0.8030	0.8571	0.904	0.945	0.981	1.012	1.039	1.062
2-Methylpentane.	"	0	0.3718	0.4000	0.482	0.584	0.671	0.745	0.807	0.861	0.907					
3- "	"	0	0.3794	0.4078	0.490	0.590	0.674	0.747	0.809	0.862	0.909					
2,2-Dimethylbutane	"	0	0.3679	0.3975	0.484	0.590	0.679	0.754	0.817	0.868	0.914					
2,3- "	"	0	0.3734	0.4020	0.485	0.587	0.675	0.747	0.810	0.863	0.910					

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2v-G(Part 2) - PARAFFINS, C_7

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

November 30, 1944

Compound (Gas)	Formula	Temperature[a] in °C													
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o cal/g deg C[c]														
n-Heptane	C_7H_{16}	0	0.3845	0.4074	0.4837	0.5823	0.6668	0.7382	0.7998	0.8532	0.900	0.940	0.975	1.006	1.033	1.055
2-Methylhexane.	"	0	d	d	d	d	d	d	d	d	d					
3-	"	0	d	d	d	d	d	d	d	d	d					
3-Ethylpentane.	"	0	d	d	d	d	d	d	d	d	d					
2,2-Dimethylpentane	"	0	d	d	d	d	d	d	d	d	d					
2,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,4- "	"	0	d	d	d	d	d	d	d	d	d					
3,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3-Trimethylbutane . . .	"	0	d	d	d	d	d	d	d	d	d					

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

[d] Until more date become available, the heat capacity of any branched-chain heptane may be taken as equal to that of the normal heptane. The meager data now available indicate that the difference in heat capacity between normal heptane and any of its isomers is not likely to exceed 3 percent.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 3v-G - PARAFFINS, C_8

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1944

Compound (gas)	Formula	Temperature[a] in °C													
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
n-Octane	C_8H_{18}	0	0.3854	0.4078	0.4836	0.5818	0.6655	0.7363	0.7974	0.8502	0.8964	0.9361	0.9709	1.001	1.028	1.050
2-Methylheptane	"	0	d	d	d	d	d	d	d	d	d					
3- "	"	0	d	d	d	d	d	d	d	d	d					
4- "	"	0	d	d	d	d	d	d	d	d	d					
3-Ethylhexane	"	0	d	d	d	d	d	d	d	d	d					
2,2-Dimethylhexane	"	0	d	d	d	d	d	d	d	d	d					
2,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,5- "	"	0	d	d	d	d	d	d	d	d	d					
3,3- "	"	0	d	d	d	d	d	d	d	d	d					
3,4- "	"	0	d	d	d	d	d	d	d	d	d					
2-Methyl-3-ethylpentane	"	0	d	d	d	d	d	d	d	d	d					
3- " -3- "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3-Trimethylpentane	"	0	d	d	d	d	d	d	d	d	d					
2,2,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,3,3- "	"	0	d	d	d	d	d	d	d	d	d					
2,3,4- "	"	0	d	d	d	d	d	d	d	d	d					
2,2,3,3-Tetramethylbutane	"	0	d	d	d	d	d	d	d	d	d					

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

[d] Until more data become available, the heat capacity of any branched-chain octane may be taken as equal to that of normal octane. The meager data now available indicate that the difference in heat capacity between normal octane and any of its isomers is not likely to exceed 3 percent.

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TABLE 5v-G - ALKYL BENZENES, C_6 to C_9

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Benzene	C_6H_6	0	0.2266	0.2499	0.3192	0.4005	0.4675	0.5217	0.5663	0.6034	0.6347	0.6613	0.6840	0.7034	0.7202	0.7347
Methylbenzene (Toluene)	C_7H_8	0	0.2463	0.2691	0.3377	0.4200	0.4892	0.5461	0.5935	0.6332	0.6669	0.6956	0.7202	0.7413	0.7595	0.7752
Ethylbenzene	C_8H_{10}	0	0.2655	0.2891	0.3600	0.4445	0.5150	0.5729	0.6210	0.6615	0.6959	0.7254	0.7507	0.7725	0.7913	0.8076
1,2-Dimethylbenzene (o-Xylene)	"	0	0.2783	0.3000	0.3645	0.4432	0.5110	0.5680	0.6161	0.6570	0.6919	0.7218	0.7475	0.7697	0.7888	0.8054
1,3- " (m- ")	"	0	0.2649	0.2872	0.3542	0.4361	0.5061	0.5647	0.6137	0.6553	0.6906	0.7209	0.7468	0.7691	0.7883	0.8050
1,4- " (p- ")	"	0	0.2640	0.2856	0.3513	0.4326	0.5028	0.5616	0.6111	0.6530	0.6886	0.7192	0.7453	0.7678	0.7872	0.8040
n-Propylbenzene	C_9H_{12}	0	0.2832	0.3056	0.376	0.461	0.532	0.591	0.640	0.681	0.716	0.747	0.773	0.795	0.815	0.831
Isopropylbenzene (Cumene)	"	0	0.2769	0.3017	0.375	0.461	0.534	0.593	0.642	0.683	0.718	0.748	0.774	0.797	0.816	0.833
1-Methyl-2-ethylbenzene	"	0	0.2916	0.3140	0.381	0.462	0.531	0.589	0.638	0.679	0.715	0.745	0.771	0.794	0.813	0.830
1- " -3- "	"	0	0.2798	0.3027	0.372	0.456	0.527	0.586	0.636	0.678	0.714	0.744	0.771	0.793	0.813	0.830
1- " -4- "	"	0	0.2790	0.3014	0.369	0.453	0.524	0.583	0.633	0.676	0.712	0.743	0.769	0.792	0.812	0.829
1,2,3-Trimethylbenzene (Hemimellitene)	"	0	0.2859	0.3066	0.369	0.447	0.516	0.575	0.626	0.669	0.706	0.737	0.765	0.788	0.808	0.826
1,2,4- " (Pseudocumene)	"	0	0.2882	0.3087	0.370	0.448	0.517	0.576	0.627	0.670	0.707	0.738	0.765	0.789	0.809	0.826
1,3,5- " (Mesitylene)	"	0	0.2771	0.2988	0.3636	0.4449	0.5160	0.5762	0.6270	0.6702	0.7072	0.7388	0.7660	0.7894	0.8096	0.8270

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8v-G (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 273.16° TO 1200°C

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Ethene (Ethylene).	C_2H_4	0	0.3485	0.3711	0.4369	0.5197	0.5920	0.6538	0.7070	0.7535	0.7944	0.8303	0.8617	0.8894	0.9134	0.9345
Propene (Propylene). . . .	C_3H_6	0	0.3402	0.3629	0.4303	0.5160	0.5921	0.6581	0.7151	0.7649	0.8083	0.8460	0.8788	0.9076	0.9328	0.9546
1-Butene.	C_4H_8	0	0.3541	0.3805	0.4551	0.5442	0.6201	0.6849	0.7408	0.7893	0.8316	0.8684	0.9004	0.9284	0.9528	0.9739
cis-2-Butene.	"	0	0.3121	0.3362	0.4083	0.5005	0.5824	0.6530	0.7137	0.7661	0.8115	0.8509	0.8851	0.9149	0.9407	0.9631
trans-2- "	"	0	0.3518	0.3741	0.4404	0.5253	0.6015	0.6678	0.7255	0.7755	0.8194	0.8578	0.8909	0.9198	0.9449	0.9669
2-Methylpropene (Isobutene)	"	0	0.3552	0.3796	0.4496	0.5355	0.6108	0.6758	0.7322	0.7816	0.8245	0.8620	0.8945	0.9229	0.9477	0.9693

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

TABLE 9v-G (Part 2) - MONOOLEFINS, C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 273.16° TO 1200°C

April 30, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
1-Pentene.	C_5H_{10}	0	0.3668	0.3906	0.4629	0.5519	0.6284	0.6932	0.7489	0.7974	0.8396	0.8762	0.9084	0.9362	0.9605	0.9815
cis-2-Pentene.	"	0	0.3203	0.3468	0.4237	0.5189	0.6020	0.6713	0.7310	0.7825	0.8272	0.8658	0.8995	0.9285	0.9537	0.9758
trans-2- "	"	0	0.3572	0.3822	0.4540	0.5424	0.6188	0.6846	0.7415	0.7908	0.8340	0.8714	0.9040	0.9323	0.9570	0.9784
2-Methyl-1-butene.	"	0	0.3544	0.3806	0.4553	0.5455	0.6226	0.6884	0.7451	0.7942	0.8370	0.8740	0.9064	0.9345	0.9590	0.9804
3- " -1- "	"	0	0.3768	0.4042	0.4785	0.5636	0.6366	0.6997	0.7544	0.8016	0.8429	0.8792	0.9108	0.9384	0.9622	0.9832
2- " -2- "	"	0	0.3394	0.3635	0.4347	0.5241	0.6030	0.6711	0.7301	0.7813	0.8258	0.8644	0.8980	0.9272	0.9524	0.9744

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8v-G (Part 3) - MONOOLEFINS, C_6

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT - 273.16° TO 1200°C

MAY 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
1-Hexene	C_6H_{12}	0	0.3700	0.3931	0.466	0.556	0.633	0.698	0.754	0.803	0.845	0.881	0.914	0.942	0.966	0.986
cis-2-Hexene	"	0	0.3371	0.3608	0.435	0.530	0.612	0.681	0.739	0.791	0.835					
trans-2- "	"	0	0.3679	0.3902	0.460	0.549	0.626	0.692	0.748	0.797	0.840					
cis-3- "	"	0	0.3235	0.3511	0.430	0.527	0.612	0.681	0.740	0.791	0.835					
trans-3- "	"	0	0.3610	0.3877	0.463	0.553	0.630	0.695	0.751	0.800	0.842					
2-Methyl-1-pentene	"	0	0.3645	0.3889	0.462	0.552	0.629	0.694	0.751	0.801	0.843					
3- " -1- "	"	0	0.3771	0.4045	0.480	0.568	0.643	0.706	0.761	0.808	0.849					
4- " -1- "	"	0	0.3583	0.3875	0.467	0.559	0.637	0.703	0.760	0.807	0.848					
2- " -2- "	"	0	0.3322	0.3596	0.437	0.531	0.612	0.680	0.739	0.790	0.834					
cis-3-Methyl-2-pentene	"	0	0.3322	0.3596	0.437	0.531	0.612	0.680	0.739	0.790	0.834					
trans-3- " -2- "	"	0	0.3322	0.3596	0.437	0.531	0.612	0.680	0.739	0.790	0.834					
cis-4- " -2- "	"	0	0.3517	0.3793	0.456	0.546	0.624	0.690	0.747	0.796	0.839					
trans-4- " -2- "	"	0	0.3755	0.4016	0.474	0.559	0.633	0.697	0.753	0.801	0.843					
2-Ethyl-1-butene	"	0	0.3516	0.3793	0.457	0.550	0.629	0.695	0.751	0.801	0.844					
2,3-Dimethyl-1-butene	"	0	0.3803	0.4075	0.482	0.568	0.640	0.704	0.759	0.806	0.847					
3,3- " -1- "	"	0	0.3494	0.3769	0.456	0.552	0.634	0.703	0.762	0.810	0.853					
2,3- " -2- "	"	0	0.3386	0.3622	0.434	0.525	0.605	0.673	0.733	0.784	0.828					

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12v-G - ACETYLENES, C_2 to C_5

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Ethyne (Acetylene)	C_2H_2	0	0.3857	0.4032	0.4470	0.4890	0.5200	0.5456	0.5679	0.5882	0.6068	0.6238	0.6392	0.6532	0.6658	0.6771
Propyne (Methylacetylene) .	C_3H_4	0	0.3430	0.3618	0.4148	0.4774	0.5311	0.5773	0.6176	0.6529	0.6840	0.7114	0.7353	0.7562	0.7746	0.7907
1-Butyne (Ethylacetylene) .	C_4H_6	0	0.3379	0.3597	0.4209	0.4932	0.5550	0.6078	0.6534	0.6932	0.7279	0.7583	0.7848	0.8079	0.8281	0.8457
2- " (Dimethylacetylene)	"	0	0.3211	0.3444	0.3989	0.4694	0.5331	0.5888	0.6376	0.6802	0.7174	0.7496	0.7777	0.8021	0.8233	0.8418
1-Pentyne	C_5H_8	0	0.3543	0.3744	0.436	0.512	0.577	0.632	0.680	0.721	0.758	0.789	0.817	0.841	0.862	0.880
2- "	"	0	0.3256	0.3463	0.407	0.484	0.552	0.611	0.662	0.707	0.745	0.779	0.808	0.834	0.856	0.875
3-Methyl-1-butyne	"	0	0.3431	0.3673	0.434	0.513	0.579	0.636	0.684	0.725	0.761	0.792	0.819	0.843	0.864	0.882

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20v-G - NORMAL PARAFFINS, C_1 to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

December 31, 1945

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Methane	CH_4	0	0.5171	0.5321	0.5853	0.6700	0.7587	0.8435	0.9216	0.9926	1.057	1.114	1.164	1.209	1.248	1.283
Ethane	C_2H_6	0	0.3943	0.4186	0.4943	0.5946	0.6870	0.7687	0.8411	0.9051	0.961	1.011	1.054	1.092	1.125	1.154
Propane	C_3H_8	0	0.3702	0.3985	0.4821	0.5870	0.6782	0.7565	0.8243	0.8836	0.936	0.981	1.020	1.055	1.085	1.111
n-Butane	C_4H_{10}	0	0.3815	0.4062	0.4850	0.5860	0.6742	0.7492	0.8139	0.8707	0.920	0.963	1.001	1.034	1.062	1.087
n-Pentane	C_5H_{12}	0	0.3821	0.4061	0.4841	0.5842	0.6706	0.7441	0.8074	0.8625	0.911	0.953	0.989	1.021	1.049	1.072
n-Hexane	C_6H_{14}	0	0.3835	0.4069	0.4839	0.5830	0.6686	0.7408	0.8030	0.8571	0.904	0.945	0.981	1.012	1.039	1.062
n-Heptane	C_7H_{16}	0	0.3845	0.4074	0.4837	0.5823	0.6668	0.7382	0.7998	0.8532	0.900	0.940	0.975	1.006	1.033	1.055
n-Octane	C_8H_{18}	0	0.3854	0.4078	0.4836	0.5818	0.6655	0.7363	0.7974	0.8502	0.896	0.936	0.971	1.001	1.028	1.050
n-Nonane	C_9H_{20}	0	0.3860	0.4081	0.4835	0.5814	0.6645	0.7348	0.7956	0.8479	0.894	0.933	0.967	0.998	1.024	1.046
n-Decane	$C_{10}H_{22}$	0	0.3865	0.4084	0.4834	0.5810	0.6637	0.7336	0.7941	0.8460	0.891	0.931	0.965	0.995	1.020	1.042
n-Undecane	$C_{11}H_{24}$	0	0.3869	0.4086	0.4833	0.5807	0.6631	0.7326	0.7928	0.8445	0.890	0.929	0.962	0.992	1.018	1.040
n-Dodecane	$C_{12}H_{26}$	0	0.3872	0.4087	0.4833	0.5805	0.6625	0.7318	0.7918	0.8432	0.888	0.927	0.961	0.990	1.016	1.037
n-Tridecane	$C_{13}H_{28}$	0	0.3875	0.4089	0.4832	0.5803	0.6621	0.7311	0.7909	0.8421	0.887	0.925	0.959	0.989	1.014	1.035
n-Tetradecane	$C_{14}H_{30}$	0	0.3878	0.4090	0.4832	0.5801	0.6617	0.7306	0.7902	0.8412	0.886	0.924	0.958	0.987	1.012	1.034
n-Pentadecane	$C_{15}H_{32}$	0	0.3880	0.4091	0.4831	0.5799	0.6614	0.7300	0.7895	0.8404	0.885	0.923	0.956	0.986	1.011	1.032
n-Hexadecane	$C_{16}H_{34}$	0	0.3882	0.4092	0.4831	0.5798	0.6611	0.7296	0.7890	0.8397	0.884	0.922	0.955	0.985	1.010	1.031
n-Heptadecane	$C_{17}H_{36}$	0	0.3883	0.4093	0.4831	0.5797	0.6608	0.7292	0.7884	0.8390	0.883	0.921	0.954	0.984	1.009	1.030
n-Octadecane	$C_{18}H_{38}$	0	0.3885	0.4094	0.4830	0.5796	0.6606	0.7288	0.7880	0.8385	0.883	0.921	0.954	0.983	1.008	1.029
n-Nonadecane	$C_{19}H_{40}$	0	0.3886	0.4094	0.4830	0.5795	0.6604	0.7285	0.7876	0.8380	0.882	0.920	0.953	0.982	1.007	1.028
n-Eicosane	$C_{20}H_{42}$	0	0.3887	0.4095	0.4830	0.5794	0.6602	0.7282	0.7872	0.8375	0.882	0.919	0.952	0.981	1.006	1.027

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21v-G - NORMAL ALKYL BENZENES, C_6 to C_{22}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

January 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity, C_p^o, in cal/g deg C[c]														
Benzene	C_6H_6	0	0.2266	0.2499	0.3192	0.4005	0.4675	0.5217	0.5663	0.6034	0.6347	0.6613	0.6840	0.7034	0.7202	0.7347
Methylbenzene (Toluene)	C_7H_8	0	0.2463	0.2691	0.3377	0.4200	0.4892	0.5461	0.5935	0.6332	0.6669	0.6956	0.7202	0.7413	0.7595	0.7752
Ethylbenzene	C_8H_{10}	0	0.2655	0.2891	0.3600	0.4445	0.5150	0.5729	0.6210	0.6615	0.6959	0.7254	0.7507	0.7725	0.7913	0.8076
n-Propylbenzene	C_9H_{12}	0	0.2832	0.3056	0.376	0.461	0.532	0.591	0.640	0.681	0.716	0.747	0.773	0.795	0.815	0.831
n-Butylbenzene	$C_{10}H_{14}$	0	0.2938	0.3161	0.387	0.473	0.545	0.605	0.654	0.697	0.733	0.764	0.790	0.813	0.833	0.850
n-Amylbenzene	$C_{11}H_{16}$	0	0.3030	0.3250	0.396	0.483	0.556	0.616	0.666	0.709	0.746	0.777	0.804	8.828	0.848	0.865
n-Hexylbenzene	$C_{12}H_{18}$	0	0.3106	0.3324	0.403	0.491	0.564	0.625	0.676	0.720	0.757	0.788	0.816	0.840	0.861	0.878
n-Heptylbenzene	$C_{13}H_{20}$	0	0.3170	0.3386	0.410	0.498	0.572	0.633	0.684	0.728	0.766	0.798	0.826	0.850	0.871	0.889
n-Octylbenzene	$C_{14}H_{22}$	0	0.3225	0.3440	0.415	0.504	0.578	0.639	0.692	0.736	0.774	0.806	0.834	0.859	0.880	0.898
n-Nonylbenzene	$C_{15}H_{24}$	0	0.3272	0.3485	0.420	0.509	0.583	0.645	0.698	0.742	0.780	0.813	0.842	0.866	0.888	0.906
n-Decylbenzene	$C_{16}H_{26}$	0	0.3313	0.3525	0.424	0.513	0.588	0.650	0.703	0.748	0.786	0.819	0.848	0.873	0.894	0.912
n-Undecylbenzene	$C_{17}H_{28}$	0	0.3349	0.3560	0.427	0.517	0.592	0.655	0.708	0.753	0.791	0.825	0.853	0.879	0.900	0.918
n-Dodecylbenzene	$C_{18}H_{30}$	0	0.3381	0.3591	0.430	0.521	0.596	0.658	0.712	0.757	0.796	0.829	0.858	0.884	0.905	0.924
n-Tridecylbenzene	$C_{19}H_{32}$	0	0.3409	0.3619	0.433	0.524	0.599	0.662	0.715	0.761	0.800	0.834	0.863	0.888	0.910	0.928
n-Tetradecylbenzene	$C_{20}H_{34}$	0	0.3435	0.3644	0.436	0.526	0.602	0.665	0.719	0.764	0.804	0.837	0.867	0.892	0.914	0.933
n-Pentadecylbenzene	$C_{21}H_{36}$	0	0.3458	0.3667	0.438	0.529	0.605	0.668	0.722	0.767	0.807	0.841	0.870	0.896	0.918	0.936
n-Hexadecylbenzene	$C_{22}H_{38}$	0	0.3479	0.3687	0.440	0.531	0.607	0.670	0.724	0.770	0.810	0.844	0.873	0.899	0.921	0.940

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 24v-G - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C

March 31, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Ethene (Ethylene)	C_2H_4	0	0.3485	0.3711	0.4369	0.5197	0.5920	0.6538	0.7070	0.7535	0.7944	0.8303	0.8617	0.8894	0.9134	0.9345
Propene (Propylene)	C_3H_6	0	0.3402	0.3629	0.4303	0.5160	0.5921	0.6581	0.7151	0.7649	0.8083	0.8460	0.8788	0.9076	0.9328	0.9546
1-Butene	C_4H_8	0	0.3541	0.3805	0.4551	0.5442	0.6201	0.6849	0.7408	0.7893	0.8316	0.8684	0.9004	0.9284	0.9528	0.9739
1-Pentene	C_5H_{10}	0	0.3668	0.3906	0.4629	0.5519	0.6284	0.6932	0.7489	0.7974	0.8396	0.8762	0.9084	0.9362	0.9605	0.9815
1-Hexene	C_6H_{12}	0	0.3700	0.3931	0.466	0.556	0.633	0.698	0.754	0.803	0.845	0.881	0.914	0.942	0.966	0.986
1-Heptene	C_7H_{14}	0	0.3731	0.3956	0.468	0.559	0.636	0.702	0.758	0.807	0.849	0.886	0.917	0.945	0.970	0.990
1-Octene	C_8H_{16}	0	0.3754	0.3975	0.470	0.561	0.639	0.705	0.761	0.810	0.852	0.888	0.920	0.948	0.973	0.993
1-Nonene	C_9H_{18}	0	0.3771	0.3989	0.471	0.563	0.641	0.707	0.763	0.812	0.854	0.890	0.922	0.950	0.975	0.995
1-Decene	$C_{10}H_{20}$	0	0.3785	0.4001	0.472	0.565	0.642	0.708	0.765	0.814	0.856	0.892	0.924	0.952	0.976	0.997
1-Undecene	$C_{11}H_{22}$	0	0.3796	0.4011	0.473	0.566	0.644	0.710	0.766	0.815	0.857	0.894	0.925	0.953	0.978	0.998
1-Dodecene	$C_{12}H_{24}$	0	0.3806	0.4019	0.474	0.567	0.645	0.711	0.767	0.816	0.859	0.895	0.926	0.955	0.979	0.999
1-Tridecene	$C_{13}H_{26}$	0	0.3814	0.4026	0.475	0.568	0.646	0.712	0.768	0.817	0.860	0.896	0.927	0.956	0.980	1.000
1-Tetradecene	$C_{14}H_{28}$	0	0.3821	0.4031	0.475	0.569	0.647	0.712	0.769	0.818	0.860	0.897	0.928	0.956	0.981	1.001
1-Pentadecene	$C_{15}H_{30}$	0	0.3827	0.4036	0.476	0.569	0.647	0.713	0.770	0.819	0.861	0.898	0.929	0.957	0.981	1.002
1-Hexadecene	$C_{16}H_{32}$	0	0.3832	0.4041	0.476	0.570	0.648	0.714	0.771	0.819	0.862	0.898	0.930	0.958	0.982	1.002
1-Heptadecene	$C_{17}H_{34}$	0	0.3836	0.4045	0.477	0.570	0.648	0.714	0.771	0.820	0.862	0.899	0.930	0.958	0.983	1.003
1-Octadecene	$C_{18}H_{36}$	0	0.3841	0.4048	0.477	0.570	0.649	0.715	0.772	0.820	0.863	0.899	0.931	0.959	0.983	1.003
1-Nonadecene	$C_{19}H_{38}$	0	0.3844	0.4051	0.477	0.571	0.649	0.715	0.772	0.821	0.863	0.900	0.931	0.959	0.984	1.004
1-Eicosene	$C_{20}H_{40}$	0	0.3848	0.4054	0.477	0.571	0.650	0.716	0.773	0.821	0.864	0.900	0.932	0.960	0.984	1.004

[a] See footnote a of Table 0v-G.

[b] See footnote b of Table 0v-G.

[c] See footnote c of Table 0v-G.

TABLE 25v-G - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}
HEAT CAPACITY, C_p^o, FOR THE IDEAL GAS STATE, AT -273.16° TO 1200°C
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °C														
		-273.16	0	25	100	200	300	400	500	600	700	800	900	1000	1100	1200
		Heat Capacity[b], C_p^o, in cal/g deg C[c]														
Ethyne (Acetylene)	C_2H_2	0	0.3857	0.4032	0.4470	0.4890	0.5200	0.5456	0.5679	0.5882	0.6068	0.6238	0.6392	0.6532	0.6658	0.6771
Propyne (Methylacetylene).	C_3H_4	0	0.3430	0.3618	0.4148	0.4774	0.5311	0.5773	0.6176	0.6529	0.6840	0.7114	0.7353	0.7562	0.7746	0.7907
1-Butyne (Ethylacetylene).	C_4H_6	0	0.3379	0.3597	0.4209	0.4932	0.5550	0.6078	0.6534	0.6932	0.7279	0.7583	0.7848	0.8079	0.8281	0.8457
1-Pentyne.	C_5H_8	0	0.3543	0.3744	0.436	0.512	0.577	0.632	0.680	0.721	0.758	0.789	0.817	0.841	0.862	0.880
1-Hexyne	C_6H_{10}	0	0.3594	0.3797	0.444	0.523	0.590	0.648	0.697	0.740	0.777	0.809	0.838	0.862	0.884	0.902
1-Heptyne.	C_7H_{12}	0	0.3640	0.3842	0.449	0.531	0.600	0.659	0.709	0.753	0.791	0.824	0.853	0.878	0.900	0.918
1-Octyne	C_8H_{14}	0	0.3674	0.3876	0.454	0.537	0.608	0.667	0.718	0.762	0.801	0.834	0.864	0.889	0.911	0.930
1-Nonyne	C_9H_{16}	0	0.3701	0.3902	0.457	0.541	0.613	0.673	0.725	0.770	0.809	0.843	0.872	0.898	0.920	0.939
1-Decyne	$C_{10}H_{18}$	0	0.3722	0.3923	0.459	0.545	0.618	0.678	0.731	0.776	0.815	0.849	0.879	0.905	0.928	0.947
1-Undecyne	$C_{11}H_{20}$	0	0.3739	0.3940	0.462	0.548	0.621	0.682	0.735	0.781	0.820	0.855	0.885	0.911	0.934	0.953
1-Dodecyne	$C_{12}H_{22}$	0	0.3754	0.3954	0.463	0.550	0.624	0.686	0.739	0.785	0.825	0.859	0.889	0.916	0.938	0.958
1-Tridecyne.	$C_{13}H_{24}$	0	0.3766	0.3966	0.465	0.553	0.627	0.689	0.742	0.788	0.828	0.863	0.893	0.920	0.942	0.962
1-Tetradecyne.	$C_{14}H_{26}$	0	0.3776	0.3976	0.466	0.554	0.629	0.691	0.745	0.791	0.832	0.866	0.897	0.923	0.946	0.965
1-Pentadecyne.	$C_{15}H_{28}$	0	0.3785	0.3985	0.467	0.556	0.631	0.693	0.748	0.794	0.834	0.869	0.900	0.926	0.949	0.968
1-Hexadecyne	$C_{16}H_{30}$	0	0.3793	0.3992	0.468	0.557	0.632	0.695	0.750	0.796	0.837	0.872	0.903	0.929	0.952	0.971
1-Heptadecyne.	$C_{17}H_{32}$	0	0.3800	0.3999	0.469	0.559	0.634	0.697	0.751	0.798	0.839	0.874	0.904	0.931	0.954	0.974
1-Octadecyne	$C_{18}H_{34}$	0	0.3806	0.4005	0.470	0.560	0.635	0.698	0.753	0.800	0.840	0.876	0.906	0.933	0.956	0.976
1-Nonadecyne	$C_{19}H_{36}$	0	0.3812	0.4010	0.470	0.561	0.636	0.700	0.754	0.801	0.842	0.877	0.908	0.935	0.958	0.978
1-Eicosyne	$C_{20}H_{38}$	0	0.3817	0.4015	0.471	0.562	0.637	0.701	0.756	0.803	0.844	0.879	0.910	0.937	0.960	0.979

[a] See footnote a of Table 0v-G. [b] See footnote b of Table 0v-G. [c] See footnote c of Table 0v-G.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 00w - O, H, N, C

HEAT OF FORMATION, ΔHf^o, AT 0° TO 4000°K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b,c], ΔHf^o, in kcal/mole[d]														
Oxygen	O	58.586	59.159	59.162	59.325	59.470	59.598	59.713	59.817	59.910	59.997	60.077	60.152	60.222	60.289	60.352
Hydrogen	H	51.620	52.089	52.092	52.242	52.389	52.536	52.682	52.826	52.967	53.105	53.239	53.368	53.492	53.611	53.725
Nitrogen	N	85.120	85.566	85.568	85.716	85.862	86.002	86.136	86.260	86.378	86.487	86.590	86.686	86.776	86.863	86.946
Carbon	C	125.055	126.362	126.368	126.618	126.797	126.917	126.990	127.028	127.037	127.029	127.004	126.967	126.914	126.849	126.774

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Heat of Formation, ΔHf^o, in kcal/mole														
Oxygen	O	59.997	60.188	60.352	60.495	60.620	60.726	60.820	60.898	60.965	61.072	61.151				
Hydrogen	H	53.105	53.431	53.725	53.987	54.220	54.428	54.614	54.780	54.931	55.189	55.408				
Nitrogen	N	86.487	86.732	86.946	87.136	87.307	87.470	87.623	87.770	87.916	88.213	88.545				
Carbon	C	127.029	126.942	126.774												

[a] Interpolation to other temperatures in the interval 298.16° to 4000°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500° and 600°K.

[b] ΔHf^o represents the increment in heat content for the reaction of forming the given substance from the elements, with all the reactants and products in their appropriate standard reference states at the temperature indicated.

[c] Because of the existing uncertainty in the determination of the states of the dissociated atoms in the spectroscopic determination of the energies of dissociation of CO (gas) and N_2 (gas), the values given in this table for the heats of formation of C (gas), from C (solid, graphite), and N (gas) from N_2 (gas), may be greatly in error. The error in the change of the heat of formation with temperature is, however, quite small.

[d] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE Ow - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

HEAT OF FORMATION, ΔHf^o, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in ^oK													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Heat of Formation[b], ΔHf^o, in kcal/mole[c]													
Oxygen	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl	OH	gas	10.0						10.060	10.063	10.069	10.059	10.036	10.003	9.963	9.919
Water	H_2O	gas	-57.1043						-57.7979	-57.8022	-58.042	-58.276	-58.499	-58.709	-58.902	-59.080
Nitrogen	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	NO	gas	21.477				21.578	21.592	21.600	21.600	21.610	21.616	21.620	21.622	21.625	21.629
Carbon	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	CO	gas	-27.2019				-26.597	-26.493	-26.4157	-26.4131	-26.317	-26.295	-26.330	-26.407	-26.511	-26.635
Carbon Dioxide	CO_2	gas	-93.9686						-94.0518	-94.0520	-94.069	-94.091	-94.123	-94.167	-94.215	-94.268

Compound	Formula	State	Temperature in ^oK													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Heat of Formation, ΔHf^o, in kcal/mole													
Oxygen	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl	OH	gas	9.875	9.831	9.788	9.748	9.712	9.676	9.590	9.515	9.422	9.368	9.295	9.220	9.052	8.885
Water	H_2O	gas	-59.239	-59.384	-59.511	-59.623	-59.724	-59.811	-60.000	-60.126	-60.23	-60.31	-60.39	-60.46		
Nitrogen	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	NO	gas	21.633	21.637	21.642	21.646	21.651	21.656	21.657	21.647	21.631	21.607	21.567	21.526	21.403	21.252
Carbon	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	CO	gas	-26.768	-26.909	-27.056	-27.212	-27.376	-27.545								
Carbon Dioxide	CO_2	gas	-94.318	-94.364	-94.410	-94.456	-94.505	-94.555								

[a] Interpolation to other temperatures in the interval 50^o to 4000^oK may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table OOw.

[c] See footnote c of Table OOw

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1w - PARAFFINS, C_1 to C_5
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
August 31, 1944

Compound (Gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o kcal/mole[c]														
Methane	CH_4	-15.987	-17.889	-17.903	-18.629	-19.302	-19.893	-20.401	-20.823	-21.166	-21.43	-21.65	-21.79	-21.92	-22.00	-22.06
Ethane	C_2H_6	-16.517	-20.236	-20.258	-21.419	-22.437	-23.28	-23.98	-24.53	-24.97	-25.28	-25.50	-25.64	-25.72	-25.75	-25.73
Propane	C_3H_8	-19.482	-24.820	-24.848	-26.358	-27.622	-28.66	-29.49	-30.12	-30.58	-30.90	-31.09	-31.16	-31.19	-31.14	-31.06
n-Butane	C_4H_{10}	-23.332	-29.812	-29.847	-31.629	-33.128	-34.33	-35.28	-36.00	-36.54	-36.88	-37.06	-37.11	-37.05	-36.95	-36.79
2-Methylpropane(Isobutane)	"	-24.602	-31.452	-31.489	-33.303	-34.783	-35.97	-36.91	-37.61	-38.10	-38.42	-38.57	-38.58	-38.54	-38.43	-38.29
n-Pentane	C_5H_{12}	-27.27	-35.00	-35.04	-37.12	-38.86	-40.25	-41.34	-42.16	-42.75	-43.10	-43.26	-43.27	-43.18	-42.99	-42.74
2-Methylbutane (Isopentane)	"	-28.66	-36.92	-36.96	-39.07	-40.78	-42.12	-43.17	-43.94	-44.47	-44.80	-44.92	-44.88	-44.78	-44.58	-44.36
2,2-Dimethylpropane (Neopentane)	"	-31.30	-39.67	-39.71	-41.77	-43.42	-44.67	-45.63	-46.29	-46.73	-46.96	-47.01	-46.90	-46.70	-46.42	-46.12

[a] Interpolation to other temperatures in the interval 298.16^o to 1500^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o and 600^oK.

[b] ΔHf^o represents the increment in heat content for the reaction of forming the given compound in the gaseous state from the elements carbon (solid, graphite) and hydrogen (gaseous), with all the reactants and products in their appropriate standard reference state at the temperature indicated.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2w (Part 1) - PARAFFINS, C_6

HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK

September 30, 1944: November 30, 1946

Compound (Gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o kcal/mole[c]														
n - Hexane	C_6H_{14}	-30.98	-39.96	-40.01	-42.38	-44.36	-45.93	-47.15	-48.06	-48.71	-49.07	-49.23	-49.19	-49.04	-48.78	-48.47
2 - Methylpentane. .	"	-32.08	-41.66	-41.71	-44.13	-46.06	-47.65	-48.82	-49.73	-50.28	-50.59					
3 - " . .	"	-31.49	-41.02	-41.06	-43.42	-45.32	-46.82	-48.02	-48.82	-49.42	-49.80					
2,2 - Dimethylbutane	"	-34.61	-44.35	-44.40	-46.78	-48.74	-50.18	-51.35	-52.10	-52.72	-52.92					
2,3 - "	"	-32.88	-42.49	-42.53	-44.93	-46.86	-48.33	-49.55	-50.37	-50.90	-51.29					

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2w (Part 2) - PARAFFINS, C_7

HEAT OF FORMATION, ΔHf^o, AT 0^o TO $1500^o K$

September 30, 1944

Compound (Gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o kcal/mole[c]														
n - Heptane	C_7H_{16}	-34.65	-44.89	-44.94	-47.60	-49.83	-51.58	-52.93	-53.94	-54.63	-55.01	-55.15	-55.08	-54.88	-54.55	-54.16
2 - Methylhexane. . . .	"	-35.77	-46.60	-46.66	-49.30	-51.45	-53.09	-54.33	-55.25	-55.91	-56.33					
3 - "	"	-34.96	-45.96	-46.02	-48.71	-50.90	-52.58	-53.84	-54.77	-55.42	-55.82					
3 - Ethylpentane. . . .	"	-34.10	-45.34	-45.40	-48.15	-50.40	-52.12	-53.43	-54.41	-55.11	-55.56					
2,2 - Dimethylpentane .	"	-38.00	-49.29	-49.35	-52.02	-54.14	-55.72	-56.87	-57.69	-58.25	-58.56					
2,3 - "	"	-36.29	-47.62	-47.68	-50.39	-52.56	-54.21	-55.43	-56.35	-57.01	-57.45					
2,4 - "	"	-36.98	-48.30	-48.36	-51.02	-53.13	-54.70	-55.85	-56.69	-57.27	-57.64					
3,3 - "	"	-36.92	-48.17	-48.23	-50.88	-52.98	-54.54	-55.67	-56.46	-56.98	-57.28					
2,2,3-Trimethylbutane .	"	-37.57	-48.96	-49.02	-51.64	-53.69	-55.19	-56.25	-57.01	-57.52	-57.83					

[a] See footnote a of Table 1w. [b] See footnote b of Table 1w. [c] See footnote c of Table 1w.

TABLE 3w - PARAFFINS, C_8

HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK

October 31, 1944

Compound (Gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o kcal/mole[c]														
n-Octane	C_8H_{18}	-38.33	-49.82	-49.88	-52.83	-55.30	-57.23	-58.71	-59.81	-60.57	-60.96	-61.08	-60.97	-60.71	-60.31	-59.86
2-Methylheptane	"	-39.42	-51.50	-51.56	-54.49	-56.87	-58.67	-60.04	-61.13	-61.91	-62.19					
3- "	"	-38.64	-50.82	-50.88	-53.84	-56.23	-58.03	-59.40	-60.49	-61.27	-61.57					
4- "	"	-38.43	-50.69	-50.75	-53.73	-56.13	-57.97	-59.39	-60.47	-61.23	-61.55					
3-Ethylhexane	"	-37.71	-50.40	-50.46	-53.59	-56.10	-58.04	-59.53	-60.64	-61.42	-61.81					
2,2-Dimethylhexane	"	-41.23	-53.71	-53.77	-56.72	-59.06	-60.85	-62.16	-63.02	-63.66	-63.96					
2,3- "	"	-38.76	-51.13	-51.19	-54.08	-56.26	-57.88	-59.11	-60.10	-60.83	-61.16					
2,4- "	"	-39.74	-52.44	-52.51	-55.50	-57.92	-59.72	-61.06	-62.10	-62.86	-63.23					
2,5- "	"	-40.61	-53.21	-53.27	-56.24	-58.58	-60.33	-61.66	-62.70	-63.45	-63.77					
3,3- "	"	-39.90	-52.61	-52.68	-55.65	-58.03	-59.78	-61.04	-61.93	-62.54	-62.84					
3,4- "	"	-38.52	-50.91	-50.97	-53.81	-56.05	-57.71	-58.98	-60.05	-60.82	-61.01					
2-Methyl-3-ethylpentane	"	-37.96	-50.48	-50.54	-53.46	-55.77	-57.52	-58.87	-59.95	-60.70	-60.93					
3- " -3- "	"	-38.68	-51.38	-51.45	-54.32	-56.65	-58.42	-59.74	-60.65	-61.18	-61.29					
2,2,3-Trimethylpentane	"	-39.77	-52.61	-52.68	-55.62	-57.92	-59.63	-60.89	-61.82	-62.43	-62.63					
2,2,4- "	"	-40.73	-53.57	-53.64	-56.58	-58.88	-60.59	-61.85	-62.78	-63.39	-63.59					
2,3,3,- "	"	-39.01	-51.73	-51.80	-54.72	-56.98	-58.66	-59.93	-60.92	-61.56	-61.62					
2,3,4- "	"	-39.12	-51.97	-52.04	-54.97	-57.18	-58.83	-60.11	-61.17	-61.91	-62.03					
2,2,3,3-Tetramethylbutane	"	-41.09	-53.99	-54.06	-56.96	-59.14	-60.65	-61.70	-62.51	-63.02	-63.03					

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w

[c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5w - ALKYL BENZENES, C_6 to C_9
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Benzene	C_6H_6	24.000	19.820	19.796	18.554	17.536	16.711	16.040	15.510	15.100	14.818	14.63	14.52	14.45	14.41	14.39
Methylbenzene (Toluene)	C_7H_8	17.500	11.950	11.919	10.327	9.005	7.932	7.067	6.399	5.895	5.564	5.36	5.27	5.22	5.23	5.27
Ethylbenzene	C_8H_{10}	13.917	7.120	7.083	5.218	3.699	2.488	1.529	0.798	0.266	-0.061	-0.23	-0.28	-0.26	-0.18	-0.05
1,2-Dimethylbenzene (o-Xylene)	"	11.096	4.540	4.506	2.711	1.189	-0.062	-1.076	-1.858	-2.434	-2.799	-3.01	-3.08	-3.09	-3.04	-2.92
1,3- " (m- ")	"	10.926	4.120	4.083	2.175	0.571	-0.738	-1.792	-2.598	-3.191	-3.567	-3.78	-3.86	-3.88	-3.84	-3.73
1,4- " (p- ")	"	11.064	4.290	4.253	2.317	0.680	-0.665	-1.751	-2.586	-3.207	-3.607	-3.84	-3.94	-3.97	-3.94	-3.84
n-Propylbenzene	C_9H_{12}	9.810	1.870	1.827	-0.31	-2.06	-3.44	-4.52	-5.34	-5.95	-6.30	-6.5	-6.5	-6.4	-6.2	-6.0
Isopropylbenzene (Cumene)	"	9.250	0.940	0.895	-1.28	-3.01	-4.37	-5.44	-6.24	-6.80	-7.13	-7.3	-7.2	-7.2	-7.0	-6.8
1-Methyl-2-ethylbenzene	"	8.092	0.290	0.250	-1.82	-3.54	-4.93	-6.03	-6.88	-7.48	-7.84	-8.0	-8.0	-8.0	-7.9	-7.7
1- " -3- "	"	7.593	-0.460	-0.503	-2.68	-4.49	-5.93	-7.08	-7.95	-8.57	-8.94	-9.1	-9.2	-9.1	-9.0	-8.8
1- " -4- "	"	7.241	-0.780	-0.823	-3.03	-4.87	-6.35	-7.53	-8.43	-9.08	-9.47	-9.7	-9.7	-9.7	-9.6	-9.4
1,2,3-Trimethylbenzene (Hemimellitene)	"	5.527	-2.290	-2.332	-4.57	-6.46	-8.04	-9.31	-10.30	-11.04	-11.51	-11.8	-11.9	-11.9	-11.8	-11.7
1,2,4- " (Pseudocumene)	"	4.468	-3.330	-3.372	-5.59	-7.46	-9.02	-10.28	-11.26	-11.98	-12.45	-12.7	-12.8	-12.8	-12.7	-12.6
1,3,5- " (Mesitylene)	"	4.241	-3.840	-3.883	-6.183	-8.107	-9.691	-10.960	-11.930	-12.643	-13.094	-13.34	-13.42	-13.42	-13.33	-13.18

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

American Petroleum Institute Research Project 44

National Bureau of Standards

Washington, D. C.

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TABLE 7w - ALKYL CYCLOHEXANES, C_6 to C_8
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
April 30, 1947

Compound (Gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Cyclohexane	C_6H_{12}	-20.01	-29.43	-29.48	-31.70	-34.08	-35.57	-36.59	-37.19	-37.46	-37.41	-37.14	-36.68	-36.05	-35.44	-34.61
Methylcyclohexane	C_7H_{14}	-26.30	-36.99	-37.04	-39.79	-41.92	-43.46	-44.50	-45.10	-45.34	-45.25	-44.92	-44.36	-43.71	-42.89	-42.10
Ethylcyclohexane	C_8H_{16}	-28.94	-41.05	-41.10	-44.13	-46.50	-48.22	-49.35	-49.98	-50.25	-50.17	-49.84	-49.25	-48.51	-47.69	-46.71
1,1-Dimethylcyclohexane	"	-30.93	-43.26	-43.31	-46.4	-48.9	-50.6	-51.8	-52.4	-52.5	-52.4	-51.9	-51.2	-50.4	-49.4	-48.4
cis-1,2- "	"	-28.95	-41.15	-41.20	-44.3	-46.7	-48.4	-49.6	-50.2	-50.5	-50.4	-50.0	-49.4	-48.6	-47.4	-46.9
trans-1,2- "	"	-30.91	-43.02	-43.07	-46.1	-48.4	-50.1	-51.2	-51.9	-52.0	-51.9	-51.5	-50.9	-50.1	-49.2	-48.2
cis-1,3-[d] "	"	-32.02	-44.16	-44.21	-47.3	-49.7	-51.4	-52.5	-53.1	-53.3	-53.2	-52.8	-52.1	-51.2	-50.4	-49.3
trans-1,3-[e] "	"	-30.06	-42.20	-42.25	-45.3	-47.7	-49.5	-50.7	-51.3	-51.6	-51.6	-51.2	-50.6	-49.9	-49.1	-48.1
cis-1,4- "	"	-30.08	-42.22	-42.27	-45.4	-47.7	-49.5	-50.7	-51.4	-51.7	-51.6	-51.2	-50.6	-49.9	-49.1	-48.2
trans-1,4- "	"	-31.99	-44.12	-44.17	-47.2	-49.6	-51.3	-52.3	-53.0	-53.2	-53.0	-52.6	-51.9	-51.2	-50.3	-49.3

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8w (Part 1) - MONOOLEFINS, C_2 to C_4
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Ethene (Ethylene)	C_2H_4	14.522	12.496	12.482	11.766	11.138	10.600	10.142	9.760	9.448	9.205	9.02	8.88	8.76	8.67	8.61
Propene (Propylene)	C_3H_6	8.468	4.879	4.858	3.758	2.793	1.98	1.30	0.76	0.34	0.03	-0.18	-0.32	-0.42	-0.47	-0.48
1-Butene.	C_4H_8	5.158	0.280	0.254	-1.090	-2.215	-3.14	-3.88	-4.46	-4.89	-5.17	-5.34	-5.40	-5.42	-5.37	-5.29
cis-2-Butene.	"	3.794	-1.362	-1.393	-2.996	-4.369	-5.51	-6.44	-7.17	-7.74	-8.14	-8.40	-8.55	-8.64	-8.66	-8.62
trans-2- "	"	2.506	-2.405	-2.432	-3.846	-5.074	-6.11	-6.95	-7.62	-8.12	-8.46	-8.69	-8.81	-8.87	-8.87	-8.82
2-Methylpropene (Isobutene)	"	1.676	-3.343	-3.370	-4.736	-5.911	-6.88	-7.69	-8.31	-8.79	-9.12	-9.31	-9.40	-9.44	-9.42	-9.35

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w. With regard to estimated uncertainties for the above compounds, see footnote c on Tables 8r, 8s, and 8t.

TABLE 8w (Part 2) - MONOOLEFINS, C_5
HEAT OF FORMATION, ΔHf^o, AT 0^o TO $1500^o K$
March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
1-Pentene.	C_5H_{10}	+ 1.019	- 5.000	- 5.034	- 6.65	- 8.01	- 9.10	- 9.97	- 10.64	- 11.14	- 11.44	- 11.60	- 11.63	- 11.58	- 11.47	- 11.31
cis-2-Pentene.	"	- 0.178	- 6.710	- 6.750	- 8.65	-10.24	- 11.53	- 12.56	- 13.36	- 13.95	- 14.33	- 14.58	- 14.67	- 14.69	- 14.63	- 14.50
trans-2- "	"	- 1.362	- 7.590	- 7.625	- 9.31	-10.73	- 11.89	- 12.83	- 13.55	- 14.08	- 14.40	- 14.59	- 14.66	- 14.65	- 14.56	- 14.41
2-Methyl-1-butene. . . .	"	- 2.303	- 8.680	- 8.716	-10.39	-11.79	- 12.92	- 13.83	- 14.53	- 15.04	- 15.36	- 15.51	- 15.56	- 15.53	- 15.41	- 15.26
3- " -1- "	"	- 0.681	- 6.920	- 6.952	- 8.47	- 9.72	- 10.75	- 11.58	- 12.22	- 12.67	- 12.94	- 13.08	- 13.08	- 13.02	- 12.92	- 12.77
2- " -2- "	"	- 3.677	-10.170	-10.207	-12.03	-13.58	- 14.85	- 15.88	- 16.68	- 17.28	- 17.68	- 17.92	- 18.02	- 18.04	- 17.98	- 17.86

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards · Washington, D. C.

TABLE 8w (Part 3) - MONOOLEFINS, C_6
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
1-Hexene	C_6H_{12}	-2.69	-9.96	-10.00	-11.9	-13.5	-14.8	-15.8	-16.6	-17.1	-17.4	-17.6	-17.6	-17.5	-17.3	-17.0
cis-2-Hexene	"	-3.89	-11.56	-11.61	-13.8	-15.6	-17.1	-18.2	-19.1	-19.8	-20.2					
trans-2- "	"	-5.19	-12.56	-12.60	-14.6	-16.2	-17.5	-18.6	-19.4	-20.0	-20.4					
cis-3- "	"	-3.66	-11.56	-11.61	-13.8	-15.7	-17.1	-18.3	-19.2	-19.8	-20.2					
trans-3- "	"	-5.02	-12.56	-12.60	-14.6	-16.2	-17.5	-18.5	-19.3	-19.8	-20.2					
2-Methyl-1-pentene	"	-6.04	-13.56	-13.60	-15.6	-17.2	-18.5	-19.5	-20.3	-20.9	-21.2					
3- " -1- "	"	-3.37	-11.02	-11.06	-12.9	-14.3	-15.5	-16.5	-17.2	-17.7	-18.0					
4- " -1- "	"	-3.86	-11.66	-11.70	-13.6	-15.2	-16.4	-17.4	-18.1	-18.6	-18.9					
2- " -2- "	"	-6.99	-14.96	-15.01	-17.2	-19.0	-20.5	-21.6	-22.5	-23.2	-23.6					
cis-3-Methyl-2-pentene . . .	"	-6.35	-14.32	-14.37	-16.5	-18.3	-19.8	-21.0	-21.9	-22.5	-22.9					
trans-3- " -2- " . . .	"	-6.35	-14.32	-14.37	-16.5	-18.3	-19.8	-21.0	-21.9	-22.5	-22.9					
cis-4- " -2- " . . .	"	-5.42	-13.26	-13.30	-15.3	-17.0	-18.3	-19.4	-20.2	-20.8	-21.2					
trans-4- " -2- " . . .	"	-6.67	-14.26	-14.30	-16.2	-17.7	-19.0	-20.0	-20.8	-21.3	-21.6					
2-Ethyl-1-butene	"	-5.17	-12.92	-12.96	-15.0	-16.6	-17.9	-19.0	-19.7	-20.3	-20.6					
2,3-Dimethyl-1-butene. . . .	"	-7.10	-14.78	-14.82	-16.6	-18.1	-19.3	-20.2	-21.0	-21.5	-21.8					
3,3- " -1- "	"	-6.18	-14.25	-14.30	-16.3	-17.9	-19.1	-20.0	-20.6	-21.0	-21.3					
2,3- " -2- "	"	-7.96	-15.91	-15.96	-18.1	-20.0	-21.5	-22.8	-23.7	-24.4	-24.8					

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12w - ACETYLENES, C_2 to C_5

HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK

April 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o. in kcal/mole[c]														
Ethyne (Acetylene)	C_2H_2	54.329	54.194	54.193	54.134	54.049	53.931	53.787	53.627	53.462	53.304	53.151	53.003	52.851	52.698	52.548
Propyne (Methylacetylene). .	C_3H_4	46.017	44.319	44.309	43.775	43.280	42.829	42.423	42.069	41.769	41.53	41.34	41.19	41.06	40.95	40.86
1-Butyne (Ethylacetylene). .	C_4H_6	42.96	39.70	39.68	38.79	38.00	37.32	36.74	36.26	35.88	35.60	35.39	35.27	35.17	35.12	35.08
2- " (Dimethylacetylene)	"	38.491	35.374	35.355	34.348	33.432	32.63	31.95	31.38	30.92	30.59	30.33	30.17	30.03	29.95	29.89
1-Pentyne.	C_5H_8	38.90	34.50	34.47	33.31	32.28	31.44	30.73	30.16	29.72	29.40	29.21	29.11	29.09	29.10	29.13
2- "	"	35.48	30.80	30.77	29.41	28.20	27.17	26.30	25.62	25.07	24.69	24.44	24.28	24.19	24.16	24.17
3-Methyl-1-butyne.	"	37.37	32.60	32.57	31.37	30.37	29.55	28.84	28.30	27.89	27.60	27.44	27.37	27.36	27.37	27.38

[a] See footnote a of Table 1w. [b] See footnote b of Table 1w. [c] See-footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20w - NORMAL PARAFFINS, C_1 TO C_{20}
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
November 30, 1945

Compound (Gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Methane	CH_4	-15.987	-17.889	-17.903	-18.629	-19.302	-19.893	-20.401	-20.823	-21.166	-21.43	-21.65	-21.79	-21.92	-22.00	-22.06
Ethane	C_2H_6	-16.517	-20.236	-20.258	-21.419	-22.437	-23.28	-23.98	-24.53	-24.97	-25.28	-25.50	-25.64	-25.72	-25.75	-25.73
Propane	C_3H_8	-19.482	-24.820	-24.848	-26.358	-27.622	-28.66	-29.49	-30.12	-30.58	-30.90	-31.09	-31.16	-31.19	-31.14	-31.06
n-Butane	C_4H_{10}	-23.332	-29.812	-29.847	-31.629	-33.128	-34.33	-35.28	-36.00	-36.54	-36.88	-37.06	-37.11	-37.05	-36.95	-36.79
n-Pentane	C_5H_{12}	-27.27	-35.00	-35.04	-37.12	-38.86	-40.25	-41.34	-42.16	-42.75	-43.10	-43.26	-43.27	-43.18	-42.99	-42.74
n-Hexane	C_6H_{14}	-30.98	-39.96	-40.01	-42.38	-44.36	-45.93	-47.15	-48.06	-48.71	-49.07	-49.23	-49.19	-49.04	-48.78	-48.47
n-Heptane	C_7H_{16}	-34.65	-44.89	-44.94	-47.60	-49.83	-51.58	-52.93	-53.94	-54.63	-55.01	-55.15	-55.08	-54.88	-54.55	-54.16
n-Octane	C_8H_{18}	-38.33	-49.82	-49.88	-52.83	-55.30	-57.23	-58.71	-59.81	-60.57	-60.96	-61.08	-60.97	-60.71	-60.31	-59.86
n-Nonane	C_9H_{20}	-42.00	-54.74	-54.81	-58.05	-60.76	-62.88	-64.49	-65.68	-66.50	-66.90	-67.01	-66.85	-66.54	-66.07	-65.55
n-Decane	$C_{10}H_{22}$	-45.67	-59.67	-59.74	-63.28	-66.23	-68.53	-70.27	-71.55	-72.42	-72.84	-72.94	-72.74	-72.37	-71.82	-71.24
n-Undecane	$C_{11}H_{24}$	-49.34	-65.60	-64.67	-68.50	-71.69	-74.17	-76.04	-77.42	-78.35	-78.78	-78.87	-78.63	-78.20	-77.58	-76.93
n-Dodecane	$C_{12}H_{26}$	-53.02	-69.52	-69.60	-73.72	-77.16	-79.82	-81.82	-83.29	-84.28	-84.72	-84.79	-84.51	-84.03	-83.34	-82.63
n-Tridecane	$C_{13}H_{28}$	-56.69	-74.45	-74.53	-78.94	-82.62	-85.47	-87.60	-89.17	-90.20	-90.66	-90.72	-90.40	-89.86	-89.10	-88.32
n-Tetradecane	$C_{14}H_{30}$	-60.36	-79.38	-79.46	-84.17	-88.09	-91.12	-93.38	-95.04	-96.13	-96.60	-96.65	-96.28	-95.69	-94.86	-94.01
n-Pentadecane	$C_{15}H_{32}$	-64.04	-84.31	-84.39	-89.39	-93.55	-96.77	-99.16	-100.91	-102.06	-102.54	-102.57	-102.17	-101.52	-100.61	-99.70
n-Hexadecane	$C_{16}H_{34}$	-67.71	-89.23	-89.33	-94.61	-99.02	-102.41	-104.93	-106.78	-107.99	-108.48	-108.50	-108.06	-107.35	-106.37	-105.39
n-Heptadecane	$C_{17}H_{36}$	-71.38	-94.15	-94.26	-99.84	-104.48	-108.06	-110.71	-112.65	-113.91	-114.42	-114.43	-113.94	-113.19	-112.13	-111.08
n-Octadecane	$C_{18}H_{38}$	-75.06	-99.08	-99.19	-105.06	-109.95	-113.71	-116.49	-118.52	-119.84	-120.37	-120.35	-119.83	-119.02	-117.89	-116.78
n-Nonadecane	$C_{19}H_{40}$	-78.73	-104.00	-104.12	-110.28	-115.41	-119.36	-122.27	-124.39	-125.77	-126.31	-126.28	-125.71	-124.85	-123.64	-122.47
n-Eicosane	$C_{20}H_{42}$	-82.40	-108.93	-109.05	-115.50	-120.88	-125.01	-128.04	-130.26	-131.69	-132.25	-132.21	-131.60	-130.68	-129.40	-128.16
Increment per CH_2 group		-3.673	-4.926	-4.931	-5.223	-5.465	-5.648	-5.778	-5.871	-5.927	-5.941	-5.927	-5.886	-5.830	-5.758	-5.692

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21w - NORMAL ALKYL BENZENES, C_6 to C_{22}
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Benzene	C_6H_6	24.000	19.820	19.796	18.554	17.536	16.711	16.040	15.510	15.100	14.818	14.63	14.52	14.45	14.41	14.39
Methylbenzene (Toluene)	C_7H_8	17.500	11.950	11.919	10.327	9.005	7.932	7.067	6.399	5.895	5.564	5.36	5.27	5.22	5.23	5.27
Ethylbenzene	C_8H_{10}	13.917	7.120	7.083	5.218	3.699	2.488	1.529	0.798	0.266	-0.061	-0.23	-0.28	-0.26	-0.18	-0.05
n-Propylbenzene	C_9H_{12}	9.810	1.870	1.827	-0.31	-2.06	-3.44	-4.52	-5.34	-5.95	-6.30	-6.5	-6.5	-6.4	-6.2	-6.0
n-Butylbenzene	$C_{10}H_{14}$	5.89	-3.30	-3.35	-5.78	-7.78	-9.34	-10.56	-11.48	-12.14	-12.49	-12.6	-12.6	-12.5	-12.3	-12.0
n-Amylbenzene	$C_{11}H_{16}$	2.22	-8.23	-8.28	-11.00	-13.24	-14.99	-16.34	-17.35	-18.07	-18.43	-18.6	-18.5	-18.3	-18.0	-17.7
n-Hexylbenzene	$C_{12}H_{18}$	-1.46	-13.15	-13.21	-16.23	-18.71	-20.64	-22.12	-23.22	-23.99	-24.37	-24.5	-24.4	-24.1	-23.8	-23.4
n-Heptylbenzene	$C_{13}H_{20}$	-5.13	-18.08	-18.14	-21.45	-24.18	-26.28	-27.89	-29.09	-29.92	-30.31	-30.4	-30.3	-30.0	-29.5	-29.0
n-Octylbenzene	$C_{14}H_{22}$	-8.80	-23.00	-23.07	-26.67	-29.64	-31.93	-33.67	-34.96	-35.85	-36.25	-36.4	-36.2	-35.8	-35.3	-34.7
n-Nonylbenzene	$C_{15}H_{24}$	-12.48	-27.93	-28.00	-31.90	-35.10	-37.58	-39.45	-40.84	-41.78	-42.20	-42.3	-42.0	-41.6	-41.1	-40.4
n-Decylbenzene	$C_{16}H_{26}$	-16.15	-32.86	-32.94	-37.12	-40.57	-43.23	-45.23	-46.71	-47.70	-48.14	-48.2	-47.9	-47.5	-46.8	-46.1
n-Undecylbenzene	$C_{17}H_{28}$	-19.82	-37.78	-37.87	-42.34	-46.04	-48.88	-51.01	-52.58	-53.63	-54.08	-54.1	-53.8	-53.3	-52.6	-51.8
n-Dodecylbenzene	$C_{18}H_{30}$	-23.49	-42.71	-42.80	-47.56	-51.50	-54.52	-56.78	-58.45	-59.56	-60.02	-60.1	-59.7	-59.1	-58.3	-57.5
n-Tridecylbenzene	$C_{19}H_{32}$	-27.17	-47.63	-47.73	-52.79	-56.96	-60.17	-62.56	-64.32	-65.48	-65.96	-66.0	-65.6	-65.0	-64.1	-63.2
n-Tetradecylbenzene	$C_{20}H_{34}$	-30.84	-52.56	-52.66	-58.01	-62.43	-65.82	-68.34	-70.19	-71.41	-71.90	-71.9	-71.5	-70.8	-69.8	-68.9
n-Pentadecylbenzene	$C_{21}H_{36}$	-34.51	-57.49	-57.59	-63.23	-67.90	-71.47	-74.12	-76.06	-77.34	-77.84	-77.8	-77.4	-76.6	-75.6	-74.6
n-Hexadecylbenzene	$C_{22}H_{38}$	-38.19	-62.41	-62.52	-68.46	-73.36	-77.12	-79.90	-81.93	-83.26	-83.78	-83.8	-83.2	-82.4	-81.4	-80.3
Increment per CH_2 group		-3.673	-4.926	-4.931	-5.223	-5.465	-5.648	-5.778	-5.871	-5.927	-5.941	-5.93	-5.89	-5.83	-5.76	-5.69

[a] See footnote a of Table 1w. [b] See footnote b of Table 1w. [c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 22w - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}
HEAT OF FORMATION, ΔHf^o, AT 0° TO 1500°K
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Cyclopentane	C_5H_{10}	-10.68	-18.46	-18.50	-20.80	-22.67	-24.12	-25.25	-26.06	-26.61	-26.91	-27.01	-26.97	-26.81	-26.57	-26.25
Methylcyclopentane	C_6H_{12}	-16.62	-25.50	-25.54	-28.07	-30.11	-31.68	-32.88	-33.74	-34.29	-34.58	-34.65	-34.52	-34.30	-33.97	-33.56
Ethylcyclopentane.	C_7H_{14}	-20.08	-30.37	-30.42	-33.24	-35.50	-37.24	-38.54	-39.47	-40.06	-40.36	-40.40	-40.22	-39.94	-39.53	-39.04
n-Propylcyclopentane . . .	C_8H_{16}	-23.85	-35.39	-35.44	-38.6	-41.1	-43.0	-44.4	-45.4	-46.1	-46.4	-46.4	-46.2	-45.9	-45.4	-44.8
n-Butylcyclopentane. . . .	C_9H_{18}	-27.43	-40.22	-40.28	-43.7	-46.4	-48.5	-50.1	-51.2	-51.9	-52.2	-52.2	-52.0	-51.6	-51.0	-50.4
n-Pentylcyclopentane . . .	$C_{10}H_{20}$	-31.10	-45.15	-45.21	-48.9	-51.9	-54.2	-55.9	-57.1	-57.8	-58.2	-58.2	-57.9	-57.4	-56.8	-56.1
n-Hexylcyclopentane. . . .	$C_{11}H_{22}$	-34.77	-50.07	-50.14	-54.1	-57.4	-59.8	-61.6	-63.0	-63.8	-64.1	-64.1	-63.8	-63.3	-62.6	-61.8
n-Heptylcyclopentane . . .	$C_{12}H_{24}$	-38.44	-55.00	-55.08	-59.4	-62.8	-65.5	-67.4	-68.8	-69.7	-70.1	-70.0	-69.6	-69.1	-68.3	-67.5
n-Octylcyclopentane. . . .	$C_{13}H_{26}$	-42.12	-59.92	-60.01	-64.6	-68.3	-71.1	-73.2	-74.7	-75.6	-76.0	-76.0	-75.5	-74.9	-74.1	-73.2
n-Nonylcyclopentane. . . .	$C_{14}H_{28}$	-45.79	-64.85	-64.94	-69.8	-73.8	-76.8	-79.0	-80.6	-81.6	-82.0	-81.9	-81.4	-80.8	-79.8	-78.9
n-Decylcyclopentane. . . .	$C_{15}H_{30}$	-49.46	-69.78	-69.87	-75.0	-79.2	-82.4	-84.8	-86.4	-87.5	-87.9	-87.8	-87.3	-86.6	-85.6	-84.6
n-Undecylcyclopentane. . .	$C_{16}H_{32}$	-53.14	-74.70	-74.80	-80.2	-84.7	-88.1	-90.5	-92.3	-93.4	-93.8	-93.7	-93.2	-92.4	-91.4	-90.3
n-Dodecylcyclopentane. . .	$C_{17}H_{34}$	-56.81	-79.63	-79.73	-85.5	-90.2	-93.7	-96.3	-98.2	-99.3	-99.8	-99.7	-99.1	-98.2	-97.1	-96.0
n-Tridecylcyclopentane . .	$C_{18}H_{36}$	-60.48	-84.55	-84.66	-90.7	-95.6	-99.4	-102.1	-104.0	-105.3	-105.7	-105.6	-105.0	-104.1	-102.9	-101.6
n-Tetradecylcyclopentane .	$C_{19}H_{38}$	-64.16	-89.48	-89.59	-95.9	-101.1	-105.0	-107.9	-109.9	-111.2	-111.6	-111.5	-110.8	-109.9	-108.6	-107.3
n-Pentadecylcyclopentane .	$C_{20}H_{40}$	-67.83	-94.41	-94.52	-101.1	-106.5	-110.7	-113.6	-115.8	-117.1	-117.6	-117.4	-116.7	-115.7	-114.4	-113.0
n-Hexadecylcyclopentane. .	$C_{21}H_{42}$	-71.50	-99.33	-99.45	-106.4	-112.0	-116.3	-119.4	-121.6	-123.0	-123.5	-123.4	-122.6	-121.6	-120.1	-118.7
Increment per CH_2 group. .		-3.673	-4.926	-4.931	-5.22	-5.46	-5.65	-5.78	-5.87	-5.93	-5.94	-5.93	-5.89	-5.83	-5.76	-5.69

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

TABLE 23w - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}
HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Cyclohexane	C_6H_{12}	-20.01	-29.43	-29.48	-31.70	-34.08	-35.57	-36.59	-37.19	-37.46	-37.41	-37.14	-36.68	-36.05	-35.44	-34.61
Methylcyclohexane	C_7H_{14}	-26.30	-36.99	-37.04	-39.79	-41.92	-43.46	-44.50	-45.10	-45.34	-45.25	-44.92	-44.36	-43.71	-42.89	-42.10
Ethylcyclohexane	C_8H_{16}	-28.94	-41.05	-41.10	-44.13	-46.50	-48.22	-49.35	-49.98	-50.25	-50.17	-49.84	-49.25	-48.51	-47.69	-46.71
n-Propylcyclohexane	C_9H_{18}	-32.79	-46.20	-46.27	-49.6	-52.2	-54.2	-55.4	-56.2	-56.5	-56.4	-56.0	-55.3	-54.5	-53.7	-52.5
n-Butylcyclohexane	$C_{10}H_{20}$	-36.29	-50.95	-51.02	-54.7	-57.5	-59.6	-61.0	-61.9	-62.3	-62.2	-61.7	-61.0	-60.2	-59.3	-58.0
n-Pentylcyclohexane	$C_{11}H_{22}$	-39.96	-55.88	-55.95	-59.9	-62.9	-65.3	-66.8	-67.8	-68.2	-68.2	-67.6	-66.9	-66.0	-65.0	-63.7
n-Hexylcyclohexane	$C_{12}H_{24}$	-43.64	-60.80	-60.88	-65.2	-68.4	-70.9	-72.6	-73.7	-74.1	-74.1	-73.6	-72.8	-71.8	-70.8	-69.4
n-Heptylcyclohexane	$C_{13}H_{26}$	-47.31	-65.73	-65.81	-70.4	-73.9	-76.6	-78.4	-79.6	-80.1	-80.0	-79.5	-78.7	-77.6	-76.5	-75.1
n-Octylcyclohexane	$C_{14}H_{28}$	-50.98	-70.65	-70.74	-75.6	-79.3	-82.2	-84.2	-85.4	-86.0	-86.0	-85.4	-84.6	-83.5	-82.3	-80.8
n-Nonylcyclohexane	$C_{15}H_{30}$	-54.66	-75.58	-75.68	-80.8	-84.8	-87.9	-89.9	-91.3	-91.9	-91.9	-91.3	-90.5	-89.3	-88.0	-86.5
n-Decylcyclohexane	$C_{16}H_{32}$	-58.33	-80.51	-80.61	-86.0	-90.3	-93.5	-95.7	-97.2	-97.8	-97.9	-97.3	-96.4	-95.1	-93.8	-92.2
n-Undecylcyclohexane	$C_{17}H_{34}$	-62.00	-85.43	-85.54	-91.3	-95.7	-99.2	-101.5	-103.0	-103.8	-103.8	-103.2	-102.2	-101.0	-99.6	-97.9
n-Dodecylcyclohexane	$C_{18}H_{36}$	-65.67	-90.36	-90.47	-96.5	-101.2	-104.8	-107.3	-108.9	-109.7	-109.8	-109.1	-108.1	-106.8	-105.3	-103.6
n-Tridecylcyclohexane	$C_{19}H_{38}$	-69.35	-95.28	-95.40	-101.7	-106.7	-110.4	-113.0	-114.8	-115.6	-115.7	-115.0	-114.0	-112.6	-111.1	-109.3
n-Tetradecylcyclohexane	$C_{20}H_{40}$	-73.02	-100.21	-100.33	-106.9	-112.1	-116.1	-118.8	-120.6	-121.6	-121.6	-121.0	-119.9	-118.5	-116.8	-115.0
n-Pentadecylcyclohexane	$C_{21}H_{42}$	-76.69	-105.14	-105.26	-112.2	-117.6	-121.8	-124.6	-126.5	-127.5	-127.6	-126.9	-125.8	-124.3	-122.6	-120.6
n-Hexadecylcyclohexane	$C_{22}H_{44}$	-80.37	-110.06	-110.19	-117.4	-123.1	-127.4	-130.4	-132.4	-133.4	-133.5	-132.8	-131.7	-130.1	-128.4	-126.3
Increment per CH_2 group		-3.673	-4.926	-4.931	-5.22	-5.46	-5.65	-5.78	-5.87	-5.93	-5.94	-5.93	-5.89	-5.83	-5.76	-5.69

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

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National Bureau of Standards — Washington, D. C.

TABLE 24w - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

HEAT OF FORMATION, ΔHf^o, AT 0^o TO 1500^oK

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf^o, in kcal/mole[c]														
Ethene (Ethylene)	C_2H_4	14.522	12.496	12.482	11.766	11.138	10.600	10.142	9.760	9.448	9.205	9.02	8.88	8.76	8.67	8.61
Propene (Propylene)	C_3H_6	8.468	4.879	4.858	3.758	2.793	1.98	1.30	0.76	0.34	0.03	- 0.18	- 0.32	- 0.42	- 0.47	- 0.48
1-Butene.	C_4H_8	5.158	0.280	0.254	- 1.090	- 2.215	- 3.14	- 3.88	- 4.46	- 4.89	- 5.17	- 5.34	- 5.40	- 5.42	- 5.37	- 5.29
1-Pentene	C_5H_{10}	1.019	- 5.000	- 5.034	- 6.65	- 8.01	- 9.10	- 9.97	-10.64	- 11.14	- 11.44	- 11.60	- 11.63	-11.58	-11.47	-11.31
1-Hexene.	C_6H_{12}	- 2.69	- 9.96	-10.00	-11.9	-13.5	-14.8	-15.8	-16.6	- 17.1	- 17.4	- 17.6	- 17.6	-17.5	-17.3	-17.0
1-Heptene	C_7H_{14}	- 6.37	-14.89	-14.94	-17.1	-19.0	-20.4	-21.6	-22.4	- 23.1	- 23.4	- 23.5	- 23.5	-23.3	-23.0	-22.7
1-Octene.	C_8H_{16}	-10.04	-19.82	-19.87	-22.4	-24.4	-26.1	-27.4	-28.3	- 29.0	- 29.3	- 29.4	- 29.3	-29.1	-28.8	-28.4
1-Nonene.	C_9H_{18}	-13.71	-24.74	-24.80	-27.6	-29.9	-31.7	-33.1	-34.2	- 34.9	- 35.3	- 35.4	- 35.2	-35.0	-34.6	-34.1
1-Decene.	$C_{10}H_{20}$	-17.39	-29.67	-29.73	-32.8	-35.4	-37.4	-38.9	-40.1	- 40.8	- 41.2	- 41.3	- 41.1	-40.8	-40.3	-39.8
1-Undecene.	$C_{11}H_{22}$	-21.06	-34.60	-34.66	-38.0	-40.8	-43.0	-44.7	-45.9	- 46.8	- 47.1	- 47.2	- 47.0	-46.6	-46.1	-45.5
1-Dodecene.	$C_{12}H_{24}$	-24.73	-39.52	-39.59	-43.3	-46.3	-48.7	-50.5	-51.8	- 52.8	- 53.1	- 53.1	- 52.9	-52.5	-51.8	-51.2
1-Tridecene	$C_{13}H_{26}$	-28.41	-44.45	-44.52	-48.5	-51.8	-54.3	-56.3	-57.7	- 58.6	- 59.0	- 59.1	- 58.8	-58.3	-57.6	-56.9
1-Tetradecene	$C_{14}H_{28}$	-32.08	-49.38	-49.45	-53.7	-57.2	-60.0	-62.0	-63.5	- 64.5	- 65.0	- 65.0	- 64.7	-64.1	-63.4	-62.6
1-Pentadecene	$C_{15}H_{30}$	-35.75	-54.31	-54.38	-58.9	-62.7	-65.6	-67.8	-69.4	- 70.5	- 70.9	- 70.9	- 70.5	-69.9	-69.1	-68.3
1-Hexadecene.	$C_{16}H_{32}$	-39.42	-59.23	-59.31	-64.1	-68.2	-71.3	-73.6	-75.3	- 76.4	- 76.9	- 76.9	- 76.4	-75.8	-74.9	-74.0
1-Heptadecene	$C_{17}H_{34}$	-43.10	-64.15	-64.25	-69.4	-73.6	-76.9	-79.4	-81.2	- 82.3	- 82.8	- 82.8	- 82.3	-81.6	-80.6	-79.7
1-Octadecene.	$C_{18}H_{36}$	-46.77	-69.08	-69.18	-74.6	-79.1	-82.6	-85.1	-87.0	- 88.3	- 88.7	- 88.7	- 88.2	-87.4	-86.4	-85.3
1-Nonadecene.	$C_{19}H_{38}$	-50.44	-74.00	-74.11	-79.8	-84.6	-88.2	-90.9	-92.9	- 94.2	- 94.7	- 94.6	- 94.1	-93.3	-92.1	-91.0
1-Eicosene.	$C_{20}H_{40}$	-54.12	-78.93	-79.04	-85.0	-90.0	-93.9	-96.7	-98.8	-100.1	-100.6	-100.6	-100.0	-99.1	-97.9	-96.7
Increment per CH_2 group . .		- 3.673	- 4.926	- 4.931	- 5.22	- 5.47	- 5.65	- 5.78	- 5.87	- 5.93	- 5.94	- 5.93	- 5.89	- 5.83	- 5.76	- 5.69

[a] See footnote a of Table 1w.

[b] See footnote b of Table 1w.

[c] See footnote c of Table 1w.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 25w - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}
HEAT OF FORMATION, ΔHf°, AT 0° TO 1500°K
February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Heat of Formation[b], ΔHf°, in kcal/mole[c]														
Ethyne (Acetylene)	C_2H_2	54.329	54.194	54.193	54.134	54.049	53.931	53.787	53.627	53.462	53.304	53.151	53.003	52.851	52.698	52.548
Propyne (Methylacetylene).	C_3H_4	46.017	44.319	44.309	43.775	43.280	42.829	42.423	42.069	41.769	41.53	41.34	41.19	41.06	40.95	40.86
1-Butyne (Ethylacetylene).	C_4H_6	42.96	39.70	39.68	38.79	38.00	37.32	36.74	36.26	35.88	35.60	35.39	35.27	35.17	35.12	35.08
1-Pentyne.	C_5H_8	38.90	34.50	34.47	33.31	33.28	31.44	30.73	30.16	29.72	29.40	29.21	29.11	29.09	29.10	29.13
1-Hexyne	C_6H_{10}	35.20	29.55	29.51	28.1	26.8	25.8	24.9	24.2	23.8	23.4	23.2	23.2	23.2	23.3	23.4
1-Heptyne.	C_7H_{12}	31.53	24.62	24.58	22.8	21.3	20.1	19.1	18.4	17.8	17.5	17.3	17.3	17.4	17.6	17.7
1-Octyne	C_8H_{14}	27.86	19.70	19.65	17.6	15.9	14.5	13.4	12.5	11.9	11.5	11.4	11.4	11.6	11.8	12.0
1-Nonyne	C_9H_{16}	24.18	14.77	14.72	12.4	10.4	8.8	7.6	6.6	6.0	5.6	5.5	5.5	5.7	6.0	6.3
1-Decyne	$C_{10}H_{18}$	20.51	9.85	9.79	7.2	4.9	3.2	1.8	0.8	0.0	-0.3	-0.5	-0.4	-0.1	0.3	0.6
1-Undecyne	$C_{11}H_{20}$	16.84	4.92	4.86	1.9	-0.5	-2.5	-4.0	-5.1	-5.9	-6.3	-6.4	-6.2	-5.9	-5.5	-5.0
1-Dodecyne	$C_{12}H_{22}$	13.16	-0.01	-0.07	-3.3	-6.0	-8.1	-9.8	-11.0	-11.8	-12.2	-12.3	-12.1	-11.8	-11.2	-10.7
1-Tridecyne.	$C_{13}H_{24}$	9.49	-4.93	-5.00	-8.5	-11.5	-13.8	-15.5	-16.8	-17.7	-18.2	-18.2	-18.0	-17.6	-17.0	-16.4
1-Tetradecyne.	$C_{14}H_{26}$	5.82	-9.86	-9.94	-13.7	-16.9	-19.4	-21.3	-22.7	-23.7	-24.1	-24.2	-23.9	-23.4	-22.8	-22.1
1-Pentadecyne.	$C_{15}H_{28}$	2.15	-14.78	-14.87	-19.0	-22.4	-25.1	-27.1	-28.6	-29.6	-30.0	-30.1	-29.8	-29.3	-28.5	-27.8
1-Hexadecyne	$C_{16}H_{30}$	-1.53	-19.71	-19.80	-24.2	-27.9	-30.7	-32.9	-34.5	-35.5	-36.0	-36.0	-35.7	-35.1	-34.3	-33.5
1-Heptadecyne.	$C_{17}H_{32}$	-5.20	-24.64	-24.73	-29.4	-33.3	-36.4	-38.6	-40.3	-41.4	-41.9	-42.0	-41.6	-40.9	-40.0	-39.2
1-Octadecyne	$C_{18}H_{34}$	-8.87	-29.56	-29.66	-34.6	-38.8	-42.0	-44.4	-46.2	-47.4	-47.9	-47.9	-47.4	-46.8	-45.8	-44.9
1-Nonadecyne	$C_{19}H_{36}$	-12.55	-34.49	-34.59	-39.8	-44.2	-47.7	-50.2	-52.1	-53.3	-53.8	-53.8	-53.3	-52.6	-51.6	-50.6
1-Eicosyne	$C_{20}H_{38}$	-16.22	-39.41	-39.52	-45.1	-49.7	-53.3	-56.0	-58.0	-59.2	-59.8	-59.7	-59.2	-58.4	-57.3	-56.3
Increment per CH_2 group		-3.673	-4.926	-4.931	-5.22	-5.47	-5.65	-5.78	-5.87	-5.93	-5.94	-5.93	-5.89	-5.83	-5.76	-5.69

[a] See footnote a of Table 1w. [b] See footnote b of Table 1w. [c] See footnote c of Table 1w.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 00x - O, H, N, C

FREE ENERGY OF FORMATION, ΔFf^o, AT 0° to 4000°K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b,c], ΔFf^o, in kcal/mole[d]														
Oxygen	O	58.586	54.994	54.969	53.547	52.085	50.596	49.085	47.561	46.023	44.476	42.919	41.356	39.788	38.215	36.634
Hydrogen	H	51.620	48.575	48.553	47.351	46.111	44.842	43.548	42.232	40.900	39.552	38.190	36.817	35.432	34.038	32.636
Nitrogen	N	85.120	81.476	81.446	80.050	78.617	77.154	75.669	74.165	72.646	71.115	69.572	68.021	66.462	64.896	63.325
Carbon	C	125.055	115.509	115.443	111.761	108.024	104.258	100.474	96.684	92.890	89.095	85.303	81.512	77.728	73.946	70.168

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Free Energy of Formation, ΔFf^o, in kcal/mole														
Oxygen	O	44.476	40.569	36.634	32.668	28.684	24.680	20.669	16.654	12.633	4.581	-3.507				
Hydrogen	H	39.552	36.130	32.636	29.100	25.529	21.930	18.309	14.670	11.014	3.673	-3.698				
Nitrogen	N	71.115	67.242	63.325	59.370	55.394	51.396	47.379	43.348	39.301	31.174	23.004				
Carbon	C	89.095	79.625	70.168												

[a] Interpolation to other temperatures in the interval 298.16° to 4000°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating the values for 300°, 400°, 500°, and 600°K.

[b] ΔFf^o represents the increment in free energy content for the reaction of forming the given substance from the elements, with all the reactants and products in their appropriate standard reference states at the temperature indicated.

[c] Because of the existing very large uncertainty in the values of ΔHf for C (gas) and N (gas), the values of the free energies of formation of C (gas), from C (solid, graphite), and of N (gas), from N_2 (gas), may correspondingly be greatly in error.

[d] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 0x - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 4000^oK

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in °K													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]													
Oxygen	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl	OH	gas	10.0						8.932	8.928	8.546	8.165	7.789	7.416	7.049	6.689
Water	H_2O	gas	-57.1043						-54.6351	-54.6152	-53.516	-52.358	-51.154	-49.912	-48.643	-47.349
Nitrogen	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	NO	gas	21.477				21.005	20.861	20.719	20.714	20.418	20.120	19.820	19.517	19.218	18.917
Carbon	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	CO	gas	-27.2019				-30.734	-31.782	-32.8079	-32.8464	-35.007	-37.184	-39.358	-41.526	-43.677	-45.816
Carbon Dioxide	CO_2	gas	-93.9686						-94.2598	-94.2603	-94.325	-94.392	-94.444	-94.497	-94.539	-94.578

Compound	Formula	State	Temperature in °K													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Free Energy of Formation, ΔFf^o, in kcal/mole													
Oxygen	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl	OH	gas	6.333	5.980	5.632	5.290	4.947	4.606	3.766	2.941	2.120	1.313	0.514	-0.284	-1.844	-3.397
Water	H_2O	gas	-46.036	-44.710	-43.370	-42.017	-40.661	-39.296	-35.878	-32.423	-28.98	-25.50	-22.00	-18.52		
Nitrogen	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	NO	gas	18.614	18.311	18.005	17.706	17.406	17.100	16.336	15.580	14.813	14.062	13.309	12.564	11.081	9.616
Carbon	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	CO	gas	-47.942	-50.053	-52.153	-54.235	-56.308	-58.370								
Carbon Dioxide	CO_2	gas	-94.610	-94.637	-94.661	-94.677	-94.690	-94.707								

[a] Interpolation to other temperatures in the interval 50^o to $4000\ ^oK$ may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table 00x.

[c] See footnote d of Table 00x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1x - PARAFFINS, C_1 to C_5

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

August 31, 1944

Compound (Gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o kcal/mole[c]														
Methane	CH_4	-15.987	-12.140	-12.105	-10.048	-7.841	-5.49	-3.05	-0.55	+2.01	4.61	7.22	9.85	12.50	15.14	17.79
Ethane	C_2H_6	-16.517	-7.860	-7.785	-3.447	+1.168	5.97	10.90	15.92	21.00	26.13	31.28	36.45	41.62	46.79	51.99
Propane	C_3H_8	-19.482	-5.614	-5.541	+1.191	8.230	15.50	22.93	30.45	38.05	45.68	53.34	61.01	68.68	76.35	84.08
n-Butane	C_4H_{10}	-23.332	-3.754	-3.595	+5.435	14.868	24.59	34.50	44.50	54.59	64.71	74.87	85.05	95.25	105.42	115.61
2-Methylpropane (Isobutane)	"	-24.602	-4.296	-4.127	+5.273	15.088	25.18	35.44	45.82	56.29	66.79	77.32	87.86	98.39	108.90	119.44
n-Pentane	C_5H_{12}	-27.27	-1.96	-1.76	+9.66	21.57	33.79	46.22	58.77	71.41	84.10	96.81	109.55	122.30	135.01	147.75
2-Methylbutane (Isopentane)	"	-28.66	-3.50	-3.38	+8.26	20.29	32.66	45.19	57.84	70.62	83.41	96.23	109.07	121.89	134.68	147.53
2,2-Dimethylpropane (Neopentane)	"	-31.30	-3.64	-3.42	+8.99	21.89	35.08	48.46	61.93	75.49	89.08	102.68	116.27	129.88	143.44	157.00

[a] Interpolation to other temperatures in the interval 298.16^o to 1500^oK may be made by appropriate graphical or analytical methods. For temperatures between 200^o and 298.16^oK, values may be estimated by extrapolating to lower temperatures the values for 300^o, 400^o, 500^o and 600^oK.

[b] ΔFf^o represents the increment in free energy for the reaction of forming the given compound in the gaseous state from the elements carbon (solid, graphite) and hydrogen (gaseous), with all the reactants and products in their appropriate standard reference state at the temperature indicated.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2x (Part 1) - PARAFFINS, C_6

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

September 30, 1944; November 30, 1946

Compound (Gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o kcal/mole[c]														
n - Hexane	C_6H_{14}	-30.98	+0.05	0.30	14.11	28.46	43.18	58.13	73.21	88.40	103.64	118.90	134.19	149.48	164.75	180.04
2 - Methylpentane	"	-32.08	-1.11	-0.86	+13.12	27.68	42.61	57.74	72.98	88.32	103.71	119.23	134.69	150.07	164.06	180.94
3 - "	"	-31.49	-0.51	-0.26	+13.71	28.22	43.08	58.19	73.33	88.64	104.00	119.38	134.80	150.14	165.49	180.93
2,2 - Dimethylbutane	"	-34.61	-2.33	-2.07	+12.39	27.45	42.84	58.43	74.13	89.93	105.78	121.65	137.56	153.39	169.23	185.01
2,3 - "	"	-32.88	-0.95	-0.69	+13.64	28.48	43.67	59.18	74.74	90.40	106.11	121.84	137.85	153.43	169.00	184.79

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2x (Part 2) - PARAFFINS, C_7

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

September 30, 1944

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o kcal/mole[c]														
n - Heptane	C_7H_{16}	-34.65	+2.09	2.38	18.58	35.39	52.60	70.08	87.70	105.43	123.22	141.02	158.85	176.69	194.50	212.38
2 - Methylhexane. . . .	"	-35.77	+0.98	1.27	17.61	34.60	52.01	69.67	87.47	105.33	123.18					
3 - "	"	-34.96	+1.10	1.39	17.57	34.40	51.68	69.21	86.87	104.59	122.29					
3 - Ethylpentane. . . .	"	-34.10	+2.59	2.88	19.36	36.52	54.15	72.06	90.09	108.19	126.25					
2,2 - Dimethylpentane .	"	-38.00	+0.09	0.39	17.33	34.95	53.01	71.33	89.73	108.18	126.55					
2,3 - "	"	-36.29	+0.16	0.45	16.83	33.90	51.43	69.24	87.17	105.18	123.16					
2,4 - "	"	-36.98	+0.72	1.02	17.81	35.28	53.19	71.37	89.66	107.99	126.27					
3,3 - "	"	-36.92	+0.63	0.93	17,64	35.02	52.84	70.92	89.10	107.34	125.53					
2,2,3- Trimethylbutane.	"	-37.57	+0.76	1.06	18.06	35.75	53.87	72.24	90.72	109.23	127.68					

[a] See footnote a of Table 1x. [b] See footnote b of Table 1x. [c] See footnote c of Table 1x.

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TABLE 3x - PARAFFINS, C_8

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO $1500^o K$

October 31, 1944

Compound (Gas)	Formula	Temperature[a] in ^{o} K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o kcal/mole[c]														
n-Octane	C_8H_{18}	-38.33	+4.14	4.47	23.06	42.32	62.03	82.03	102.17	122.45	142.79	163.14	183.51	203.90	224.26	244.71
2-Methylheptane	"	-39.42	+3.06	3.39	22.14	41.58	61.47	81.63	101.88	122.27	142.83					
3- "	"	-38.64	+3.29	3.62	22.21	41.50	61.27	81.31	101.44	121.68	142.07					
4- "	"	-38.43	+4.00	4.34	23.12	42.62	62.61	82.88	103.23	123.68	144.26					
3-Ethylhexane	"	-37.71	+3.95	4.28	22.94	42.39	62.37	82.64	102.98	123.42	143.98					
2,2-Dimethylhexane	"	-41.23	+2.56	2.91	22.18	42.20	62.71	83.48	104.30	125.21	146.27					
2,3- "	"	-38.76	+4.23	4.57	23.51	43.16	63.27	83.64	104.09	124.63	145.30					
2,4- "	"	-39.74	+2.80	3.14	22.05	41.72	61.89	82.32	102.84	123.43	144.07					
2,5- "	"	-40.61	+2.50	2.84	21.92	41.75	62.08	82.69	103.41	124.20	144.99					
3,3- "	"	-39.90	+3.17	3.51	22.63	42.50	62.85	83.47	104.16	124.93	145.76					
3,4- "	"	-38.52	+4.97	5.31	24.42	44.27	64.57	85.12	105.75	126.49	147.35					
2-Methyl-3-ethylpentane	"	-37.96	+5.08	5.43	24.47	44.24	64.47	84.96	105.52	126.21	147.09					
3- " -3- "	"	-38.68	+4.76	5.11	24.32	44.30	64.77	85.48	106.22	127.05	148.01					
2,2,3-Trimethylpentane	"	-39.77	+4.09	4.44	23.82	43.98	64.63	85.54	106.52	127.57	148.68					
2,2,4- "	"	-40.73	+3.13	3.48	22.86	43.02	63.67	84.58	105.56	126.61	147.72					
2,3,3- "	"	-39.01	+4.52	4.86	24.09	44.08	64.55	85.30	106.10	126.98	147.90					
2,3,4- "	"	-39.12	+4.32	4.67	23.89	43.89	64.37	85.11	105.94	126.84	147.80					
2,2,3,3-Tetramethylbutane	"	-41.09	+4.88	5.24	25.34	46.19	67.47	88.97	110.52	132.19	154.05					

[a] See footnote a of Table 1x. [b] See footnote b of Table 1x. [c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5x - ALKYL BENZENES, C_6 to C_9

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Benzene	C_6H_6	24.000	30.989	31.058	35.008	39.242	43.663	48.211	52.838	57.537	62.270	67.02	71.79	76.57	81.34	86.11
Methylbenzene (Toluene)	C_7H_8	17.500	29.228	29.335	35.390	41.811	48.477	55.306	62.236	69.255	76.320	83.40	90.50	97.61	104.71	111.81
Ethylbenzene.	C_8H_{10}	13.917	31.208	31.357	39.741	48.554	57.646	66.921	76.302	85.779	95.303	104.84	114.39	123.95	133.48	143.02
1,2-Dimethylbenzene (o-Xylene).	"	11.096	29.177	29.329	37.883	46.852	56.103	65.548	75.110	84.777	94.494	104.23	113.99	123.76	133.50	143.24
1,3- " (m- ").	"	10.926	28.405	28.554	37.008	45.906	55.099	64.492	74.006	83.630	93.307	103.00	112.72	122.45	132.15	141.85
1,4- " (p- ").	"	11.064	28.952	29.104	37.688	46.724	56.060	65.604	75.275	85.058	94.897	104.76	114.64	124.54	134.40	144.27
n-Propylbenzene	C_9H_{12}	9.810	32.810	33.000	43.73	54.94	66.48	78.22	90.09	102.07	114.08	126.1	138.2	150.3	162.3	174.3
Isopropylbenzene (Cumene)	"	9.250	32.738	32.934	43.96	55.46	67.29	79.33	91.48	103.74	116.06	128.4	140.7	153.1	165.4	177.6
1-Methyl-2-ethylbenzene	"	8.092	31.323	31.514	42.26	53.48	65.02	76.78	88.65	100.64	112.67	124.7	136.8	148.9	160.9	173.0
1- " -3- "	"	7.593	30.217	30.406	41.05	52.20	63.68	75.38	87.20	99.14	111.14	123.2	135.2	147.2	159.2	171.2
1- " -4- "	"	7.241	30.281	30.472	41.25	52.54	64.16	76.02	88.00	100.10	112.26	124.4	136.6	148.8	161.0	173.2
1,2,3-Trimethylbenzene (Hemimellitene).	"	5.527	29.319	29.513	40.56	52.06	63.91	76.01	88.26	100.63	113.071	125.5	138.0	150.6	163.03	175.51
1,2,4- " (Pseudocumene) .	"	4.468	27.912	28.104	39.02	50.39	62.11	74.07	86.17	98.41	110.71	123.0	135.4	147.8	160.1	172.4
1,3,5- " (Mesitylene) . .	"	4.241	28.172	28.369	39.558	51.223	63.237	75.495	87.903	100.443	113.045	125.67	138.32	150.98	163.60	176.23

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

TABLE 7x - ALKYL CYCLOHEXANES, C_6 to C_8
FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK
April 30, 1947

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Cyclohexane	C_6H_{12}	-20.01	+7.59	7.81	20.66	34.07	47.86	61.85	75.96	90.13	104.30	118.42	132.58	146.69	160.73	174.72
Methylcyclohexane	C_7H_{14}	-26.30	+6.52	6.79	21.84	37.51	53.55	69.80	86.16	102.59	119.03	135.43	151.83	168.13	184.43	200.65
Ethylcyclohexane	C_8H_{16}	-28.94	+9.38	9.69	27.12	45.19	63.72	82.50	101.37	120.28	139.23	158.17	177.11	195.93	214.71	233.36
1,1-Dimethylcyclohexane	"	-30.93	+8.42	8.74	26.6	45.2	64.1	83.4	102.7	122.1	141.4	160.8	180.2	199.5	218.4	237.1
cis-1,2- "	"	-28.95	+9.85	10.17	27.8	46.1	64.8	83.8	102.9	122.1	141.2	160.4	179.5	198.6	217.4	236.0
trans-1,2- "	"	-30.91	+8.24	8.55	26.2	44.6	63.4	82.4	101.5	120.6	139.9	159.1	178.1	197.3	216.1	234.9
cis-1,3-[d] "	"	-32.02	+7.13	7.44	25.2	43.6	62.4	81.4	100.6	119.8	139.0	158.3	177.5	196.6	215.6	234.5
trans-1,3-[e] "	"	-30.06	+8.68	8.99	26.6	44.8	63.6	82.5	101.5	120.6	139.8	158.9	178,0	197.2	216.0	234.7
cis-1,4- "	"	-30.08	+9.07	9.38	27.1	45.5	64.3	83.4	102.6	121.8	141.2	160.4	179.7	190.0	217.8	236.5
trans-1,4- "	"	-31.99	+7.58	7.89	25.8	44.3	63.2	82.4	101.6	121.0	140.3	159.6	179.0	198.2	217.2	235.9

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

[d] Formerly labeled "trans"; see footnote d of Table 7a.

[e] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8x (Part 1) - MONOOLEFINS, C_2 to C_4
FREE ENERGY OF FORMATION, ΔFf^o, AT 0° TO 1500°K
December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, kcal/mole[c]														
Ethene (Ethylene)	C_2H_4	14.522	16.282	16.305	17.675	19.245	20.918	22.676	24.490	26.354	28.249	30.16	32.09	34.03	35.97	37.92
Propene (Propylene)	C_3H_6	8.468	14.990	15.051	18.610	22.450	26.46	30.59	34.81	39.10	43.43	47.78	52.15	56.52	60.90	65.28
1-Butene.	C_4H_8	5.158	17.217	17.320	23.205	29.430	35.85	42.41	49.05	55.78	62.54	69.31	76.10	82.90	89.67	96.46
cis-2-Butene.	"	3.794	16.046	16.154	22.232	28.730	35.46	42.37	49.39	56.50	63.66	70.84	78.06	85.29	92.51	99.74
trans-2- "	"	2.506	15.315	15.424	21.578	28.100	34.83	41.72	48.71	55.80	62.93	70.08	77.25	84.43	91.59	98.77
2-Methylpropene (Isobutene)	"	1.676	14.582	14.693	20.910	27.480	34.25	41.17	48.19	55.28	62.42	69.58	76.76	83.96	91.13	98.31

[a] See footnote a of Table 1x. [b] See footnote b of Table 1x.

[c] See footnote c of Table 1x. With regard to estimated uncertainties for the above compounds, see footnote c on Tables 8r, 8s, and 8t.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8x (Part 2) - MONOOLEFINS, C_5

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
1-Pentene	C_5H_{10}	1.019	18.787	18.930	27.16	35.78	44.65	53.69	62.81	72.02	81.27	90.55	99.86	109.19	118.46	127.71
cis-2-Pentene	"	- 0.178	17.173	17.322	25.62	34.41	43.48	52.72	62.11	71.58	81.10	90.63	100.22	109.80	119.36	128.88
trans-2- "	"	- 1.362	16.575	16.723	25.08	33.87	42.91	52.12	61.43	70.86	80.31	89.79	99.28	108.78	118.28	127.74
2-Methyl-1-butene	"	- 2.303	15.509	15.659	24.03	32.82	41.85	51.06	60.37	69.76	79.20	88.65	98.14	107.63	117.10	126.53
3- " -1- "	"	- 0.681	17.874	18.029	26.62	35.50	44.63	53.94	63.34	72.82	82.35	91.88	101.46	111.01	120.52	130.00
2- " -2- "	"	- 3.677	14.267	14.414	22.88	31.82	41.03	50.42	59.94	69.57	79.25	88.94	98.68	108.39	118.12	127.81

[a] See footnote a of Table 1x. [b] See footnote b of Table 1x. [c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8x (Part 3) - MONOOLEFINS, C_6
FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK
April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
1-Hexene	C_6H_{12}	-2.69	20.80	20.99	31.6	42.7	54.1	65.6	77.3	89.1	100.9	112.7	124.6	136.5	148.3	160.1
cis-2-Hexene	"	-3.89	19.18	19.36	30.0	41.2	52.7	64.4	76.3	88.3	100.3					
trans-2- "	"	-5.19	18.46	18.65	29.3	40.5	52.0	63.7	75.5	87.4	99.4					
cis-3- "	"	-3.66	19.66	19.86	30.7	42.0	53.7	65.7	77.7	89.9	102.1					
trans-3- "	"	-5.02	18.86	19.06	29.9	41.2	52.8	64.6	76.6	88.6	100.6					
2-Methyl-1-pentene	"	-6.04	17.48	17.67	28.4	39.6	51.1	62.7	74.5	86.4	98.3					
3- " -1- "	"	-3.37	20.28	20.47	31.3	42.5	54.0	65.6	77.4	89.2	101.2					
4- " -1- "	"	-3.86	19.90	20.09	31.0	42.3	54.0	65.8	77.7	89.7	101.8					
2- " -2- "	"	-6.99	16.34	16.54	27.4	38.8	50.5	62.4	74.4	86.6	98.8					
cis-3-Methyl-2-pentene . . .	"	-6.35	16.98	17.18	28.0	39.4	51.1	63.0	75.1	87.2	99.4					
trans-3- " -2- " . . .	"	-6.35	16.74	16.93	27.7	39.0	50.6	62.4	74.4	86.5	98.6					
cis-4- " -2- " . . .	"	-5.42	18.40	18.60	29.6	41.0	52.7	64.6	76.7	88.8	101.1					
trans-4- " -2- " . . .	"	-6.67	17.77	17.96	29.0	40.5	52.2	64.2	76.2	88.4	100.7					
2-Ethyl-1-butene	"	-5.17	18.51	18.71	29.6	40.9	52.5	64.4	76.3	88.4	100.5					
2,3-Dimethyl-1-butene. . . .	"	-7.10	17.43	17.63	28.7	40.2	52.0	64.0	76.0	88.2	100.4					
3,3- " -1- "	"	-6.18	19.04	19.25	30.7	42.6	54.9	67.3	79.9	92.4	105.0					
2,3- " -2- "	"	-7.96	16.52	16.72	27.9	39.7	51.8	64.1	76.6	89.2	101.8					

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12x - ACETYLENES, C_2 to C_5
FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK
April 30, 1945

Compound (gas)	Formula	Temperature[a] in ^oK														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Ethyne (Acetylene)	C_2H_2	54.329	50.000	49.975	48.577	47.196	45.835	44.498	43.178	41.882	40.604	39.339	38.089	36.854	35.624	34.410
Propyne (Methylacetylene). .	C_3H_4	46.017	46.313	46.481	47.287	48.224	49.255	50.360	51.514	52.715	53.95	55.20	56.46	57.74	59.02	60.32
1-Butyne (Ethylacetylene). .	C_4H_6	42.96	48.52	48.57	51.67	54.99	58.45	62.02	65.66	69.36	73.10	76.85	80.62	84.41	88.20	91.99
2- " (Dimethylacetylene)	"	38.491	44.725	44.783	48.080	51.620	55.34	59.18	63.10	67.10	71.14	75.20	79.29	83.39	87.49	91.60
1-Pentyne.	C_5H_8	38.90	50.17	50.26	55.71	61.42	67.33	73.38	79.50	85.69	91.92	98.17	104.46	110.78	117.06	123.31
2- "	"	35.48	46.41	46.51	51.96	57.74	63.75	69.92	76.19	82.55	88.96	95.39	101.84	108.32	114.79	121.26
3-Methyl-1-butyne.	"	37.37	49.12	49.23	54.96	60.97	67.17	73.50	79.92	86.40	92.93	99.47	106.04	112.61	119.15	125.68

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20x - NORMAL PARAFFINS, C_1 TO C_{20}

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Methane	CH_4	-15.987	-12.140	-12.105	-10.048	-7.841	-5.49	-3.05	-0.55	+2.01	4.61	7.22	9.85	12.50	15.14	17.79
Ethane	C_2H_6	-16.517	-7.860	-7.785	-3.447	+1.168	5.97	10.90	15.92	21.00	26.13	31.28	36.45	41.62	46.79	51.99
Propane	C_3H_8	-19.482	-5.614	-5.541	+1.191	8.230	15.50	22.93	30.45	38.05	45.68	53.34	61.01	68.68	76.35	84.08
n-Butane	C_4H_{10}	-23.332	-3.754	-3.595	+5.435	14.868	24.59	34.50	44.50	54.59	64.71	74.87	85.05	95.25	105.42	115.61
n-Pentane	C_5H_{12}	-27.27	-1.96	-1.76	+9.66	21.57	33.79	46.22	58.77	71.41	84.10	96.81	109.55	122.30	135.01	147.75
n-Hexane	C_6H_{14}	-30.98	+0.05	0.30	14.11	28.46	43.18	58.13	73.21	88.40	103.64	118.90	134.19	149.48	164.75	180.04
n-Heptane	C_7H_{16}	-34.65	+2.09	2.38	18.58	35.39	52.60	70.08	87.70	105.43	123.22	141.02	158.85	176.69	194.50	212.38
n-Octane	C_8H_{18}	-38.33	+4.14	4.47	23.06	42.32	62.03	82.03	102.17	122.45	142.79	163.14	183.51	203.90	224.26	244.71
n-Nonane	C_9H_{20}	-42.00	+6.18	6.56	27.54	49.25	71.46	93.98	116.66	139.48	162.37	185.26	208.18	231.12	254.03	277.04
n-Decane	$C_{10}H_{22}$	-45.67	+8.23	8.65	32.01	56.18	80.89	105.93	131.14	156.51	181.95	207.39	232.85	258.33	283.79	309.37
n-Undecane	$C_{11}H_{24}$	-49.34	+10.28	10.74	36.49	63.11	90.31	117.88	145.63	173.54	201.53	229.51	257.52	285.54	313.55	341.70
n-Dodecane	$C_{12}H_{26}$	-53.02	+12.33	12.83	40.97	70.04	99.74	129.83	160.11	190.57	221.11	251.63	282.19	312.76	343.32	374.03
n-Tridecane	$C_{13}H_{28}$	-56.69	+14.37	14.92	45.45	76.97	109.17	141.78	174.59	207.60	240.69	273.76	306.86	339.97	373.08	406.36
n-Tetradecane	$C_{14}H_{30}$	-60.36	+16.42	17.01	49.93	83.90	118.60	153.73	189.08	224.63	260.26	295.88	331.52	367.19	402.85	438.69
n-Pentadecane	$C_{15}H_{32}$	-64.04	+18.47	19.10	54.41	90.83	128.03	165.68	203.56	241.66	279.84	318.01	356.19	394.40	432.61	471.02
n-Hexadecane	$C_{16}H_{34}$	-67.71	+20.52	21.19	58.89	97.76	137.46	177.63	218.04	258.69	299.42	340.13	380.86	421.62	462.38	503.36
n-Heptadecane	$C_{17}H_{36}$	-71.38	+22.56	23.27	63.36	104.69	146.88	189.58	232.53	275.72	319.00	362.25	405.53	448.83	492.14	535.69
n-Octadecane	$C_{18}H_{38}$	-75.06	+24.61	25.36	67.84	111.62	156.31	201.53	247.01	292.75	338.58	384.38	430.20	476.05	521.90	568.02
n-Nonadecane	$C_{19}H_{40}$	-78.73	+26.66	27.45	72.32	118.55	165.74	213.48	261.49	309.78	358.16	406.50	454.86	503.26	551.67	600.35
n-Eicosane	$C_{20}H_{42}$	-82.40	+28.71	29.54	76.80	125.48	175.17	225.43	275.98	326.81	377.74	428.63	479.53	530.48	581.43	632.68
Increment per CH_2 group		-3.673	+2.048	2.090	4.479	6.931	9.428	11.951	14.484	17.029	19.579	22.124	24.668	27.215	29.764	32.331

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 21x - NORMAL ALKYL BENZENES, C_6 to C_{22}
FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK
November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Benzene	C_6H_6	24.000	30.989	31.058	35.008	39.242	43.663	48.211	52.838	57.537	62.270	67.02	71.79	76.57	81.34	86.11
Methylbenzene (Toluene)	C_7H_8	17.500	29.228	29.335	35.390	41.811	48.477	55.306	62.236	69.255	76.320	83.40	90.50	97.61	104.71	111.81
Ethylbenzene	C_8H_{10}	13.917	31.208	31.357	39.741	48.554	57.646	66.921	76.302	85.779	95.303	104.84	114.39	123.95	133.48	143.02
n-Propylbenzene	C_9H_{12}	9.810	32.810	33.000	43.73	54.94	66.48	78.22	90.09	102.07	114.08	126.1	138.2	150.3	162.3	174.3
n-Butylbenzene	$C_{10}H_{14}$	5.89	34.62	34.86	47.98	61.65	75.70	89.97	104.38	118.90	133.48	148.1	162.7	177.3	191.9	206.5
n-Amylbenzene	$C_{11}H_{16}$	2.22	36.67	36.95	52.46	68.58	85.13	101.92	118.86	135.93	153.06	170.2	187.4	204.5	221.7	238.8
n-Hexylbenzene	$C_{12}H_{18}$	-1.46	38.72	39.04	56.94	75.51	94.56	113.87	133.35	152.96	172.64	192.3	212.0	231.8	251.4	271.1
n-Heptylbenzene	$C_{13}H_{20}$	-5.13	40.76	41.13	61.42	82.44	103.98	125.82	147.83	169.99	192.22	214.4	236.7	259.0	281.2	303.5
n-Octylbenzene	$C_{14}H_{22}$	-8.80	42.81	43.22	65.90	89.37	113.41	137.77	162.32	187.02	211.80	236.5	261.4	286.2	311.0	335.8
n-Nonylbenzene	$C_{15}H_{24}$	-12.48	44.86	45.31	70.38	96.30	122.84	149.72	176.80	204.04	231.38	258.7	286.0	313.4	340.7	368.1
n-Decylbenzene	$C_{16}H_{26}$	-16.15	46.91	47.40	74.85	103.24	132.27	161.68	191.28	221.07	250.95	280.8	310.7	340.6	370.5	400.5
n-Undecylbenzene	$C_{17}H_{28}$	-19.82	48.96	49.49	79.33	110.17	141.70	173.63	205.77	238.10	270.53	302.9	335.4	367.8	400.2	432.8
n-Dodecylbenzene	$C_{18}H_{30}$	-23.49	51.00	51.58	83.81	117.10	151.12	185.58	220.25	255.13	290.11	325.0	360.0	395.0	430.0	465.1
n-Tridecylbenzene	$C_{19}H_{32}$	-27.17	53.05	53.67	88.29	124.03	160.55	197.53	234.74	272.16	309.69	347.1	384.7	422.3	459.8	497.4
n-Tetradecylbenzene	$C_{20}H_{34}$	-30.84	55.10	55.76	92.77	130.96	169.98	209.48	249.22	289.19	329.27	369.2	409.4	449.5	489.5	529.8
n-Pentadecylbenzene	$C_{21}H_{36}$	-34.51	57.15	57.85	97.25	137.89	179.41	221.43	263.70	306.22	348.85	391.4	434.0	476.7	519.3	562.1
n-Hexadecylbenzene	$C_{22}H_{38}$	-38.19	59.20	59.94	101.73	144.82	188.84	233.38	278.19	323.25	368.43	413.5	458.7	503.9	549.1	594.4
Increment per CH_2 group		-3.673	2.048	2.090	4.479	6.931	9.428	11.951	14.484	17.029	19.579	22.12	24.67	27.22	29.76	32.33

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C

TABLE 22x - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}
FREE ENERGY OF FORMATION, ΔFr^o, AT 0° TO 1500°K
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFr^o, in kcal/mole[c]														
Cyclopentane	C_5H_{10}	-10.68	+9.23	9.40	19.06	29.25	39.78	50.52	61.40	72.37	83.38	94.41	105.43	116.47	127.48	138.47
Methylcyclopentane	C_6H_{12}	-16.62	+8.55	8.76	20.59	33.00	45.78	58.79	71.93	85.17	98.46	111.77	125.08	138.41	151.68	164.87
Ethylcyclopentane.	C_7H_{14}	-20.08	+10.59	10.84	25.05	39.90	55.17	70.66	86.29	102.06	117.86	133.68	149.50	165.29	181.11	196.83
n-Propylcyclopentane . . .	C_8H_{16}	-23.85	+12.54	12.84	29.4	46.7	64.5	82.5	100.7	119.0	137.4	155.7	174.1	192.4	210.8	229.1
n-Butylcyclopentane. . . .	C_9H_{18}	-27.43	+14.69	15.02	34.0	53.8	74.0	94.6	115.3	136.1	157.0	177.9	198.8	219.7	240.6	261.5
n-Pentylcyclopentane . . .	$C_{10}H_{20}$	-31.10	+16.73	17.11	38.5	60.7	83.4	106.5	129.7	153.2	176.6	200.0	223.5	246.9	270.4	293.8
n-Hexylcyclopentane. . . .	$C_{11}H_{22}$	-34.77	+18.78	19.20	43.0	67.6	92.9	118.5	144.2	170.2	196.2	222.2	248.2	274.2	300.2	326.2
n-Heptylcyclopentane . . .	$C_{12}H_{24}$	-38.44	+20.83	21.29	47.4	74.6	102.3	130.4	158.7	187.2	215.8	244.3	272.8	301.4	329.9	358.5
n-Octylcyclopentane. . . .	$C_{13}H_{26}$	-42.12	+22.88	23.38	51.9	81.5	111.7	142.4	173.2	204.2	235.3	266.4	297.5	328.6	359.7	390.8
n-Nonylcyclopentane. . . .	$C_{14}H_{28}$	-45.79	+24.93	25.47	56.4	88.4	121.2	154.3	187.7	221.3	254.9	288.6	322.2	355.8	389.5	423.2
n-Decylcyclopentane. . . .	$C_{15}H_{30}$	-49.46	+26.97	27.56	60.9	95.4	130.6	166.3	202.2	238.3	274.5	310.7	346.8	383.0	419.2	455.5
n-Undecylcyclopentane. . .	$C_{16}H_{32}$	-53.14	+29.02	29.65	65.4	102.3	140.0	178.2	216.6	255.3	294.1	332.8	371.5	410.2	449.0	487.8
n-Dodecylcyclopentane. . .	$C_{17}H_{34}$	-56.81	+31.07	31.74	69.8	109.2	149.4	190.2	231.1	272.4	313.6	354.9	396.2	437.4	478.8	520.1
n-Tridecylcyclopentane . .	$C_{18}H_{36}$	-60.48	+33.12	33.83	74.3	116.1	158.9	202.1	245.6	289.4	333.2	377.0	420.8	464.7	508.5	552.5
n-Tetradecylcyclopentane .	$C_{19}H_{38}$	-64.16	+35.17	35.92	78.8	123.1	168.3	214.1	260.1	306.4	352.8	399.2	445.5	491.9	538.3	584.8
n-Pentadecylcyclopentane .	$C_{20}H_{40}$	-67.83	+37.21	38.01	83.3	130.0	177.7	226.0	274.6	323.4	372.4	421.3	470.2	519.1	568.0	617.1
n-Hexadecylcyclopentane. .	$C_{21}H_{42}$	-71.50	+39.26	40.10	87.8	136.9	187.2	238.0	289.1	340.5	392.0	443.4	494.8	546.3	597.8	649.5
Increment per CH_2 Group		-3.673	+2.048	2.090	4.48	6.93	9.43	11.95	14.48	17.03	19.58	22.12	24.67	27.22	29.76	32.33

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

TABLE 23x - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}
FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK
March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Cyclohexane	C_6H_{12}	-20.01	+7.59	7.81	20.66	34.07	47.86	61.85	75.96	90.13	104.30	118.42	132.58	146.69	160.73	174.72
Methylcyclohexane	C_7H_{14}	-26.30	+6.52	6.79	21.84	37.51	53.55	69.80	86.16	102.59	119.03	135.43	151.83	168.13	184.43	200.65
Ethylcyclohexane.	C_8H_{16}	-28.94	+9.38	9.69	27.12	45.19	63.72	82.50	101.37	120.28	139.23	158.17	177.11	195.93	214.71	233.36
n-Propylcyclohexane	C_9H_{18}	-32.79	+11.33	11.70	31.5	52.2	73.2	94.6	116.0	137.6	159.1	180.7	202.3	223.6	245.0	266.4
n-Butylcyclohexane.	$C_{10}H_{20}$	-36.29	+13.55	13.97	36.2	59.3	82.8	106.7	130.7	154.8	178.8	203.0	227.1	251.0	275.0	298.9
n-Pentylcyclohexane	$C_{11}H_{22}$	-39.96	+15.60	16.06	40.7	66.2	92.3	118.7	145.2	171.8	198.4	225.1	251.8	278.2	304.8	331.2
n-Hexylcyclohexane.	$C_{12}H_{24}$	-43.64	+17.65	18.15	45.2	73.2	101.7	130.6	159.6	188.8	218.0	247.2	276.5	305.4	334.5	363.5
n-Heptylcyclohexane	$C_{13}H_{26}$	-47.31	+19.69	20.24	49.6	80.1	111.1	142.6	174.1	205.8	237.6	269.4	301.1	332.6	364.3	395.9
n-Octylcyclohexane.	$C_{14}H_{28}$	-50.98	+21.74	22.33	54.1	87.0	120.6	154.5	188.6	222.9	257.2	291.5	325.8	359.8	394.0	428.2
n-Nonylcyclohexane.	$C_{15}H_{30}$	-54.66	+23.79	24.42	58.6	94.0	130.0	166.5	203.1	239.9	276.7	313.6	350.5	387.0	423.8	460.5
n-Decylcyclohexane.	$C_{16}H_{32}$	-58.33	+25.84	26.51	63.1	100.9	139.4	178.4	217.6	256.9	296.3	335.7	375.1	414.3	453.6	492.9
n-Undecylcyclohexane. . . .	$C_{17}H_{34}$	-62.00	+27.89	28.60	67.6	107.8	148.8	190.4	232.1	274.0	315.9	357.9	399.8	441.5	483.3	525.2
n-Dodecylcyclohexane. . . .	$C_{18}H_{36}$	-65.67	+29.93	30.69	72.0	114.8	158.3	202.3	246.6	291.0	335.5	380.0	424.5	468.7	513.1	557.5
n-Tridecylcyclohexane . . .	$C_{19}H_{38}$	-69.35	+31.98	32.78	76.5	121.7	167.7	214.3	261.0	308.0	355.0	402.1	449.1	495.9	542.9	589.9
n-Tetradecylcyclohexane . .	$C_{20}H_{40}$	-73.02	+34.03	34.87	81.0	128.6	177.1	226.2	275.5	325.0	374.6	424.2	473.8	523.1	572.6	622.2
n-Pentadecylcyclohexane . .	$C_{21}H_{42}$	-76.69	+36.08	36.96	85.5	135.5	186.6	238.2	290.0	342.1	394.2	446.4	498.5	550.3	602.4	654.5
n-Hexadecylcyclohexane. . .	$C_{22}H_{44}$	-80.37	+38.13	39.05	90.0	142.5	196.0	250.1	304.5	359.1	413.8	468.5	523.1	577.6	632.2	686.8
Increment per CH_2 group . .		-3.673	+2.048	2.090	4.48	6.93	9.43	11.95	14.48	17.03	19.58	22.12	24.67	27.22	29.76	32.33

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

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TABLE 24x - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

FREE ENERGY OF FORMATION, ΔFf^o, AT 0° TO 1500°K

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K: 0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Ethene (Ethylene)	C_2H_4	14.522	16.282	16.305	17.675	19.245	20.918	22.676	24.490	26.354	28.249	30.16	32.09	34.03	35.97	37.92
Propene (Propylene)	C_3H_6	8.468	14.990	15.051	18.610	22.450	26.46	30.59	34.81	39.10	43.43	47.78	52.15	56.52	60.90	65.28
1-Butene	C_4H_8	5.158	17.217	17.320	23.205	29.430	35.85	42.41	49.05	55.78	62.54	69.31	76.10	82.90	89.67	96.46
1-Pentene	C_5H_{10}	1.019	18.787	18.930	27.16	35.78	44.65	53.69	62.81	72.02	81.27	90.55	99.86	109.19	118.46	127.71
1-Hexene	C_6H_{11}	- 2.69	20.80	20.99	31.6	42.7	54.1	65.6	77.3	89.1	100.9	112.7	124.6	136.5	148.3	160.1
1-Heptene	C_7H_{12}	- 6.37	22.84	23.08	36.1	49.6	63.5	77.6	91.8	106.1	120.5	134.8	149.2	163.7	178.0	192.4
1-Octene	C_8H_{16}	-10.04	24.89	25.17	40.6	56.6	72.9	89.5	106.3	123.1	140.0	157.0	173.9	190.9	207.8	224.7
1-Nonene	C_9H_{18}	-13.71	26.94	27.26	45.1	63.5	82.4	101.5	120.8	140.2	159.6	179.1	198.6	218.1	237.6	257.1
1-Decene	$C_{10}H_{20}$	-17.39	28.99	29.35	49.5	70.4	91.8	113.4	135.2	157.2	179.2	201.2	223.3	245.3	267.3	289.4
1-Undecene	$C_{11}H_{22}$	-21.06	31.03	31.44	54.0	77.4	101.2	125.4	149.7	174.2	198.8	223.3	247.9	272.5	297.1	321.7
1-Dodecene	$C_{12}H_{24}$	-24.73	33.08	33.53	58.5	84.3	110.6	137.3	164.2	191.3	218.4	245.4	272.6	299.7	326.9	354.1
1-Tridecene	$C_{13}H_{26}$	-28.41	35.13	35.62	63.0	91.2	120.1	149.3	178.7	208.3	237.9	267.6	297.3	327.0	356.6	386.4
1-Tetradecene	$C_{14}H_{28}$	-32.08	37.18	37.71	67.4	98.2	129.5	161.2	193.2	225.3	257.5	289.7	321.9	354.2	386.4	418.7
1-Pentadecene	$C_{15}H_{30}$	-35.75	39.23	39.80	71.9	105.1	138.9	173.2	207.7	242.3	277.1	311.8	346.6	381.4	416.1	451.1
1-Hexadecene	$C_{16}H_{32}$	-39.42	41.27	41.89	76.4	112.0	148.3	185.1	222.1	259.4	296.7	333.9	371.3	408.6	445.9	483.4
1-Heptadecene	$C_{17}H_{34}$	-43.10	43.32	43.98	80.9	118.9	157.8	197.1	236.6	276.4	316.3	356.0	395.9	435.8	475.7	515.7
1-Octadecene	$C_{18}H_{36}$	-46.77	45.37	46.07	85.4	125.9	167.2	209.0	251.1	293.4	335.8	378.1	420.6	463.0	505.4	548.1
1-Nonadecene	$C_{19}H_{38}$	-50.44	47.42	48.16	89.8	132.8	176.6	221.0	265.6	310.5	355.4	400.3	445.3	490.3	535.2	580.4
1-Eicosene	$C_{20}H_{40}$	-54.12	49.47	50.25	94.3	139.7	186.1	232.9	280.1	327.5	375.0	422.4	469.9	517.5	565.0	612.7
Increment per CH_2 group		- 3.673	2.048	2.090	4.48	6.93	9.43	11.95	14.48	17.03	19.58	22.12	24.67	27.22	29.76	32.33

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

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TABLE 25x - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

FREE ENERGY OF FORMATION, ΔFf^o, AT 0^o TO 1500^oK

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Free Energy of Formation[b], ΔFf^o, in kcal/mole[c]														
Ethyne (Acetylene)	C_2H_2	54.329	50.000	49.975	48.577	47.196	45.835	44.498	43.178	41.882	40.604	39.339	38.089	36.854	35.624	34.410
Propyne (Methylacetylene).	C_3H_4	46.017	46.313	46.481	47.287	48.224	49.255	50.360	51.514	52.715	53.95	55.20	56.46	57.74	59.02	60.32
1-Butyne (Ethylacetylene).	C_4H_6	42.96	48.52	48.57	51.67	54.99	58.45	62.02	65.66	69.36	73.10	76.85	80.62	84.41	88.20	91.99
1-Pentyne.	C_5H_8	38.90	50.17	50.26	55.71	61.42	67.33	73.38	79.50	85.69	91.92	98.17	104.46	110.78	117.06	123.31
1-Hexyne	C_6H_{10}	35.20	52.19	52.34	60.2	68.3	76.8	85.3	94.0	102.8	111.5	120.4	129.2	138.1	146.9	155.7
1-Heptyne.	C_7H_{12}	31.53	54.24	54.42	64.6	75.3	86.2	97.3	108.5	119.8	131.1	142.5	153.9	165.3	176.6	188.0
1-Octyne	C_8H_{14}	27.86	56.29	56.52	69.1	82.2	95.6	109.2	123.0	136.8	150.7	164.6	178.5	192.5	206.4	220.4
1-Nonyne	C_9H_{16}	24.18	58.34	58.60	73.6	89.1	105.0	121.2	137.4	153.8	170.3	186.7	203.2	219.7	236.2	252.7
1-Decyne	$C_{10}H_{18}$	20.51	60.39	60.70	78.1	96.1	114.5	133.1	151.9	170.9	189.9	208.8	227.9	246.9	265.9	285.0
1-Undecyne	$C_{11}H_{20}$	16.84	62.43	62.78	82.6	103.0	123.9	145.1	166.4	187.9	209.4	230.9	252.5	274.1	295.7	317.3
1-Dodecyne	$C_{12}H_{22}$	13.16	64.48	64.88	87.0	109.9	133.3	157.0	180.9	204.9	229.0	253.1	277.2	301.4	325.5	349.7
1-Tridecyne.	$C_{13}H_{24}$	9.49	66.53	66.96	91.5	116.9	142.8	169.0	195.4	222.0	248.6	275.2	301.9	328.6	355.2	382.0
1-Tetradecyne.	$C_{14}H_{26}$	5.82	68.58	69.06	96.0	123.8	152.2	180.9	209.9	239.0	268.2	297.3	326.5	355.8	385.0	414.3
1-Pentadecyne.	$C_{15}H_{28}$	2.15	70.63	71.14	100.5	130.7	161.6	192.9	224.4	256.0	287.8	319.4	351.2	383.0	414.8	446.7
1-Hexadecyne	$C_{16}H_{30}$	-1.53	72.67	73.24	105.0	137.7	171.0	204.8	238.8	273.0	307.3	341.5	375.9	410.2	444.5	479.0
1-Heptadecyne.	$C_{17}H_{32}$	-5.20	74.72	75.32	109.4	144.6	180.5	216.8	253.3	290.1	326.9	363.6	400.6	437.4	474.3	511.3
1-Octadecyne	$C_{18}H_{34}$	-8.87	76.77	77.42	113.9	151.5	189.9	228.7	267.8	307.1	346.5	385.8	425.2	464.6	504.1	543.7
1-Nonadecyne	$C_{19}H_{36}$	-12.55	78.82	79.50	118.4	158.4	199.3	240.7	282.3	324.1	366.1	407.9	449.9	491.9	533.8	576.0
1-Eicosyne	$C_{20}H_{38}$	-16.22	80.87	81.60	122.9	165.4	208.7	252.6	296.8	341.2	385.6	430.0	474.6	519.1	563.6	608.3
Increment per CH_2 group		-3.673	2.048	2.090	4.48	6.93	9.43	11.95	14.48	17.03	19.58	22.12	24.67	27.22	29.76	32.33

[a] See footnote a of Table 1x.

[b] See footnote b of Table 1x.

[c] See footnote c of Table 1x.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 00y - O, H, N, C

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}Kf$, AT 0° TO 4000°K

June 30, 1946

Compound (gas, monatomic)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b,c,d] $\log_{10}Kf$														
Oxygen. . . .	O	infinite	-40.31022	-40.04460	-29.25654	-22.76620	-18.42943	-15.32498	-12.99286	-11.17574	-9.72002	-8.52720	-7.53183	-6.68892	-5.96561	-5.33746
Hydrogen. . .	H	infinite	-35.60481	-35.37064	-25.87091	-20.15490	-16.33349	-13.59607	-11.53714	-9.93179	-8.64411	-7.58754	-6.70515	-5.95662	-5.31344	-4.75505
Nitrogen. . .	N	infinite	-59.71761	-59.33297	-43.73692	-34.36306	-28.10326	-23.62470	-20.26075	-17.64086	-15.54206	-13.82253	-12.33816	-11.17320	-10.13069	-9.22630
Carbon. . . .	C	infinite	-84.66650	-84.09848	-61.06280	-47.21683	-37.97519	-31.36916	-26.41250	-22.55646	-19.47151	-16.94791	-14.84531	-13.06711	-11.54334	-10.22343

Compound (gas, monatomic)	Formula	Temperature in °K														
		1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000				
		Logarithm of Equilibrium Constant of Formation, $\log_{10}Kf$														
Oxygen. . . .	O	-9.72002	-7.09298	-5.33746	-4.07968	-3.13446	-2.39726	-1.80688	-1.32353	-0.92030	-0.28606	+0.19160				
Hydrogen. . .	H	-8.64411	-6.31680	-4.75505	-3.63412	-2.78965	-2.13008	-1.60054	-1.16585	-0.80240	-0.22936	+0.20204				
Nitrogen. . .	N	-15.54206	-11.75658	-9.22630	-7.41447	-6.05316	-4.99222	-4.14180	-3.44496	-2.86306	-1.94654	-1.25689				
Carbon. . . .	C	-19.47151	-13.92149	-10.22343												

[a] Interpolation to other temperatures in the interval 298.16° to 4000°K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating the values for 300°, 400°, 500°, and 600°K.

[b] $\log_{10}Kf$ represents the logarithm (to the base 10) of the equalibrium constant for the reaction of forming the given substance from the elements, with all of the reactants and products in their appropriate standard reference states at the termperature indicated.

[c] Because of the existing very large uncertainty in the values of ΔHf for C (gas) and N (gas), the values of the equilibrium constants of formation of C (gas), from C (solid,graphite), and of N (gas), from N_2 (gas), may correspondingly be greatly in error.

[d] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 0y - O_2, H_2, OH, H_2O, N_2, NO, C, CO, CO_2

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} Kf$, AT 0° TO 4000 $^\circ$K

July 31, 1944; August 31, 1946

Compound	Formula	State	Temperature[a] in $^\circ$K													
			0	50	100	150	200	250	298.16	300	400	500	600	700	800	900
			Logarithm of Equilibrium Constant of Formation[b,c], $\log_{10} Kf$													
Oxygen.	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen.	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl.	OH	gas	infinite						-8.54755	-8.50431	-4.66916	-3.56897	-2.83704	-2.31549	-1.92561	-1.62422
Water	H_2O	gas	infinite						40.04695	39.78683	29.23972	22.88551	18.63228	15.58315	13.22846	11.49776
Nitrogen.	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide. . .	NO	gas	infinite				-22.95310	-18.23634	-15.18688	-15.08963	-11.15555	-8.79436	-7.21929	-6.09355	-5.24995	-4.59365
Carbon.	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide .	CO	gas	infinite				33.58393	27.78329	24.04790	23.92845	19.12672	16.25283	14.33621	12.96479	11.93193	11.12559
Carbon Dioxide. .	CO_2	gas	infinite						69.09145	68.66801	51.53648	41.25820	34.40107	29.50309	25.82664	22.96647

Compound	Formula	State	Temperature in $^\circ$K													
			1000	1100	1200	1300	1400	1500	1750	2000	2250	2500	2750	3000	3500	4000
			Logarithm of Equilibrium Constant of Formation, $\log_{10} Kf$													
Oxygen.	O_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen.	H_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyl.	OH	gas	-1.38407	-1.18815	1.02555	-0.88942	-0.77215	-0.67114	-0.47026	-0.32142	-0.20597	-0.11478	-0.04084	+0.02066	0.11509	0.18558
Water	H_2O	gas	10.06104	8.88300	7.89864	7.06367	6.34747	5.72542	4.48052	3.54299	2.8150	2.2289	1.7482	1.3488		
Nitrogen.	N_2	gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide. . .	NO	gas	-4.06805	-3.63794	-3.27909	-2.97662	-2.71720	-2.49144	-2.04014	-1.70249	-1.43680	-1.22933	-1.05771	-0.91528	-0.69192	-0.52539
Carbon.	C	solid, graphite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide .	CO	gas	10.47772	9.94448	9.49826	9.11762	8.78099	8.50449								
Carbon Dioxide. .	CO_2	gas	20.67675	18.80256	17.23998	15.91654	14.78159	13.79863								

[a] Interpolation to other temperatures in the interval 50°K to 4000°K may be made by appropriate graphical or analytical methods.

[b] See footnote b of Table 00y. [c] See footnote d of Table 00y.

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National Bureau of Standards — Washington, D. C.

TABLE 1y - PARAFFINS, C_1 to C_5

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}$ Kf, AT 0° TO 1500°K

August 31, 1944

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b,c], $\log_{10}$ Kf														
Methane	CH_4	infinite	8.8985	8.8184	5.4899	3.4273	2.0004	0.9529	0.1500	-0.4881	-1.0075	-1.4345	-1.7936	-2.1006	-2.3638	-2.5923
Ethane	C_2H_6	infinite	5.7613	5.6713	1.8833	-0.5105	-2.1749	-3.4019	-4.3480	-5.1004	-5.7104	-6.2147	-6.6377	-6.9972	-7.3048	-7.5744
Propane	C_3H_8	infinite	4.1150	4.0366	-0.6507	-3.5973	-5.6469	-7.1584	-8.3182	-9.2395	-9.9839	-10.5966	-11.1106	-11.5457	-11.9182	-12.2499
n-Butane	C_4H_{10}	infinite	2.7516	2.6189	-2.9695	-6.4987	-8.9565	-10.7697	-12.1562	-13.2552	-14.1427	-14.8746	-15.4900	-16.0130	-16.4567	-16.8445
2-Methylpropane (Isobutane)	"	infinite	3.1489	3.0065	-2.8810	-6.5949	-9.1714	-11.0660	-12.5173	-13.6680	-14.5973	-15.3610	-16.0017	-16.5404	-16.9993	-17.4026
n-Pentane	C_5H_{12}	infinite	1.4366	1.2821	-5.2779	-9.4282	-12.3079	-14.4304	-16.0551	-17.3406	-18.3799	-19.2342	-19.9516	-20.5603	-21.0758	-21.5270
2-Methylbutane (Isopentane)	"	infinite	2.5655	2.4623	-4.5130	-8.8687	-11.8963	-14.1088	-15.8010	-17.1487	-18.2291	-19.1190	-19.8642	-20.4914	-21.0243	-21.4949
2,2-Dimethylpropane (Neopentane)	"	infinite	2.6681	2.4915	-4.9119	-9.5680	-12.7778	-15.1298	-16.9184	-18.3313	-19.4683	-20.4005	-21.1755	-21.8346	-22.3918	-22.8747

[a] Interpolation to other temperatures in the interval 298.16° to 1500° K may be made by appropriate graphical or analytical methods. For temperatures between 200° and 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 300°, 400°, 500° and 600°K.

[b] $\log_{10}$Kf represents the logarithm (to the base 10) of the equilibrium constant for the reaction of forming the given compound in the gaseous state from the elements carbon (solid, graphite) and hydrogen (gaseous), with all the reactants and products in their appropriate standard reference state at the temperature indicated. $\log_{10}Kf = -\Delta Ff^\circ/2.302585\ RT = -\Delta Ff^\circ/0.00457565l\,T$; ΔFf° in kcal/mole, T in °K.

[c] The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

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TABLE 2y (Part 1) - PARAFFINS, C_8

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}Kf$, AT 0° TO 1500°K

September 30, 1944; November 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b,c], $\log_{10}Kf$														
n - Hexane	C_6H_{14}	infinite	-0.037	-0.219	-7.709	-12.440	-15.728	-18.149	-20.000	-21.466	-22.650	-23.623	-24.439	-25.130	-25.718	-26.232
2 - Methylpentane	"	infinite	0.813	0.626	-7.168	-12.098	-15.520	-18.027	-19.937	-21.446	-22.666	-23.688	-24.530	-25.228	-25.610	-26.362
3 - "	"	infinite	0.373	0.189	-7.490	-12.334	-15.691	-18.167	-20.032	-21.524	-22.729	-23.718	-24.550	-25.240	-25.833	-26.361
2,2 - Dimethylbutane.	"	infinite	1.707	1.507	-6.769	-11.998	-15.604	-18.242	-20.251	-21.837	-23.118	-24.169	-25.052	-25.786	-26.417	-26.955
2,3 - "	"	infinite	0.696	0.502	-7.452	-12.448	-15.906	-18.476	-20.417	-21.951	-23.190	-24.207	-25.105	-25.793	-26.381	-26.923

[a] See footnote a of Table 1y.

[b] See footnote b of Table 1y.

[c] See footnote c of Table 1y.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 2y (Part 2) - PARAFFINS, C_7

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}Kf$, AT 0° TO 1500°K

September 30, 1944

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation [b], $\log_{10}Kf$														
n - Heptane	C_7H_{16}	infinite	-1.532	-1.734	-10.152	-15.469	-19.159	-21.880	-23.958	-25.602	-26.930	-28.018	-28.930	-29.704	-30.363	-30.944
2 - Methylhexane	"	infinite	-0.718	-0.925	-9.622	-15.124	-18.944	-21.752	-23.896	-25.577	-26.921					
3 - "	"	infinite	-0.806	-1.013	-9.600	-15.036	-18.824	-21.608	-23.732	-25.398	-26.726					
3 - Ethylpentane	"	infinite	-1.898	-2.098	-10.578	-15.963	-19.724	-22.498	-24.611	-26.272	-27.592					
2,2 - Dimethylpentane. . . .	"	infinite	-0.066	-0.284	-9.469	-15.277	-19.309	-22.270	-24.513	-26.269	-27.657					
2,3 - "	"	infinite	-0.117	-0.328	-9.195	-14.818	-18.733	-21.618	-23.814	-25.541	-26.916					
2,4 - "	"	infinite	-0.528	-0.743	-9.731	-15.421	-19.374	-22.283	-24.494	-26.223	-27.596					
3,3 - "	"	infinite	-0.462	-0.677	-9.638	-15.307	-19.247	-22.142	-24.341	-26.066	-27.434					
2,2,3 - Trimethylbutane . .	"	infinite	-0.557	-0.772	-9.867	-15.626	-19.622	-22.554	-24.783	-26.524	-27.904					

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

National Bureau of Standards — American Petroleum Institute Research Project 44 — Washington, D. C.

TABLE 3y - PARAFFINS, C_8

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} Kf$, AT 0° TO 1500 °K

October 31, 1944

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} Kf$														
n-Octane	C_8H_{18}	infinite	-3.035	-3.256	-12.599	-18.498	-22.594	-25.611	-27.911	-29.735	-31.206	-32.413	-33.421	-34.278	-35.008	-35.654
2-Methylheptane	"	"	-2.243	-2.470	-12.097	-18.174	-22.390	-25.486	-27.832	-29.691	-31.215					
3- "	"	"	-2.412	-2.637	-12.135	-18.139	-22.317	-25.386	-27.712	-29.548	-31.049					
4- "	"	"	-2.932	-3.162	-12.632	-18.629	-22.805	-25.876	-28.201	-30.033	-31.528					
3-Ethylhexane	"	"	-2.895	-3.118	-12.534	-18.529	-22.718	-25.801	-28.133	-29.970	-31.467					
2,2-Dimethylhexane	"	"	-1.876	-2.120	-12.118	-18.445	-22.842	-26.063	-28.493	-30.405	-31.967					
2,3- "	"	"	-3.101	-3.329	-12.845	-18.865	-23.046	-26.113	-28.436	-30.264	-31.755					
2,4- "	"	"	-2.052	-2.287	-12.047	-18.236	-22.543	-25.701	-28.094	-29.973	-31.486					
2,5- "	"	"	-1.832	-2.069	-11.976	-18.249	-22.612	-25.817	-28.250	-30.160	-31.687					
3,3- "	"	"	-2.324	-2.557	-12.364	-18.577	-22.893	-26.060	-28.455	-30.337	-31.856					
3,4- "	"	"	-3.643	-3.868	-13.342	-19.350	-23.519	-26.575	-28.889	-30.716	-32.203					
2-Methyl-3-ethylpentane	"	"	-3.724	-3.956	-13.370	-19.337	-23.483	-26.526	-28.827	-30.648	-32.146					
3- " -3- "	"	"	-3.489	-3.723	-13.288	-19.363	-23.592	-26.688	-29.018	-30.852	-32.347					
2,2,3-Trimethylpentane	"	"	-2.998	-3.235	-13.015	-19.223	-23.541	-26.707	-29.100	-30.978	-32.494					
2,2,4- "	"	"	-2.294	-2.535	-12.490	-18.804	-23.192	-26.407	-28.837	-30.745	-32.284					
2,3,3- "	"	"	-3.313	-3.540	-13.162	-19.267	-23.512	-26.632	-28.985	-30.835	-32.323					
2,3,4- "	"	"	-3.167	-3.402	-13.053	-19.184	-23.447	-26.572	-28.941	-30.801	-32.301					
2,2,3,3-Tetramethylbutane	"	"	-3.577	-3.817	-13.845	-20.189	-24.576	-27.777	-30.192	-32.100	-33.667					

[a] See footnote a of Table 1y. [b] See footnotes b and c of Table 1y.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5y - ALKYL BENZENES, C_6 to C_9

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}Kf$, AT 0° TO $1500^\circ K$

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10}Kf$														
Benzene	C_6H_6	infinite	-22.7143	-22.6252	-19.1271	-17.1521	-15.9040	-15.0519	-14.4345	-13.9716	-13.6088	-13.3153	-13.0738	-12.8717	-12.6971	-12.5461
Methylbenzene (Toluene)	C_7H_8	infinite	-21.4236	-21.3698	-19.3356	-18.2752	-17.6574	-17.2671	-17.0018	-16.8171	-16.6794	-16.5699	-16.4825	-16.4102	-16.3455	-16.2900
Ethylbenzene	C_8H_{10}	infinite	-22.8750	-22.8428	-21.7132	-21.2223	-20.9972	-20.8934	-20.8442	-20.8296	-20.8281	-20.8294	-20.8333	-20.8368	-20.8362	-20.8375
1,2-Dimethylbenzene (o-Xylene)	"	infinite	-21.3860	-21.3655	-20.6980	-20.4786	-20.4351	-20.4646	-20.5188	-20.5864	-20.6513	-20.7081	-20.7601	-20.8051	-20.8399	-20.8692
1,3- " (m- ")	"	infinite	-20.8202	-20.8014	-20.2201	-20.0651	-20.0693	-20.1349	-20.2172	-20.3077	-20.3919	-20.4646	-20.5296	-20.5853	-20.6290	-20.6670
1,4- " (p- ")	"	infinite	-21.2214	-21.2018	-20.5912	-20.4227	-20.4194	-20.4821	-20.5638	-20.6545	-20.7393	-20.8128	-20.8788	-20.9358	-20.9808	-21.0202
n-Propylbenzene	C_9H_{12}	infinite	-24.049	-24.040	-23.894	-24.012	-24.215	-24.422	-24.610	-24.785	-24.932	-25.056	-25.168	-25.262	-25.336	-25.395
Isopropylbenzene (Cumene)	"	infinite	-23.996	-23.992	-24.016	-24.241	-24.510	-24.768	-24.991	-25.192	-25.364	-25.509	-25.631	-25.732	-25.812	-25.880
1-Methyl-2-ethylbenzene	"	infinite	-22.960	-22.958	-23.090	-23.377	-23.684	-23.970	-24.218	-24.437	-24.624	-24.780	-24.914	-25.027	-25.119	-25.199
1- " -3- "	"	infinite	-22.149	-22.150	-22.428	-22.816	-23.194	-23.533	-23.822	-24.075	-24.289	-24.468	-24.620	-24.749	-24.853	-24.945
1- " -4- "	"	infinite	-22.195	-22.198	-22.537	-22.964	-23.371	-23.733	-24.040	-24.308	-24.535	-24.723	-24.885	-25.021	-25.133	-25.232
1,2,3-Trimethylbenzene (Hemimellitene)	"	infinite	-21.490	-21.500	-22.159	-22.754	-23.279	-23.731	-24.110	-24.436	-24.712	-24.942	-25.140	-25.310	-25.450	-25.571
1,2,4- " (Pseudocumene)	"	infinite	-20.459	-20.473	-21.319	-22.025	-22.622	-23.124	-23.541	-23.897	-24.196	-24.445	-24.657	-24.839	-24.990	-25.121
1,3,5- " (Mesitylene)	"	infinite	-20.6497	-20.6666	-21.6131	-22.3891	-23.0336	-23.5702	-24.0136	-24.3904	-24.7055	-24.9678	-25.1916	-25.3815	-25.5390	-25.6761

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 7y - ALKYL CYCLOHEXANES, C_6 to C_8
LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} K_f$, AT 0° TO 1500°K
April 30, 1947

Compound (Gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} K_f$														
Cyclohexane	C_6H_{12}	infinite	-5.5605	-5.6931	-11.2861	-14.8932	-17.4318	-19.3103	-20.7501	-21.8852	-22.7943	-23.5277	-24.1458	-24.6613	-25.0905	-25.4571
Methylcyclohexane . . .	C_7H_{14}	infinite	-4.7819	-4.9487	-11.9344	-16.3959	-19.5065	-21.7937	-23.5374	-24.9110	-26.0133	-26.9077	-27.6521	-28.2657	-28.7908	-29.2345
Ethylcyclohexane. . . .	C_8H_{16}	infinite	-6.8744	-7.0592	-14.8200	-19.7522	-23.2097	-25.7561	-27.6926	-29.2075	-30.4279	-31.4243	-32.2567	-32.9394	-33.5168	-33.9999
1,1-Dimethylcyclohexane	"	infinite	-6.174	-6.363	-14.541	-19.735	-23.359	-26.031	-28.045	-29.642	-30.911	-31.947	-32.813	-33.544	-34.146	-34.628
cis-1,2- "	"	infinite	-7.225	-7.408	-15.186	-20.163	-23.622	-26.168	-28.105	-29.642	-30.863	-31.859	-32.692	-33.396	-33.974	-34.435
trans-1,2- "	"	infinite	-6.038	-6.227	-14.334	-19.503	-23.083	-25.731	-27.723	-29.298	-30.566	-31.601	-32.445	-33.176	-33.755	-34.259
cis-1,3-[c] "	"	infinite	-5.228	-5.423	-13.749	-19.040	-22.722	-25.428	-27.485	-29.094	-30.389	-31.446	-32.330	-33.055	-33.670	-34.195
trans-1,3-[d] "	"	infinite	-6.363	-6.549	-14.510	-19.590	-23.152	-25.756	-27.737	-29.286	-30.555	-31.573	-32.425	-33.144	-33.736	-34.230
cis-1,4- "	"	infinite	-6.650	-6.836	-14.831	-19.887	-23.429	-26.034	-27.994	-29.586	-30.856	-31.875	-32.727	-33.447	-34.038	-34.533
trans-1,4- "	"	infinite	-6.552	-5.746	-14.071	-19.359	-23.039	-25.722	-27.756	-29.384	-30.657	-31.714	-32.597	-33.322	-33.937	-34.430

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

[c] Formerly labeled "trans"; see footnote d of Table 7a.

[d] Formerly labeled "cis"; see footnote e of Table 7a.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

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TABLE 8y (Part 1) - MONOOLEFINS, C_2 to C_4

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}Kf$, AT 0° TO 1500°K

December 31, 1944; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b,c], $\log_{10}$ Kf														
Ethene (Ethylene).	C_2H_4	infinite	-11.9345	-11.8781	- 9.6571	- 8.4119	- 7.6193	- 7.0797	- 6.6903	- 6.3996	- 6.1738	- 5.9918	- 5.8440	- 5.7206	- 5.6151	- 5.5249
Propene (Propylene). . . .	C_3H_6	infinite	-10.9875	-10.9648	-10.1677	- 9.8128	- 9.6375	- 9.5519	- 9.5093	- 9.4942	- 9.4909	- 9.4922	- 9.4970	- 9.5027	- 9.5066	- 9.5117
1-Butene	C_4H_8	infinite	-12.6199	-12.6175	-12.6785	-12.8637	-13.0582	-13.2403	-13.4005	-13.5442	-13.6669	-13.7707	-13.8598	-13.9358	-13.9986	-14.0537
cis-2-Butene	"	infinite	-11.7618	-11.7677	-12.1469	-12.5576	-12.9169	-13.2274	-13.4923	-13.7200	-13.9126	-14.0749	-14.2166	-14.3389	-14.4417	-14.5321
trans-2- "	"	infinite	-11.2255	-11.2362	-11.7896	-12.2824	-12.6874	-13.0268	-13.3081	-13.5498	-13.7526	-13.9226	-14.0688	-14.1938	-14.2979	-14.3901
2-Methylpropene (Isobutene)	"	infinite	-10.6888	-10.7038	-11.4244	-12.0112	-12.4763	-12.8533	-13.1649	-13.4245	-13.6424	-13.8249	-13.9805	-14.1141	-14.2257	-14.3232

[a] See footnote a of table 1y.

[b] See footnotes b and c of Table 1y.

[c] With regard to estimated uncertainties for the above compounds, see footnote c on Tables 8r, 8s, and 8t.

TABLE 8y (Part 2) - MONOOLEFINS, C_5

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} Kf$, AT 0° TO $1500^{\circ}K$

March 31, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} Kf$														
1- Pentene.	C_5H_{10}	infinite	-13.7704	-13.7904	-14.8394	-15.6377	-16.2629	-16.7617	-17.1601	-17.4898	-17.7622	-17.9911	-18.1863	-18.3556	-18.4920	-18.6070
cis-2-Pentene	"	infinite	-12.5874	-12.6191	-13.9997	-15.0403	-15.8357	-16.4601	-16.9665	-17.3806	-17.7236	-18.0069	-18.2524	-18.4561	-18.6329	-18.7779
trans-2- "	"	infinite	-12.1495	-12.1824	-13.7022	-14.8045	-15.6315	-16.2717	-16.7827	-17.2066	-17.5522	-17.8393	-18.0804	-18.2874	-18.4612	-18.6119
2- Methyl-1-butene. . .	"	infinite	-11.3680	-11.4073	-13.1269	-14.3451	-15.2451	-15.9408	-16.4929	-16.9409	-17.3094	-17.6130	-17.8741	-18.0943	-18.2793	-18.4355
3- " -1- " . . .	"	infinite	-13.1017	-13.1337	-14.5425	-15.5156	-16.2580	-16.8408	-17.3034	-17.6825	-17.9984	-18.2545	-18.4778	-18.6621	-18.8146	-18.9408
2- " -2- " . . .	"	infinite	-10.4572	-10.5005	-12.5009	-13.9086	-14.9457	-15.7414	-16.3755	-16.8936	-17.3195	-17.6701	-17.9692	-18.2218	-18.4386	-18.6222

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 8y (Part 3) - MONOOLEFINS, C_6

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} K_f$, AT 0° TO 1500°K

April 30, 1945; October 31, 1945

Compound (gas)	Formula	Temperature[a] in °K													
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} K_f$														
1-Hexene	C_6H_{12}	infinite	-15.2491	-15.2938	-17.2736	-18.6647	-19.6963	-20.4918	-21.1243	-21.6299	-22.0483	-22.3959	-22.6900	-22.9410	-23.1468	-23.3230
cis-2-Hexene	"	infinite	-14.0549	-14.1069	-16.3965	-18.0038	-19.1969	-20.1158	-20.8432	-21.4310	-21.9115					
trans-2- "	"	infinite	-13.5291	-13.5828	-16.0336	-17.7155	-18.9490	-19.8900	-20.6267	-21.2278	-21.7158					
cis-3- "	"	infinite	-14.4094	-14.4646	-16.7566	-18.3784	-19.5768	-20.4970	-21.2287	-21.8205	-22.3040					
trans-3- "	"	infinite	-13.8262	-13.8814	-16.3258	-18.0179	-19.2480	-20.1803	-20.9127	-21.5110	-21.9949					
2-Methyl-1-pentene	"	infinite	-12.8135	-12.8733	-15.5074	-17.2955	-18.5953	-19.5871	-20.3614	-20.9840	-21.4927					
3- " -1- "	"	infinite	-14.8655	-14.9154	-17.1002	-18.5657	-19.6579	-20.4888	-21.1392	-21.6720	-22.1070					
4- " -1- "	"	infinite	-14.5865	-14.6386	-16.9303	-18.5063	-19.6670	-20.5432	-21.2302	-21.7932	-22.2489					
2- " -2- "	"	infinite	-11.9780	-12.0461	-14.9509	-16.9386	-18.3774	-19.4687	-20.3302	-21.0209	-21.5874					
cis-3-Methyl-2-pentene	"	infinite	-12.4471	-12.5123	-15.3006	-17.2183	-18.6105	-19.6685	-20.5050	-21.1763	-21.7273					
trans-3- " -2- "	"	infinite	-12.2697	-12.3353	-15.1236	-17.0413	-18.4335	-19.4915	-20.3280	-20.9993	-21.5503					
cis-4- " -2- "	"	infinite	-13.4903	-13.5519	-16.1567	-17.9059	-19.1914	-20.1730	-20.9472	-21.5665	-22.0864					
trans-4- " -2- "	"	infinite	-13.0216	-13.0864	-15.8569	-17.6895	-19.0243	-20.0378	-20.8301	-21.4740	-22.0000					
2-Ethyl-1-butene	"	infinite	-13.5690	-13.6292	-16.1492	-17.8819	-19.1405	-20.1003	-20.8539	-21.4611	-21.9553					
2,3-Dimethyl-1-butene	"	infinite	-12.7782	-12.8449	-15.7069	-17.5844	-18.9418	-19.9712	-20.7737	-21.4175	-21.9475					
3,3- " -1- "	"	infinite	-13.9578	-14.0211	-16.7485	-18.5996	-19.9697	-21.0179	-21.8171	-22.4417	-22.9383					
2,3- " -2- "	"	infinite	-12.1073	-12.1779	-15.2525	-17.3503	-18.8661	-20.0122	-20.9180	-21.6491	-22.2478					

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 12y - ACETYLENES, C_2 to C_5

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} K_f$, AT 0° TO 1500°K

April 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} K_f$														
Ethyne (Acetylene)	C_2H_2	infinite	-36.6490	-36.4058	-26.5406	-20.6290	-16.6952	-13.8925	-11.7978	-10.1702	-8.8738	-7.8158	-6.9369	-6.1956	-5.5611	-5.0134
Propyne (Methylacetylene). .	C_3H_4	infinite	-33.9469	-33.8610	-25.8360	-21.0781	-17.9409	-15.7228	-14.0728	-12.8007	-11.7897	-10.9660	-10.2830	-9.7072	-9.2137	-8.7879
1-Butyne (Ethylacetylene). .	C_4H_6	infinite	-35.5616	-35.3839	-28.2320	-24.0341	-21.2892	-19.3627	-17.9369	-18.8427	-15.9748	-15.2680	-14.6832	-14.1910	-13.7682	-13.4030
2- " (Dimethylacetylene)	"	infinite	-32.7823	-32.8236	-28.2690	-22.5629	-20.1556	-18.4752	-17.2380	-16.2932	-15.5471	-14.9409	-14.4400	-14.0186	-13.6574	-13.3462
1-Pentyne	C_5H_8	infinite	-38.7712	-36.6154	-30.4369	-26.8440	-24.5230	-22.9082	-21.7167	-20.8084	-20.0881	-19.5046	-19.0244	-18.6227	-18.2733	-17.9662
2- "	"	infinite	-34.0177	-33.8792	-28.3891	-25.2377	-23.2205	-21.8297	-20.8130	-20.0457	-19.4412	-18.9519	-18.5480	-18.2095	-17.9186	-17.6668
3-Methyl-1-butyne	"	infinite	-36.0081	-35.8614	-30.0293	-26.6495	-24.4662	-22.9488	-21.8318	-20.9810	-20.3088	-19.7622	-19.3118	-18.9315	-18.6004	-18.3115

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 20y - NORMAL PARAFFINS, C_1 TO C_{20}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} K_f$, AT 0° TO $1500^\circ K$

November 30, 1945

Compound (gas)	Formula	Temperature [a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation [b], $\log_{10} K_f$														
Methane	CH_4	infinite	8.8985	8.8184	5.4899	3.4273	2.0004	0.9529	0.1500	-0.4881	-1.0075	-1.4345	-1.7936	-2.1006	-2.3638	-2.5923
Ethane	C_2H_6	infinite	5.7613	5.6713	1.8833	-0.5105	-2.1749	-3.4019	-4.3480	-5.1004	-5.7104	-6.2147	-6.6377	-6.9972	-7.3048	-7.5744
Propane	C_3H_8	infinite	4.1150	4.0366	-0.6507	-3.5973	-5.6469	-7.1584	-8.3182	-9.2395	-9.9839	-10.5966	-11.1106	-11.5457	-11.9182	-12.2499
n-Butane	C_4H_{10}	infinite	2.7516	2.6189	-2.9695	-6.4987	-8.9565	-10.7697	-12.1562	-13.2552	-14.1427	-14.8746	-15.4900	-16.0130	-16.4567	-16.8445
n-Pentane	C_5H_{12}	infinite	1.4366	1.2821	-5.2779	-9.4282	-12.3079	-14.4304	-16.0551	-17.3406	-16.3799	-19.2342	-19.9516	-20.5603	-21.0758	-21.5270
n-Hexane	C_6H_{14}	infinite	-0.037	-0.219	-7.709	-12.440	-15.728	-18.149	-20.000	-21.466	-22.650	-23.623	-24.439	-25.130	-25.718	-26.232
n-Heptane	C_7H_{16}	infinite	-1.532	-1.734	-10.152	-15.469	-19.159	-21.880	-23.958	-25.602	-26.930	-28.018	-26.930	-29.704	-30.363	-30.944
n-Octane	C_8H_{18}	infinite	-3.035	-3.256	-12.599	-18.498	-22.594	-25.611	-27.911	-29.735	-31.206	-32.413	-33.421	-34.278	-35.008	-35.654
n-Nonane	C_9H_{20}	infinite	-4.536	-4.779	-15.046	-21.528	-26.028	-29.342	-31.868	-33.870	-35.485	-36.807	-37.914	-38.853	-39.654	-40.365
n-Decane	$C_{10}H_{22}$	infinite	-6.037	-6.301	-17.493	-24.557	-29.462	-33.073	-35.825	-38.005	-39.764	-41.202	-42.406	-43.428	-44.301	-45.075
n-Undecane	$C_{11}H_{24}$	infinite	-7.539	-7.824	-19.941	-27.586	-32.896	-36.805	-39.781	-42.141	-44.043	-45.596	-46.899	-48.004	-48.947	-49.786
n-Dodecane	$C_{12}H_{26}$	infinite	-9.040	-9.346	-22.388	-30.616	-36.330	-40.536	-43.738	-46.276	-48.322	-49.991	-51.391	-52.579	-53.593	-54.496
n-Tridecane	$C_{13}H_{28}$	infinite	-10.541	-10.869	-24.835	-33.646	-39.764	-44.267	-47.695	-50.411	-52.601	-54.385	-55.884	-57.154	-58.240	-59.207
n-Tetradecane	$C_{14}H_{30}$	infinite	-12.042	-12.392	-27.282	-36.675	-43.199	-47.998	-51.652	-54.546	-56.880	-58.779	-60.377	-61.729	-62.886	-63.918
n-Pentadecane	$C_{15}H_{32}$	infinite	-13.543	-13.914	-29.729	-39.704	-46.633	-51.729	-55.609	-58.681	-61.159	-63.174	-64.869	-66.304	-67.532	-68.628
n-Hexadecane	$C_{16}H_{34}$	infinite	-15.045	-15.437	-32.177	-42.734	-50.067	-55.461	-59.565	-62.817	-65.438	-67.568	-69.362	-70.880	-72.178	-73.339
n-Heptadecane	$C_{17}H_{36}$	infinite	-16.546	-16.959	-34.624	-45.764	-53.501	-59.192	-63.522	-66.952	-69.717	-71.963	-73.854	-75.455	-76.825	-78.049
n-Octadecane	$C_{18}H_{38}$	infinite	-18.047	-18.482	-37.071	-48.793	-56.935	-62.923	-67.479	-71.087	-73.996	-76.357	-78.347	-80.030	-81.471	-82.760
n-Nonadecane	$C_{19}H_{40}$	infinite	-19.548	-20.005	-39.518	-51.822	-60.369	-66.654	-71.436	-75.222	-78.275	-80.751	-82.840	-84.605	-86.117	-87.471
n-Eicosane	$C_{20}H_{42}$	infinite	-21.049	-21.527	-41.965	-54.852	-63.803	-70.385	-75.393	-79.357	-82.554	-85.146	-87.332	-89.180	-90.764	-92.181
Increment per CH_2 group		infinite	-1.5012	-1.5226	-2.4472	-3.0295	-3.4341	-3.7312	-3.9568	-4.1352	-4.2790	-4.3944	-4.4926	-4.5752	-4.6463	-4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

TABLE 21y - NORMAL ALKYL BENZENES, C_6 to C_{22}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} K_f$, AT 0° TO 1500°K

November 30, 1945

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} K_f$														
Benzene	C_6H_6	infinite	-22.7143	-22.6252	-19.1271	-17.1521	-15.9040	-15.0519	-14.4345	-13.9716	-13.6088	-13.3153	-13.0738	-12.8717	-12.6971	-12.5461
Methylbenzene (Toluene)	C_7H_8	infinite	-21.4236	-21.3698	-19.3356	-18.2752	-17.6574	-17.2671	-17.0018	-16.8171	-16.6794	-16.5699	-16.4825	-16.4102	-16.3455	-16.2900
Ethylbenzene	C_8H_{10}	infinite	-22.8750	-22.8428	-21.7132	-21.2223	-20.9972	-20.8934	-20.8442	-20.8296	-20.8281	-20.8294	-20.8333	-20.8368	-20.8362	-20.8375
n-Propylbenzene	C_9H_{12}	infinite	-24.049	-24.040	-23.894	-24.012	-24.215	-24.422	-24.610	-24.785	-24.932	-25.056	-25.168	-25.262	-25.336	-25.395
n-Butylbenzene	$C_{10}H_{14}$	infinite	-25.374	-25.392	-26.212	-26.948	-27.572	-28.090	-28.515	-28.873	-29.171	-29.419	-29.631	-29.811	-29.957	-30.082
n-Amylbenzene	$C_{11}H_{16}$	infinite	-26.876	-26.914	-28.660	-29.977	-31.006	-31.822	-32.472	-33.008	-33.450	-33.813	-34.124	-34.386	-34.604	-34.793
n-Hexylbenzene	$C_{12}H_{18}$	infinite	-28.377	-28.437	-31.107	-33.007	-34.440	-35.553	-36.429	-37.144	-37.729	-38.208	-38.616	-38.961	-39.250	-39.504
n-Heptylbenzene	$C_{13}H_{20}$	infinite	-29.878	-29.959	-33.554	-36.036	-37.874	-39.284	-40.386	-41.279	-42.008	-42.602	-43.109	-43.536	-43.896	-44.214
n-Octylbenzene	$C_{14}H_{22}$	infinite	-31.379	-31.482	-36.001	-39.066	-41.309	-43.015	-44.343	-45.414	-46.287	-46.996	-47.602	-48.112	-48.542	-48.925
n-Nonylbenzene	$C_{15}H_{24}$	infinite	-32.880	-33.004	-38.448	-42.095	-44.743	-46.746	-48.299	-49.549	-50.566	-51.391	-52.094	-52.687	-53.189	-53.635
n-Decylbenzene	$C_{16}H_{26}$	infinite	-34.382	-34.527	-40.896	-45.125	-48.177	-50.478	-52.256	-53.684	-54.845	-55.785	-56.587	-57.262	-57.835	-58.346
n-Undecylbenzene	$C_{17}H_{28}$	infinite	-35.883	-36.050	-43.343	-48.154	-51.611	-54.209	-56.213	-57.820	-59.124	-60.180	-61.080	-61.837	-62.481	-63.057
n-Dodecylbenzene	$C_{18}H_{30}$	infinite	-37.384	-37.572	-45.790	-51.184	-55.045	-57.940	-60.170	-61.955	-63.403	-64.574	-65.572	-66.412	-67.128	-67.767
n-Tridecylbenzene	$C_{19}H_{32}$	infinite	-38.885	-39.095	-48.237	-54.213	-58.479	-61.671	-64.127	-66.090	-67.682	-68.968	-70.065	-70.988	-71.774	-72.478
n-Tetradecylbenzene	$C_{20}H_{34}$	infinite	-40.386	-40.618	-50.684	-57.243	-61.913	-65.402	-68.083	-70.225	-71.961	-73.363	-74.557	-75.563	-76.420	-77.188
n-Pentadecylbenzene	$C_{21}H_{36}$	infinite	-41.888	-42.140	-53.132	-60.272	-65.347	-69.134	-72.040	-74.360	-76.240	-77.757	-79.050	-80.138	-81.066	-81.899
n-Hexadecylbenzene	$C_{22}H_{38}$	infinite	-43.389	-43.663	-55.579	-63.302	-68.781	-72.865	-75.997	-78.496	-80.519	-82.152	-83.542	-84.713	-85.713	-86.610
Increment per CH_2 group		infinite	- 1.5012	- 1.5226	- 2.4472	- 3.0295	- 3.4341	- 3.7312	- 3.9568	- 4.1352	- 4.2790	- 4.3944	- 4.4926	- 4.5752	- 4.6463	- 4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 22y - NORMAL ALKYL CYCLOPENTANES, C_5 to C_{21}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}$ Kf, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10}$ Kf														
Cyclopentane	C_5H_{10}	infinite	-6.7643	-6.8490	-10.4144	-12.7851	-14.4897	-15.7722	-16.7736	-17.5731	-18.2238	-18.7571	-19.2005	-19.5796	-19.9002	-20.1753
Methylcyclopentane. . . .	C_6H_{12}	infinite	-6.2649	-6.3801	-11.2501	-14.4250	-16.6770	-18.3549	-19.6492	-20.6813	-21.5189	-22.2067	-22.7795	-23.2694	-23.6775	-24.0218
Ethylcyclopentane	C_7H_{14}	infinite	-7.7632	-7.8999	-13.6861	-17.4379	-20.0959	-22.0620	-23.5741	-24.7831	-25.7585	-26.5600	-27.2278	-27.7871	-28.2725	-28.6778
n-Propylcyclopentane. . .	C_8H_{16}	infinite	-9.195	-9.351	-16.082	-20.429	-23.495	-25.763	-27.504	-28.896	-30.016	-30.936	-31.703	-32.347	-32.904	-33.375
n-Butylcyclopentane . . .	C_9H_{18}	infinite	-10.768	-10.942	-18.582	-23.498	-26.965	-29.523	-31.487	-33.054	-34.316	-35.351	-36.213	-36.938	-37.565	-38.099
n-Pentylcyclopent ne . .	$C_{10}H_{20}$	infinite	-12.269	-12.465	-21.029	-26.528	-30.399	-33.254	-35.444	-37.189	-38.595	-39.746	-40.706	-41.513	-42.212	-42.809
n-Hexylcyclopentane . . .	$C_{11}H_{22}$	infinite	-13.770	-13.987	-23.476	-29.557	-33.837	-36.985	-39.401	-41.325	-42.874	-44.140	-45.199	-46.088	-46.858	-47.520
n-Heptylcyclopentane . .	$C_{12}H_{24}$	infinite	-15.271	-15.510	-25.924	-32.587	-37.268	-40.716	-43.358	-45.460	-47.153	-48.534	-49.691	-50.664	-51.504	-52.231
n-Octylcyclopentane . . .	$C_{13}H_{26}$	infinite	-16.772	-17.032	-28.371	-35.616	-40.702	-44.448	-47.314	-49.595	-51.432	-52.929	-54.184	-55.239	-56.150	-56.941
n-Nonylcyclopentane . . .	$C_{14}H_{28}$	infinite	-18.274	-18.555	-30.818	-38.646	-44.136	-48.179	-51.271	-53.730	-55.711	-57.323	-58.676	-59.814	-60.797	-61.652
n-Decylcyclopentane . . .	$C_{15}H_{30}$	infinite	-19.775	-20.078	-33.265	-41.675	-47.570	-51.910	-55.228	-57.865	-59.990	-61.718	-63.169	-64.389	-65.443	-66.362
n-Undecylcyclopentane . .	$C_{16}H_{32}$	infinite	-21.276	-21.600	-35.712	-44.705	-51.004	-55.641	-59.185	-62.001	-64.269	-66.112	-67.662	-68.964	-70.089	-71.073
n-Dodecylcyclopentane . .	$C_{17}H_{34}$	infinite	-22.777	-23.123	-38.160	-47.734	-54.438	-59.372	-63.142	-66.136	-68.548	-70.506	-72.154	-73.540	-74.736	-75.784
n-Tridecylcyclopentane. .	$C_{18}H_{36}$	infinite	-24.278	-24.645	-40.607	-50.764	-57.872	-63.104	-67.098	-70.271	-72.827	-74.901	-76.647	-78.115	-79.382	-80.494
n-Tetradecylcyclopentane.	$C_{19}H_{38}$	infinite	-25.780	-26.168	-43.054	-53.793	-61.306	-66.835	-71.055	-74.406	-77.106	-79.295	-81.139	-82.690	-84.028	-85.205
n-Pentadecylcyclopentane	$C_{20}H_{40}$	infinite	-27.281	-27.691	-45.501	-56.823	-64.740	-70.566	-75.012	-78.541	-81.385	-83.690	-85.632	-87.265	-88.675	-89.915
n-Hexadecylcyclopentane .	$C_{21}H_{42}$	infinite	-28.782	-29.213	-47.948	-59.852	-68.174	-74.297	-78.969	-82.677	-85.664	-88.084	-90.125	-91.840	-93.321	-94.626
Increment per CH_2 group		infinite	-1.5012	-1.5226	-2.4472	-3.0295	-3.4341	-3.7312	-3.9568	-4.1352	-4.2790	-4.3944	-4.4926	-4.5752	-4.6463	-4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 23y - NORMAL ALKYL CYCLOHEXANES, C_6 to C_{22}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}$ Kf, AT 0° TO 1500°K

March 31, 1947

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10}$ kf														
Cyclohexane	C_6H_{12}	infinite	-5.5605	-5.6931	-11.2861	-14.8932	-17.4318	-19.3103	-20.7501	-21.8852	-22.7943	-23.5277	-24.1458	-24.6613	-25.0905	-25.4571
Methylcyclohexane	C_7H_{14}	infinite	-4.7819	-4.9487	-11.9344	-16.3959	-19.5065	-21.7937	-23.5374	-24.9110	-26.0133	-26.9077	-27.6521	-28.2657	-28.7908	-29.2345
Ethylcyclohexane.	C_8H_{16}	infinite	-6.8744	-7.0592	-14.8200	-19.7522	-23.2097	-25.7561	-27.6926	-29.2075	-30.4279	-31.4243	-32.2567	-32.9394	-33.5168	-33.9999
n-Propylcyclohexane	C_9H_{18}	infinite	-8.304	-8.522	-17.232	-22.814	-26.679	-29.534	-31.696	-33.402	-34.770	-35.900	-36.841	-37.587	-38.253	-38.810
n-Butylcyclohexane.	$C_{10}H_{20}$	infinite	-9.935	-10.174	-19.776	-25.918	-30.176	-33.318	-35.700	-37.579	-39.086	-40.330	-41.365	-42.192	-42.928	-43.546
n-Pentylcyclohexane	$C_{11}H_{22}$	infinite	-11.436	-11.697	-22.223	-28.948	-33.610	-37.050	-39.657	-41.715	-43.365	-44.724	-45.857	-46.767	-47.574	-48.257
n-Hexylcyclohexane.	$C_{12}H_{24}$	infinite	-12.937	-13.219	-24.670	-31.978	-37.044	-40.781	-43.613	-45.850	-47.644	-49.119	-50.350	-51.342	-52.220	-52.967
n-Heptylcyclohexane	$C_{13}H_{26}$	infinite	-14.438	-14.742	-27.118	-35.007	-40.478	-44.512	-47.570	-49.985	-51.923	-53.513	-54.842	-55.917	-56.866	-57.678
n-Octylcyclohexane.	$C_{14}H_{28}$	infinite	-15.940	-16.264	-29.565	-38.036	-43.912	-48.243	-51.527	-54.120	-56.202	-57.908	-59.335	-60.492	-61.513	-62.388
n-Nonylcyclohexane.	$C_{15}H_{30}$	infinite	-17.441	-17.787	-32.012	-41.066	-47.346	-51.974	-55.484	-58.255	-60.481	-62.302	-63.828	-65.068	-66.159	-67.099
n-Decylcyclohexane.	$C_{16}H_{32}$	infinite	-18.942	-19.310	-34.459	-44.096	-50.780	-55.706	-59.441	-62.391	-64.760	-66.696	-68.320	-69.643	-70.805	-71.810
n-Undecylcyclohexane. . . .	$C_{17}H_{34}$	infinite	-20.443	-20.832	-36.906	-47.125	-54.214	-59.437	-63.397	-66.526	-69.039	-71.091	-72.813	-74.218	-75.452	-76.520
n-Dodecylcyclohexane. . . .	$C_{18}H_{36}$	infinite	-21.944	-22.355	-39.354	-50.154	-57.648	-63.168	-67.354	-70.661	-73.318	-75.485	-77.305	-78.793	-80.098	-81.231
n-Tridecylcyclohexane . . .	$C_{19}H_{38}$	infinite	-23.446	-23.878	-41.801	-53.184	-61.083	-66.899	-71.311	-74.796	-77.597	-79.880	-81.798	-83.368	-84.744	-85.941
n-Tetradecylcyclohexane . .	$C_{20}H_{40}$	infinite	-24.947	-25.400	-44.248	-56.214	-64.517	-70.630	-75.268	-78.931	-81.876	-84.274	-86.291	-87.944	-89.390	-90.652
n-Pentadecylcyclohexane . .	$C_{21}H_{42}$	infinite	-26.448	-26.923	-46.695	-59.243	-67.951	-74.362	-79.225	-83.067	-86.155	-88.668	-90.783	-92.519	-94.037	-95.363
n-Hexadecylcyclohexane. . .	$C_{22}H_{44}$	infinite	-27.949	-28.445	-49.142	-62.272	-71.385	-78.093	-83.181	-87.202	-90.434	-93.063	-95.276	-97.094	-98.683	-100.073
Increment per CH_2 group . .		infinite	-1.5012	-1.5226	-2.4472	-3.0295	-3.4341	-3.7312	-3.9568	-4.1352	-4.2790	-4.3944	-4.4926	-4.5752	-4.6463	-4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

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National Bureau of Standards — Washington, D. C.

TABLE 24y - NORMAL MONOOLEFINS (1-ALKENES), C_2 to C_{20}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10}$ Kf, AT 0° TO 1500°K

November 30, 1945; April 30, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10}$Kf														
Ethene (Ethylene)	C_2H_4	infinite	-11.9345	-11.8781	- 9.6571	- 8.4119	- 7.6193	- 7.0797	- 6.6903	- 6.3996	- 6.1738	- 5.9918	- 5.8440	- 5.7206	- 5.6151	- 5.5249
Propene (Propylene)	C_3H_6	infinite	-10.9875	-10.9648	-10.1677	- 9.8128	- 9.6375	- 9.5519	- 9.5093	- 9.4942	- 9.4909	- 9.4922	- 9.4970	- 9.5027	- 9.5066	- 9.5117
1-Butene.	C_4H_8	infinite	-12.6199	-12.6175	-12.6785	-12.8637	-13.0582	-13.2403	-13.4005	-13.5442	-13.6669	-13.7707	-13.8598	-13.9358	-13.9986	-14.0537
1-Pentene	C_5H_{10}	infinite	-13.7704	-13.7904	-14.8394	-15.6377	-16.2629	-16.7617	-17.1601	-17.4898	-17.7622	-17.9911	-18.1863	-18.3556	-18.4920	-18.6070
1-Hexene.	C_6H_{12}	infinite	-15.2491	-15.2938	-17.2736	-18.6647	-19.6963	-20.4918	-21.1243	-21.6299	-22.0483	-22.3959	-22.6900	-22.9410	-23.1468	-23.3230
1-Heptene	C_7H_{14}	infinite	-16.742	-16.814	-19.719	-21.693	-23.126	-24.221	-25.076	-25.764	-26.326	-26.790	-27.180	-27.514	-27.792	-28.034
1-Octene.	C_8H_{16}	infinite	-18.244	-18.336	-22.166	-24.722	-26.561	-27.952	-29.031	-29.900	-30.606	-31.185	-31.673	-32.090	-32.437	-32.744
1-Nonene.	C_9H_{18}	infinite	-19.747	-19.859	-24.614	-27.751	-29.996	-31.683	-32.987	-34.035	-34.885	-35.580	-36.166	-36.666	-37.083	-37.455
1-Decene.	$C_{10}H_{20}$	infinite	-21.249	-21.381	-27.062	-30.780	-33.431	-35.414	-36.946	-38.171	-39.164	-39.974	-40.659	-41.240	-41.730	-42.165
1-Undecene.	$C_{11}H_{22}$	infinite	-22.745	-22.904	-29.510	-33.809	-36.862	-39.145	-40.901	-42.306	-43.443	-44.367	-45.150	-45.814	-46.376	-46.876
1-Dodecene.	$C_{12}H_{24}$	infinite	-24.247	-24.426	-31.957	-36.839	-40.297	-42.876	-44.860	-46.442	-47.722	-48.762	-49.643	-40.391	-51.023	-51.586
1-Tridecene	$C_{13}H_{26}$	infinite	-25.750	-25.949	-34.186	-39.872	-43.732	-46.610	-48.816	-50.577	-52.001	-53.157	-54.136	-54.967	-55.669	-56.298
1-Tetradecene	$C_{14}H_{28}$	infinite	-27.253	-27.472	-36.847	-42.901	-47.166	-50.341	-52.771	-54.710	-56.278	-57.552	-58.629	-59.541	-60.315	-61.009
1-Pentadecene	$C_{15}H_{30}$	infinite	-28.755	-28.994	-39.295	-45.930	-50.601	-54.072	-56.730	-58.845	-60.558	-61.947	-63.120	-64.117	-64.962	-64.719
1-Hexadecene.	$C_{16}H_{32}$	infinite	-30.251	-30.517	-41.743	-48.959	-54.032	-57.803	-60.685	-62.981	-64.837	-66.339	-67.613	-69.691	-69.608	-70.429
1-Heptadecene	$C_{17}H_{34}$	infinite	-31.753	-32.039	-44.190	-51.988	-57.467	-61.534	-64.644	-67.116	-69.116	-70.734	-72.106	-73.267	-74.255	-75.140
1-Octadecene.	$C_{18}H_{36}$	infinite	-33.256	-33.562	-46.638	-55.017	-60.902	-65.265	-68.600	-71.252	-73.395	-75.129	-76.599	-77.842	-78.901	-79.850
1-Nonadecene.	$C_{19}H_{38}$	infinite	-34.758	-35.084	-49.086	-58.046	-64.337	-68.996	-72.555	-75.387	-77.674	-79.524	-81.092	-82.418	-83.546	-84.561
1-Eicosene.	$C_{20}H_{40}$	infinite	-36.261	-36.607	-51.534	-61.076	-67.772	-72.727	-76.514	-79.522	-81.953	-83.919	-85.584	-86.992	-88.194	-89.271
Increment per CH_2 group . .		infinite	- 1.5012	- 1.5226	- 2.4472	- 3.0295	- 3.4341	- 3.7312	- 3.9568	- 4.1352	- 4.2790	- 4.3944	- 4.4926	- 4.5752	- 4.6463	- 4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

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National Bureau of Standards — Washington, D. C.

TABLE 25y - NORMAL ACETYLENES (1-ALKYNES), C_2 to C_{20}

LOGARITHM OF EQUILIBRIUM CONSTANT OF FORMATION, $\log_{10} Kf$, AT 0° TO 1500°K

February 28, 1946

Compound (gas)	Formula	Temperature[a] in °K														
		0	298.16	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
		Logarithm of Equilibrium Constant of Formation[b], $\log_{10} Kf$														
Ethyne (Acetylene)	C_2H_2	infinite	-36.6490	-36.4058	-26.5406	-20.6290	-16.6952	-13.8925	-11.7978	-10.1702	-8.8738	-7.8158	-6.9369	-6.1956	-5.5611	-5.0134
Propyne (Methylacetylene)	C_3H_4	infinite	-33.9469	-33.8610	-25.8360	-21.0781	-17.9409	-15.7228	-14.0728	-12.8007	-11.7897	-10.9660	-10.2830	-9.7072	-9.2137	-8.7879
1-Butyne (Ethylacetylene)	C_4H_6	infinite	-35.5616	-35.3839	-28.2320	-24.0341	-21.2892	-19.3627	-17.9369	-16.8427	-15.9748	-15.2680	-14.6832	-14.1910	-13.7682	-13.4030
1-Pentyne	C_5H_8	infinite	-36.7712	-36.6154	-30.4369	-26.8440	-24.5230	-22.9082	-21.7167	-20.8084	-20.0881	-19.5046	-19.0244	-18.6227	-18.2733	-17.9662
1-Hexyne	C_6H_{10}	infinite	-38.258	-38.125	-32.877	-29.875	-27.959	-26.641	-25.678	-24.951	-24.376	-23.911	-23.530	-23.210	-22.930	-22.683
1-Heptyne	C_7H_{12}	infinite	-39.759	-39.648	-35.324	-32.904	-31.394	-30.372	-29.635	-29.086	-28.655	-28.306	-28.023	-27.785	-27.576	-27.394
1-Octyne	C_8H_{14}	infinite	-41.260	-41.170	-37.771	-35.934	-34.828	-34.103	-33.592	-33.221	-32.934	-32.700	-32.515	-32.360	-32.222	-32.104
1-Nonyne	C_9H_{16}	infinite	-42.761	-42.693	-40.218	-38.963	-38.262	-37.834	-37.549	-37.356	-37.213	-37.094	-37.008	-36.935	-36.868	-36.815
1-Decyne	$C_{10}H_{18}$	infinite	-44.262	-44.216	-42.666	-41.993	-41.696	-41.566	-41.506	-41.492	-41.492	-41.489	-41.500	-41.511	-41.515	-41.525
1-Undecyne	$C_{11}H_{20}$	infinite	-45.764	-45.738	-45.113	-45.022	-45.130	-45.297	-45.462	-45.627	-45.771	-45.883	-45.993	-46.086	-46.161	-46.236
1-Dodecyne	$C_{12}H_{22}$	infinite	-47.265	-47.261	-47.560	-48.052	-48.564	-49.028	-49.419	-49.762	-50.050	-50.278	-50.486	-50.661	-50.807	-50.946
1-Tridecyne	$C_{13}H_{24}$	infinite	-48.766	-48.783	-50.007	-51.081	-51.998	-52.759	-53.376	-53.897	-54.329	-54.672	-54.978	-55.236	-55.454	-55.657
1-Tetradecyne	$C_{14}H_{26}$	infinite	-50.267	-50.306	-52.454	-54.111	-55.432	-56.490	-57.333	-58.032	-58.608	-59.066	-59.471	-59.811	-60.100	-60.368
1-Pentadecyne	$C_{15}H_{28}$	infinite	-51.768	-51.828	-54.902	-57.140	-58.866	-60.222	-61.290	-62.168	-62.887	-63.461	-63.963	-64.387	-64.746	-65.078
1-Hexadecyne	$C_{16}H_{30}$	infinite	-53.270	-53.351	-57.349	-60.170	-62.300	-63.953	-65.246	-66.303	-67.166	-67.855	-68.456	-68.962	-69.393	-69.789
1-Heptadecyne	$C_{17}H_{32}$	infinite	-54.771	-54.874	-59.796	-63.199	-65.734	-67.684	-69.203	-70.438	-71.445	-72.250	-72.949	-73.537	-74.039	-74.500
1-Octadecyne	$C_{18}H_{34}$	infinite	-56.272	-56.396	-62.243	-66.229	-69.169	-71.415	-73.160	-74.573	-75.724	-76.644	-77.441	-78.112	-78.685	-79.210
1-Nonadecyne	$C_{19}H_{36}$	infinite	-57.773	-57.919	-64.690	-69.258	-72.603	-75.146	-77.117	-78.708	-80.003	-81.038	-81.934	-82.687	-83.332	-83.921
1-Eicosyne	$C_{20}H_{38}$	infinite	-59.274	-59.442	-67.138	-72.288	-76.037	-78.878	-81.074	-82.844	-84.282	-85.433	-86.426	-87.263	-87.978	-88.631
[a] Increment per CH_2 group		infinite	-1.5012	-1.5226	-2.4472	-3.0295	-3.4341	-3.7312	-3.9568	-4.1352	-4.2790	-4.3944	-4.4926	-4.5752	-4.6463	-4.7106

[a] See footnote a of Table 1y.

[b] See footnotes b and c of Table 1y.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 1z - PARAFFINS, C_1 to C_5

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

December 31, 1944

Compound	Formula	Crystalline Form[a]	Freezing Point		Heat of Fusion	Entropy of Fusion[e]	Cryoscopic Constants[f]	
			In air at 1 atm.[b]		ΔH_m^o	ΔS_m^o	A	B
			°C	°K[c]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
Methane	CH_4	I	-182.48[d]	90.68[d]	0.225	2.481	0.01377	0.0057
Ethane	C_2H_6	I	-183.23[d]	89.93[d]	0.6829	7.594	0.04249	0.0095
Propane	C_3H_8	I	-187.65[d]	85.51[d]	0.8422	9.849	0.05796	0.0073
n - Butane	C_4H_{10}	I	-138.33	134.83	1.114	8.262	0.03084	0.0048
2 - Methylpropane (Isobutane)	"	I	-159.60	113.56	1.085	9.554	0.04234	0.0057
n - Pentane	C_5H_{12}	I	-129.723	143.437	2.011	14.020	0.04919	0.0042
2 - Methylbutane (Isopentane)	"	I	-159.890	113.270	1.232	10.877	0.04832	0.0058
2,2 - Dimethylpropane (Neopentane)	"	I	-16.6	256.56	0.7782	3.033	0.00595	0.000

[a] When a given hydorcarbon has more than one crystalline form, the several forms will be labeled I, II, III, etc., in order of decreasing temperature of fusion (or freezing point). Forms other than I will be, at their respective freezing points, in metastable equilibrium with the undercooled liquid, but will be unstable with respect to transition to some other solid form at the same temperature and pressure (one atmosphere). This is indicated by a letter u in parentheses following the Roman numeral.

[b] Unless otherwise indicated.

[c] 0°C = 273.16°K.

[d] Triple point.

[e] Entropy of fusion (per mole), $\Delta S_m^o = \Delta H_m^o / T_{f_o}$, where ΔH_m^o is the heat of fusion (per mole) and T_{f_o} is the absolute temperature of the liquid-solid equilibrium for the pure substance (freezing point for zero impurity). 1 kcal = 1000 cal: see Table α (Part 1).

[f] For use in the equation, $-\ln N_1 = A(t_{f_o} - t_f)\left[1 + B(t_{f_o} - t_f) + \ldots\right]$, which gives the thermodynamic relation between the temperature of equilibrium and the composition of the liquid phase for an ideal or sufficiently dilute solution in which the liquid phase consists of the major component and one or more other components and the solid phase consists of crystals of the major component alone. Here, N_1 is the mole fraction of the major component in the liquid phase; t_{f_o} is the freezing point in degrees Centigrade of the major component when pure (that is, when $N_1 = 1$); t_f is the freezing point in degrees Centigrade when N_1 is less than 1 (that is, the freezing point of an actual sample of the material); $A = \Delta H_m^o / R T_{f_o}^2$; $B = 1/T_{f_o} - (\Delta C_p)_m^o / 2\Delta H_m^o$; ΔH_m^o and T_{f_o} are defined as in footnote e; R is the gas constant per mole (R = 1.98718 cal/deg mole); and $(\Delta C_p)_m^o$ is the heat capacity per mole of the liquid less that of the solid for the major component in the pure state of the temperature T_{f_o}. For calculating the purity, p, in mole percent, for a given sample, the following equation may be used: $\log_{10} p = 2.00000 - (A/2.30259)(t_{f_o} - t_f)\left[1 + B(t_{f_o} - t_f)\right]$.

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SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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National Bureau of Standards

Washington, D. C.

TABLE 2z (Part 1) - PARAFFINS, C_6

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

January 31, 1945; revised March 31, 1945

Compound	Formula	Crystalline Form [a]	Freezing Point		Heat of Fusion	Entropy of Fusion [c]	Cryoscopic Constants [d]	
			In air at 1 atm.		ΔHm^o	ΔSm^o	A	B
			°C	°K [b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
n - Hexane	C_6H_{14}	I	-95.320	177.840	3.114	17.51	0.0495	0.0039
2 - Methylpentane	"	I	-153.680	119.480	1.500	12.55	0.05288	0.005
3 - "	"							
2,2 - Dimethylbutane	"	I	-99.73	173.43	0.1385	0.799	0.002317	0.000
2,3 - "	"	I	-128.41	144.75	0.194	1.34	0.00466	

[a] See footnote a of Table 1 z. [b] 0°C = 273.160°K. [c] See footnote e of Table 1 z. [d] See footnote f of Table 1 z.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 2z (Part 2) - PARAFFINS, C_7

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

January 31, 1945

Compound	Formula	Crystalline Form [a]	Freezing Point in air at 1 atm.		Heat of Fusion	Entropy of Fusion [c]	Cryoscopic Constants [d]	
					ΔHm^o	ΔSm^o	A	B
			°C	°K [b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
n-Heptane	C_7H_{16}	I	-90.595	182.565	3.358	18.39	0.05070	0.0033
2-Methylhexane	"	J	-118.270	154.890	2.120	13.69	0.0445	0.0036
3-Methylhexane	"							
3-Ethylpentane	"	I	-118.593	154.567	2.260	14.62	0.0476	0.0039
2,2-Dimethylpentane	"	I	-123.790	149.370	1.401	9.38	0.0316	0.0036
2,3-Dimethylpentane	"							
2,4-Dimethylpentane	"	I	-119.230	153.930	1.600	10.41	0.0341	0.0038
3,3-Dimethylpentane	"	I	-134.46	138.70	1.689	12.18	0.0442	0.0040
"	"	II (u)	-134.95	138.21				
"	"	III (u)	-135.36	137.80				
2,2,3-Trimethylbutane	"	I	-24.96	248.20	0.526	2.12	0.00430	0.0033

[a] See footnote a of Table 1z. [b] 0°C = 273.160°K. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

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TABLE 3z - PARAFFINS, C_8

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

August 31, 1945

Compound	Formula	Crystalline Form[a]	Freezing Point		Heat of Fusion	Entropy of Fusion[c]	Cryoscopic Constants[d]	
			In air at 1 atm.		ΔHm^o	ΔSm^o	A	B
			°C	°K[b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
n-Octane	C_8H_{18}	I	-56.798	216.362	4.931	22.79	0.0530	0.0031
2-Methylheptane	"	I	-109.04	164.12	2.451[e]	14.94[e]	.0458	
3- "	"	I	-120.50	152.66	2.718[e]	17.80[e]	.0587	
4- "	"	I	-120.955	152.205	2.592[e]	17.03[e]	.0563	
3-Ethylhexane	"							
2,2-Dimethylhexane	"	I	-121.18	151.98	1.625[e]	10.69[e]	.0354	
2,3- "	"							
2,4- "	"							
2,5- "	"	I	-91.200	181.960	3.073[e]	16.89[e]	.0467	
3,3- "	"	I	-126.10	147.06	1.7[e]	12.[e]	.04	
3,4- "	"							
2-Methyl-3-ethylpentane	"	I	-114.960	158.200	2.706[e]	17.10[e]	.0544	
3- " -3- "	"	I	-90.870	182.290	2.588[e]	14.20[e]	.0392	
2,2,3-Trimethylpentane	"	I	-112.27	160.89	2.063[e]	12.82[e]	.0401	
2,2,4- "	"	I	-107.365	165.795	2.202	13.28	.04031	.0043
2,3,3- "	"	I	-100.70	172.46	0.366[e]	2.12[e]	.0062	
2,3,4- "	"	I	-109.210	163.950	2.215	13.51	.04122	.0035
2,2,3,3-Tetramethylbutane	"	I	+100.69	373.85	1.702	4.553	.00613	

[a] See footnote a of Table 1z. [b] 0°C = 273.160°K. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

[e] Calculated from experimentally determined cryoscopic constant A.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

TABLE 5z - ALKYL BENZENES, C_6 to C_o

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

January 31, 1945; August 31, 1945

Compound	Formula	Crystalline Form[a]	Freezing Point		Heat of Fusion	Entropy of Fusion[c]	Cryoscopic Constants[d]	
			In air at 1 atm.					
			°C	°K[b]	ΔHm^o	ΔSm^o	A	B
					kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
Benzene	C_6H_6	I	+5.533	278.693	2.351	8.436	0.01523	0.0032
Methylbenzene (Toluene)	C_7H_8	I	-94.991	178.169	1.582	8.879	0.02508	0.0019
Ethylbenzene	C_8H_{10}	I	-94.950	178.210	2.190	12.289	0.03470	0.0029
1,2-Dimethylbenzene (o-Xylene)	"	I	-25.187	247.973	3.250	13.106	0.02660	0.0030
1,3-Dimethylbenzene (m-Xylene)	"	I	-47.872	225.288	2.765	12.273	0.02742	0.0027
1,4-Dimethylbenzene (p-Xylene)	"	I	+13.263	286.423	4.090	14.280	0.02509	0.0028
n-Propylbenzene	C_9H_{12}	I	-99.500	173.660	2.04[e]	11.7[e]	0.034	0.003
"	"	II(u)	-101.55	171.61	1.87[e]	10.9[e]	0.032	0.003
Isopropylbenzene (Cumene)	"	I	-96.028	177.132	2.31[e]	13.0[e]	0.028	0.003
1-Methyl-2-ethylbenzene	"	I	-80.833	192.327	2.54[e]	13.2[e]	0.0346	0.003
"	"	II(u)	-86.556	186.604	2.28[e]	12.2[e]	0.033	0.003
1-Methyl-3-ethylbenzene	"	I	-95.55	177.61	1.82[e]	10.2[e]	0.029	0.003
"	"	II(u)	-96.96	176.20	1.79[e]	10.2[e]	0.029	0.003
1-Methyl-4-ethylbenzene	"	I	-62.350	210.810	3.04[e]	14.4[e]	0.0344	0.003
1,2,3-Trimethylbenzene (Hemimellitene)	"	I	-25.375	247.785	2.00[e]	8.1[e]	0.0164	0.003
1,2,4-Trimethylbenzene (Pseudocumene)	"	I	-43.80	229.36	2.95[e]	12.9[e]	0.0282	0.0028
"	"	II(u)	-49.00	224.16				
1,3,5-Trimethylbenzene (Mesitylene)	"	I	-44.720	228.440	2.28	10.0	0.022	0.003
"	"	II(u)	-49.79	223.37	1.98	8.9	0.020	0.003
"	"	III(u)	-51.68	221.48	1.91	8.6	0.020	0.003

[a] See footnote a of Table 1z. [b] $0^oC = 273.160\ ^oK$. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

[e] Calculated from experimentally determined cryoscopic constant A.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 6z - ALKYL CYCLOPENTANES, C_5 to C_7

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

April 30, 1946; May 31, 1947

Compound	Formula	Crystalline Form[a]	Freezing Point		Heat of Fusion	Entropy of Fusion[c]	Cryoscopic Constants[d]	
			In air at 1 atm		ΔHm^o	ΔSm^o	A	B
			°C	°K[b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
Cyclopentane	C_5H_{10}	I	- 93.80	179.36	0.1450	0.808	0.00227	0.00
Methylcyclopentane	C_6H_{12}	I	-142.445	130.715	1.656	12.67	0.04877	0.0046
Ethylcyclopentane	C_7H_{14}	I	-138.435	134.725	1.640	12.17	0.04547	
1,1-Dimethylcyclopentane	"	I	- 69.73	203.43	.258	1.27	0.00314	
cis-1,2-Dimethylcyclopentane	"	I	- 53.85	219.31	0.38[e]	1.7[e]	0.004	
trans-1,2- "	"	I	-117.57	155.59	1.54	9.90	0.0320	0.003
cis-1,3- "	"							
trans-1,3- "	"	I	-133.680	139.480	1.76[e]	12.6[e]	0.0455	

[a] See footnote a of Table 1z. [b] $0^oC = 273.160^oK$. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

[e] Calculated from experimentally determined cryoscopic constant A.

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American Petroleum Institute Research Project 44

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TABLE 7z - ALKYL CYCLOHEXANES, C_6 to C_8

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

March 31, 1947

Compound	Formula	Crystalline Form[a]	Freezing Points		Heat of Fusion	Entropy of Fusion[c]	Cryoscopic Constants[d]	
			In air at 1 atm		ΔH_m^o	ΔS_m^o	A	B
			°C	°K[b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
Cyclohexane	C_6H_{12}	I	+6.554	279.714	0.637	2.28	0.0041	0.00072
Methylcyclohexane	C_7H_{14}	I	-126.60	146.56	1.613	11.01	0.0378	0.0032
Ethylcyclohexane	C_8H_{16}	I	-111.300	161.860	1.990	12.29	0.0382	
1,1-Dimethylcyclohexane	"	I	-33.54	239.62	0.485	2.02	.0042	
cis-1,2-Dimethylcyclohexane	"	I	-50.00	223.16	0.393	1.76	.0040	
trans-1,2- "	"	I	-88.180	184.980	2.507	13.55	.0369	
cis-1,3-[e] "	"	I	-75.560	197.600	2.586	13.09	.0333	
trans-1,3-[f] "	"	I	-90.100	183.060	2.32	12.7	.035	
cis-1,4- "	"	I	-87.425	185.735	2.224	11.97	.0324	
trans-1,4- "	"	I	-36.92	236.24	2.725	11.53	.0246	

[a] See footnote a of Table 1z. [b] 0°C = 273.160°K. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

[e] Formerly labeled "trans"; see footnote d of Table 7a. [f] Formerly labeled "cis"; see footnote e of Table 7a.

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TABLE 8z (Part 1) - MONOOLEFINS, C_2 to C_4

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

January 31, 1945

Compound	Formula	Crystalline Form [a]	Freezing Point		Heat of Fusion	Entropy of Fusion[e]	Cryoscopic Constants[f]	
			In air at 1 atm[b]		ΔHm^o	ΔSm^o	A	B
			°C	°K[c]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
Ethene (Ethylene)	C_2H_4	I	-169.15[d]	104.01[d]	0.8008	7.699	0.03725	0.0130
Propene (Propylene)	C_3H_6	I	-185.25[d]	87.91[d]	0.7176	8.163	0.04673	0.0054
1-Butene	C_4H_8	I	-185.35[d]	87.81[d]	0.9197	10.474	0.06002	0.0045
cis-2-Butene	"	I	-138.91	134.25	1.7468	13.012	.04878	.0052
trans-2-Butene	"	I	-105.55	167.61	2.3319	13.913	.04177	.0058
2-Methylpropene (Isobutene)	"	I	-140.35	132.81	1.4175	10.673	.04044	.005

[a] See footnote a of Table 1z.

[b] Unless otherwise indicated.

[c] 0°C = 273.160 °K.

[d] Triple Point.

[e] See footnote e of Table 1z.

[f] See footnote f of Table 1z.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

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TABLE 8z (Part 2) - MONOOLEFINS, C_5

HEAT AND ENTROPY OF FUSION, FREEZING POINTS, AND CRYOSCOPIC CONSTANTS

August 31, 1945; May 31, 1947

Compound	Formula	Crystalline Form[a]	Freezing Point		Heat of Fusion	Entropy of Fusion[c]	Cryoscopic Constants[d]	
			In air at 1 atm.		ΔHm^o	ΔSm^o	A	B
			°C	°K[b]	kcal/mole	cal/deg mole	deg^{-1}	deg^{-1}
1-Pentene	C_5H_{10}	I	-165.22	107.94	1.388	12.86	0.05995	0.0048
cis-2-Pentene	"	I	-151.370	121.790	1.6997	13.956	.05767	.0048
trans-2- "	"	I	-140.235	132.925	1.9960	15.016	.05685	.0052
2-Methyl-1-butene	"	I	-137.560	135.600	1.8906	13.942	.05174	.0043
3- " -1- "	"	I	-168.500	104.660	1.2809	12.239	.05885	.0047
2- " -2- "	"	I	-133.780	139.380	1.8158	13.028	.04704	0.0048

[a] See footnote a of Table 1z. [b] 0°C = 273.160°K. [c] See footnote e of Table 1z. [d] See footnote f of Table 1z.

IV. SPECIFIC REFERENCES FOR TABLES OF PROPERTIES

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 1a, 1a-E, and 1b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Methane	3,10,11,12			12,13,15,16,17, 18,19	
Ethane	3,20,21,22			13,20,21	
Propane	3,23,24,25,26, 27		2,8	23,26,27	
n-Butane	1,3,5,29		1,2,8	5,30,31	
2-Methylpropane	1,3,28,32,33, 34,35		1,2,8	28,31,36	
n-Pentane	6,9,34,37,38, 39,40,41,42, 43,44,45,46, 47	6,7,9,40,42, 43,44,45,46, 47,51,55	2,6,7,8,9,44, 45,46,48,50	9,14,37,38,44, 46,47,49,55	7,9,46
2-Methylbutane	6,9,34,40,41, 42,44,52,53	6,7,9,40,42, 44,51,55	2,6,9,44,50	6,9,40,49,52, 53,54,55	7,9
2,2-Dimethylpropane	1,4		1	1,4,6,45	

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50. Geist and Cannon[1]
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SPECIFIC REFERENCES

FOR TABLES 2a (Part 1), 2a-E (Part 1), and 2b (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Hexane	3,6,7,8,10,11, 12,13,14,15, 16,17	1,5,6,7,8,10,11, 13,15,16,17, 19	1,5,6,7,8,11, 15,18	1,2,7,10,11,13, 20	5,7,11,21
2-Methylpentane	3,4,6,7,8,9,12, 15,16,17	1,4,6,7,8,9,13, 15,16,17,19	1,4,6,7,8,9,15	1,2,4,9	7,21
3-Methylpentane	3,4,6,7,8,9,11, 12,17	1,4,6,7,8,9,13, 17,19	1,4,6,7,8,9,18		7,21
2,2-Dimethylbutane	3,4,6,7,8,12,13, 16,17,22,23, 24,25,27	1,4,6,7,8,13, 16,17,19,22 23,24,26,27	1,4,6,7,8,22, 23,24,27	1,2,4,7,13,22, 23,24,25	7,21
2,3-Dimethylbutane	3,6,7,8,9,12,13, 14,15,16,17, 22	1,6,7,8,9,13, 15,16,17,19, 22,28	1,6,7,8,9,15, 22,28	1,2,7,9,13,22	7,21

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 2a (Part 2), 2a-E (Part 2), and 2b (Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Heptane	3,5,6,7,8,9,10, 11,12,13,14, 15,16,17	1,5,6,7,8,9,10, 11,12,13,15, 16,18	1,5,6,7,11,12, 13,15,18,19, 20,21	1,2,5,6,7,8,10, 11,12,13	5,11,18,27,28, 29
2-Methylhexane	5,6,7,8,9	5,6,7,8,9	5,6,7	5,7,8,22	5,28
3-Methylhexane	6,7,9,14	6,7,9	6,7		28
3-Ethylpentane	6,7,9,13,14	6,7,9,13	6,7,13	13,22	28
2,2-Dimethylpentane	3,5,6,7,8,9,14, 16	1,5,6,7,8,9,16	1,5,6,7	5,7,8,22	5,28,29
2,3-Dimethylpentane	4,5,6,7,8,9,14, 16,23,24	4,5,6,7,8,9,16, 23,24	4,5,6,7,23,24		5,28
2,4-Dimethylpentane	4,5,6,7,8,9,16, 24	4,5,6,7,8,9,16, 24	4,5,6,7,24	4,5,7,8,22	5,28
3,3-Dimethylpentane	3,5,7,8,9,25,26	1,5,7,8,9,25,26	1,5,7,25,26	5,7,8,22,26	5,28,29
2,2,3-Trimethylbutane	5,6,7,8,9,13, 14,16,24	5,6,7,8,9,13, 16,18,24	5,6,7,13,18,24	2,5,6,7,8,13	5,18,28

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 3a, 3a-E, and 3b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Octane	3,7,8,10,11,12, 13,14	1,6,7,8,10,11, 13,14	1,5,6,7,8,11,13, 15	1,2,7,8,10,11, 13	6,8,11,32,33
2-Methylheptane	3,7	1,6,7	1,5,7,15	1,2	6,32,33
3-Methylheptane	3,8	1,6,7	1,5,6,8,15	1,2	6,8,32,33
4-Methylheptane	3,16,17	1,6,16,17	1,5,6,15,16,17	1,2,16,17	6,32,33
3-Ethylhexane	3	1	1,5,15		32,33
2,2-Dimethylhexane	3,18	1,18	1,5,18	1,2	32,33
2,3-Dimethylhexane	3,8,9,17,19	1,8,9,17,19	1,5,8,9,17,19		8,32,33
2,4-Dimethylhexane	3,7	1,7	1,5,7		32,33
2,5-Dimethylhexane	3,7,8,20	1,7,8,20	1,7,8,20	1,2	8,32,33
3,3-Dimethylhexane	3	1	1,5	1,2	32,33
3,4-Dimethylhexane	3,7,8,9	1,7,8,9	1,5,7,8,9		8,32,33
2-Methyl-3-ethylpentane	3,4,9	1,4,6,9	1,4,5,6,9	1,2,4	6,32,33
3-Methyl-3-ethylpentane	3,8,18	1,6,8,18	1,5,6,8,18	1,2,8,17	6,8,32,33
2,2,3-Trimethylpentane	3,7,8,9,22	1,7,8,9,22	1,5,7,8,22	1,2,22	8,32,33
2,2,4-Trimethylpentane	3,7,8,12,14,21, 23,24	1,6,7,8,14,21, 23,25	1,5,6,7,8,21, 23,25	1,7,8,21,23,26	6,8,25,30,31, 32,33
2,3,3-Trimethylpentane	3,4,7,19	1,4,7,19	1,4,5,7,19	1,2,17	32,33
2,3,4-Trimethylpentane	3,7,9,23	1,6,7,9,23	1,5,7,9,23	1,2,23,29	6,32,33
2,2,3,3-Tetramethylbutane	27,28	28	28	9,28	32,33

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National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 4a (Part 1), 4a-E (Part 1), and 4b (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Nonane	9,10,11,12,13, 14,16,17,26	9,10,11,12,15, 16,17	9,10,11,12,13, 15	9,10,11,12,15, 17,18	10,12,28,29
2-Methyloctane	3,5,19	3,5,19	3,5,19	3,5	29
3-Methyloctane	1,3	1,3	1,3	3	29
4-Methyloctane	3	3	3	3	29
3-Ethylheptane	5,19	5,19	5,19	5	29
4-Ethylheptane	1,2,20,21	1,2,20,21	1,2,20,21		29
2,2-Dimethylheptane	6	6	6		29
2,3-Dimethylheptane	5,22	4,5,22	4,5,22	5	29
2,4-Dimethylheptane	7,8,23	7,8	7,8,23		29
2,5-Dimethylheptane	7,8,23	7,8	7,8,23		29
2,6-Dimethylheptane	21,24	21,24	21,24	24	29
3,3-Dimethylheptane	6,25	6,25	6,25		29
3,4-Dimethylheptane	1,2,27	1,2,27	1,2,27		29
3,5-Dimethylheptane	1,2	1,2	1,2		29
4,4-Dimethylheptane	1,2	1,2	1,2		29

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National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 4a(Part 2), 4a-E(Part 2), and 4b(Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
2-Methyl-3-ethylhexane	1,2,7	1,2,7	1,2,7		20
2-Methyl-4-ethylhexane	1,2	1,2	1,2		20
3-Methyl-3-ethylhexane	1,2	1,2	1,2		20
3-Methyl-4-ethylhexane	1,2	1,2	1,2		20
2,2,3-Trimethylhexane.	1,2,6,7	1,2,6,7	1,2,6,7		20
2,2,4-Trimethylhexane.	3,4,5	3,4,5,19	3,4,5	3,4	20
2,2,5-Trimethylhexane.	3,4,8,9,10	3,4,8,9,10,11	3,4,8,9,10	3,4,11	20
2,3,3-Trimethylhexane.	1,2,12	1,2,12	1,2,12		20
2,3,4-Trimethylhexane.	1,2	1,2	1,2		20
2,3,5-Trimethylhexane.	4,8,12	4,8,12,19	4,8,12	4	20
2,4,4-Trimethylhexane.	1,2,7,13	1,2,7,11,13	1,2,7,13		20
3,3,4-Trimethylhexane.	1,2,7	1,2,7	1,2,7		20
3,3-Diethylpentane.	14,21	14,21	14,21	14,21	20
2,2-Dimethyl-3-ethylpentane. .	4	4	4	4	20
2,3-Dimethyl-3-ethylpentane. .	1,2	1,2	1,2		20
2,4-Dimethyl-3-ethylpentane. .	4,7	4,7	4,7		20
2,2,3,3-Tetramethylpentane . .	4	4	4	4	20
2,2,3,4-Tetramethylpentane . .	4	4	4	4	20
2,2,4,4-Tetramethylpentane . .	15,16,17	15,17	15,17	11,15,17	20
2,3,3,4-Tetramethylpentane . .	4,18	4,18	4,18	4	20

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SPECIFIC REFERENCES

FOR TABLES 5a, 5a-E, and 5-b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Benzene	3,4,7,9,10,11, 12,13,14,15, 16,17,19,60	1,4,6,7,9,10, 14,16,17,18, 19,60	1,4,5,9,10,19, 20,60	2,4,7,9,10,14, 60	6,43,56,59
Methylbenzene	3,4,7,9,13,17, 21,60	1,4,7,9,17,18, 57,60	1,4,5,9,20,22, 57,60	2,4,7,9,23,60	34,43,56,57,59
Ethylbenzene	3,4,9,17,21,25, 26,60	1,4,6,9,17,18, 25,26,59,60	1,4,5,9,20,25, 26,59,60	2,4,9,25,26,55, 60	6,43,56,58,59
1,2-Dimethylbenzene	3,4,21,24,26, 27,28,29,30, 31,60	1,4,6,24,26,28, 29,30,31,59, 60	1,4,5,20,24,26, 29,30,59,60	2,4,24,26,30, 32,60	6,43,56,58,59
1,3-Dimethylbenzene	3,4,21,24,26, 27,28,31,33	1,4,6,18,24,26, 28,31,33,59	1,4,5,20,24,26, 33,59	2,4,24,26,32, 33	6,43,56,58,59
1,4-Dimethylbenzene	3,4,21,24,26, 27,28,31,34, 35,60	1,4,6,18,24,26, 28,31,34,35, 59,60	1,4,5,20,24,26, 28,34,35,59, 60	2,4,24,26,28, 32,34,35,36, 60	6,24,43,56,57, 58,59
n-Propylbenzene	3,4,17,33,37, 60	1,4,6,17,18,33, 37,39,59,60	1,4,5,20,33,37, 39,59,60	2,4,33,38,39, 60	6,43,58,59
Isopropylbenzene	3,4,7,17,21,37, 40,41,42,60	1,4,6,7,17,18, 37,39,41,42, 59,60	1,4,5,37,39,41, 42,59,60	2,7,39,41,42, 60	6,43,58,59
1-Methyl-2-ethylbenzene	4,8,38,43,44	4,8,18,38,39, 43,44,45,59	4,8,39,43,45, 59	4,38,39	43,59
1-Methyl-3-ethylbenzene	4,8,38,43,44	4,8,18,38,39, 43,59	4,8,39,43,59	4,8,38,39	18,43,59
1-Methyl-4-ethylbenzene	4,8,43,44,46	4,8,18,35,38, 39,43,44,46, 59	4,8,35,39,43, 46,59	4,35,38,39	18,43,51,59
1,2,3-Trimethylbenzene	4,8,31,43,47	4,31,38,39,43, 47,59	4,39,43,47,59	2,4,38,39,47	43,47,59
1,2,4-Trimethylbenzene	4,8,31,43,47, 48,49,50	4,8,18,31,38, 39,43,47,48, 49,51,59	4,8,39,43,47, 51,59	4,8,38,39,47, 48,52	43,51,58,59
1,3,5-Trimethylbenzene	4,8,21,31,43, 47,50,53,54	4,8,18,31,38, 39,43,47,51, 59	4,8,39,43,47, 51,53,54,59	4,8,38,39,47	43,51,58,59

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SPECIFIC REFERENCES

FOR TABLES 5a, 5a-E, and 5b - (Continued)

(Applicable as of the date of issue of the numerical table)

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SPECIFIC REFERENCES

FOR TABLES 6a, 6a-E, and 6b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Cyclopentane	2,5,10,11,12, 13,34,35	1,2,3,5,11,15, 35,36	1,2,3,4,5,11, 34,35	2,5,10,14,15	3,5,32,37
Methylcyclopentane	2,5,9,11,13, 16,17,34,40	1,2,3,5,11,12, 15,16,17,18, 36,40	1,2,3,4,5,9,11, 16,17,18,34, 40	5,9,14	3,5,31,32,37
Ethylcyclopentane	2,9,11,16,19, 20,22,23,32, 34,38,39,40	2,3,9,11,16, 18,19,20,22, 23,24,32,38, 39,40	2,3,4,9,11,16, 18,22,23,32, 34,38,39,40	9,14,21,23,24	3,9,31,32
1,1-Dimethylcyclopentane	2,24,25,26,27, 28,32,44	2,24,25,26,27, 28,32,44	2,25,26,27,32	2,24,25,26	24,32,33
cis-1,2-Dimethylcyclopentane	2,6,8,32,41,44	2,6,8,24,32,44	2,6,8,32,41	6,8,24,41	6,8,32,33
trans-1,2-Dimethlcyclopentane	2,6,8,24,29,32, 41,44	2,6,8,24,29, 32,41,44	2,6,8,29,32	6,8,24,29,41, 42	6,8,32,33
cis-1,3-Dimethylcyclopentane	23,33,43	23,33,43	23,33,43		33
trans-1,3-Dimethylcyclopentane	7,11,19,24, 29,30,32	7,11,24,29, 32	7,11,29,30, 32	7,24,29	7,32,33

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American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 7a, 7a-E and 7b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Cyclohexane	3,4,6,9,11,12,13	1,4,5,6,9,10,12,13,14,15	1,4,5,6,7,9,14,15,16	2,4,6,9,10,14,17,29	5,6,26,28
Methylcyclohexane	3,4,6,9,13,18,30	1,4,5,6,9,10,13,14,18,19,31	1,4,5,6,7,9,14,16,19,30	2,4,6,32	5,6,19,26,28
Ethylcyclohexane	3,4,9,13,20,21	1,4,5,9,13,21	1,4,5,7,9	2,20,21,33	5,28
1,1-Dimethylcyclohexane	8,21,22,23,24,25,28	8,21,22,23,24,25,28	8,22,23,25,28	8,21,23,25,33	8
cis-1,2-Dimethylcyclohexane	3,8,21,25	1,5,8,21	1,5,7,8	8,21,33	5,8,27,28
trans-1,2-Dimethylcyclohexane	3,8,21	1,5,8,21	1,5,7,8	8,21,33	5,8,27,28
cis-1,3-Dimethylcyclohexane	3,4,8,34	1,4,8,34	1,4,7,8,34	8,33,35	8,28
trans-1,3-Dimethylcyclohexane	3,8,34	1,8,34	1,7,8,34	8,33,35	8,28
cis-1,4-Dimethylcyclohexane	3,8	1,5,8,21	1,5,7,8	8,21,33	5,8,28
trans-1,4-Dimethylcyclohexane	3,8	1,5,8,21	1,5,7,8	8,21	5,8,28

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 8a (Part 1), 8a-E (Part 1), and 8b (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Ethene	4,10,11,12,49			10,11	
Propene	3,4,13,14,15, 49		1	13,16	
1-Butene	2,3,4,17,18,49		1,2	18	
cis-2-Butene	2,3,4,19,49,51		1,2	3,20,31,51	
trans-2-Butene	2,3,4,19,21,49		1,2	3,20,21,31	
2-Methylpropene	2,3,4,22,49		1,2	3,20,22,31,52	
1-Pentene	8,9,23,24,25, 26,27,28	9,24,28	8,24,28	9,54	50
cis-2-Pentene	5,6,7,8,28,29, 30,32	5,6,7,9,28,29, 30	5,6,7,8,29,30	5,7,9	30,50
trans-2-Pentene	5,6,7,8,9,28, 30,33,34,35	5,6,7,9,28,30, 33,34,35	6,7,8,28,30,34, 35	5,7,9,28	50
2-Methyl-1-butene	8,9,36,37,38, 39,53	9,36,37,38,39, 53	8,37,53	9,28,53	50
3-Methyl-1-butene	6,7,8,9,23, 40,41,42,43, 48	6,7,40,41,42, 43	6,7,8,41,43	9,31	43,50
2-Methyl-2-butene	4,6,7,8,9,28, 36,38,39,43, 44,45,46,47	6,7,9,28,36, 38,39,43,44, 45,46,47	6,7,8,28,47	7,9,28,31,36, 43	50

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American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 8a (Part 2), 8a-E (Part 2), and 8b (Part 2)

(Applicable as of the date of issue of the numerical value)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
1-Hexene	2,4,5,9,10,14, 20,21,22,23	2,4,9,10,14,21	2,4,5,9,10,14, 21,22	4,5,14,21	4,9,14,21,47
cis-2-Hexene	2,4,14,24,25	2,4,14,25	2,4,14,25	4,14,26	2,4,14,47
trans-2-Hexene	2,4,14,17,24	2,4,14,17	2,4,14,17	4,14,17	2,4,14,47
cis-3-Hexene	2,3,6,18,19,27	2,3,6,18,19,27	2,3,6,18,19,27	3,26	4,18,47
trans-3-Hexene	2,3,6,18,27	2,3,6,18,27	2,3,6,18,27	3	4,18,47
2-Methyl-1-pentene	1,2,10	1,2,10	1,2,10		47
3-Methyl-1-pentene	2,28,29	2,28,29	2,28,29		47
4-Methyl-1-pentene	2,16,17,22	2,16	2,16,22		2,16,47
2-Methyl-2-pentene	2,13,15,17,30, 31,32	2,13,15,30,31, 32	2,13,15,30,31, 32	13,30	2,15,47
cis(?)-3-Methyl-2-pentene	2,7,12,19,33, 34,35	2,7,33,34,35	2,7,34,35	7	2,47
trans(?)-3-Methyl-2-pentene	2,7,12,19,33, 34,35	2,7,33,34,35	2,7,34,35	7	2,47
cis(?)-4-Methyl-2-pentene	2,5,11,17,19, 23,30	2,23,30	2,23,30		47
trans(?)-4-Methyl-2-pentene	2,5,19	2	2		47
2-Ethyl-1-butene	1,2,9,10,35, 36	1,2,9,10,35, 36	1,2,9,10,35, 36		9,47
2,3-Dimethyl-1-butene	1,2,7,8,37,38, 39	1,2,7,8,37,38, 39	1,2,7,8,38	7,38	47
3,3-Dimethyl-1-butene	8,38,39,40,41, 42,43,46	8,38,39,40,41, 42,43,46	8,38,41,43	8,44,46	47
2,3-Dimethyl-2-butene	6,7,8,30,37, 38,39	6,7,8,30,37, 38,39	7,8,30,38	7,8,30,37,38, 45	38,47

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SPECIFIC REFERENCES

FOR TABLES 9a(Part 1), 9a-E(Part 1), and 9b(Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
1-Heptene	2,3,7,8,10,11, 12,13,14,15,17	2,3,7,8,10,11, 13,14,15	2,7,8,11,13, 14,15	7,8,10,16	7,8,13
cis-2-Heptene	1,2,3,4	1,2,3,4	1,2,4		27
trans-2-Heptene	1,2,3,4	1,2,3,4	1,2,4		27
cis-3-Heptene trans-3-Heptene	1,2,5,6,9,18, 19	1,2,5,6,9,18, 19	1,2,5,6,9,18, 19		27
2-Methyl-1-hexene	1,2	1,2	1,2		27
3-Methyl-1-hexene	1,2	1,2	1,2		27
4-Methyl-1-hexene	1,2	1,2	1,2		27
5-Methyl-1-hexene	2,17,20,21	1,2,17,21	2,17,20,21		27
2-Methyl-2-hexene	2,5,22,23	2,5,23	2,5,23		27
cis-3-Methyl-2-hexene	1,2,24,25	1,2,24,25	1,2,25		27
trans-3-Methyl-2-hexene	1,2,24,25	1,2,24,25	1,2,25		27
cis-4-Methyl-2-hexene	1,2	1,2	1,2		27
trans-4-Methyl-2-hexene	1,2	1,2	1,2		27
cis-5-Methyl-2-hexene	1,2,5	1,2,5	1,2,5		27
trans-5-Methyl-2-hexene	1,2,5	1,2,5	1,2,5		27
cis-2-Methyl-3-hexene trans-2-Methyl-3-hexene	1,2	1,2	1,2		27
cis-3-Methyl-3-hexene trans-3-Methyl-3-hexene	1,22,26	1	1		27

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American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES
FOR TABLES 9a(Part 2), 9a-E(Part 2), and 9b (Part 2)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
2-Ethyl-1-pentene	1,2	1,2	1,2		23
3-Ethyl-1-pentene	1,7	1,7	1,7		23
2,3-Dimethyl-1-pentene	1,2	1,2	1,2		23
2,4-Dimethyl-1-pentene	1,2	1,2	1,2		23
3,3-Dimethyl-1-pentene	1,3,8	1,3,8	1,3,8		23
3,4-Dimethyl-1-pentene	1	1	1		23
4,4-Dimethyl-1-pentene	6,9,10,11	6,9,10,11	6,9,11	6,10	23
3-Ethyl-2-pentene	2,4,12,13,14	2,4,12,14	2,4,12		2,23
2,3-Dimethyl-2-pentene	4,5,13,15	4,5,15	4,5,15	5	23
2,4-Dimethyl-2-pentene	13,14,16,17, 18,19	16,17,18,19	16,17,18,19		17,18,23
cis-3,4-Dimethyl-2-pentene	1,2,4	1,2,4	1,2,4		23
trans-3,4-Dimethyl-2-pentene					23
cis-4,4-Dimethyl-2-pentene	1,3	1,3	1,3		23
trans-4,4-Dimethyl-2-pentene					23
3-Methyl-2-ethyl-1-butene	1,2	1,2	1,2		23
2,3,3-Trimethyl-1-butene	5,6,20,21,22	5,6,20,21,22	6,20,21,22	6,20,21	21,23

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SPECIFIC REFERENCES

FOR TABLES 10a (Part 1), 10a-E (Part 1), and 10b (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
1-Octene	2,3,6,7,8,9,11, 12,13,14	2,3,6,7,8,9,11, 12,13,14	2,3,6,7,8,9,11, 12,13,14	2,6,7,9	6,13,14,26
cis-2-Octene	2,3,4,6,7,8,11, 15	2,3,4,6,7,8,11, 15	2,3,4,6,7,8,11, 15	2,6,7	6,26
trans-2-Octene	2,3,4,6,7,8,9, 11	2,3,4,6,7,8,9, 11	2,3,4,6,7,8,9, 11	2,6,7,9	6,26
cis-3-Octene	2,5,8,16,17	2,5,8,16,17	2,5,8,16,17		6,16,26
trans-3-Octene	2,5,8,9,16,17, 18,25	2,5,8,9,16,17, 18,25	2,5,8,9,16,17, 18,25	2,5,18,25	6,16,26
cis-4-Octene	2,5,8,19,20	2,5,8,19,20	2,5,8,19,20	2,5,19,20	6,26
trans-4-Octene	2,4,5,8,9,18, 20,25	2,4,5,8,9,18, 20,25	2,4,5,8,9,18, 20,25	2,5,9,18,20, 25	6,26
2-Methyl-1-heptene	7,8,10,21	7,8,10,21	7,8,10	7,10	26
3-Methyl-1-heptene	1,4	1,4	1,4		26
4-Methyl-1-heptene	1,3	1,3	1,3		26
5-Methyl-1-heptene	1,3	1,3	1,3		26
6-Methyl-1-heptene	3,7,10,22	3,7,10,22	3,7,10,22		26
2-Methyl-2-heptene	17,21,23,24	17,21,23,24	17,23,24		26

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American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 10a (Part 2), 10a-E (Part 2), and 10b (Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
cis-3-Methyl-2-heptene	1,2,3,4	1,2,3,4	1,2,4		14
trans-3-Methyl-2-heptene . . .					
cis-4-Methyl-2-heptene	1,5,6,7,9	1,5,6,7,9	1,5,6,7		14
trans-4-Methyl-2-heptene . . .					
cis-5-Methyl-2-heptene	1	1	1		14
trans-5-Methyl-2-heptene . . .					
cis-6-Methyl-2-heptene	1,5,13	1,5,13	1,5,13		14
trans-6-Methyl-2-heptene . . .					
cis-2-Methyl-3-heptene	1,8	1,8	1,8		14
trans-2-Methyl-3-heptene . . .					
cis-3-Methyl-3-heptene	1,10,11	1,10,11	1,10,11		14
trans-3-Methyl-3-heptene . . .					
cis-4-Methyl-3-heptene	1	1	1		14
trans-4-Methyl-3-heptene . . .					
cis-5-Methyl-3-heptene	1,8	1,8	1,8		14
trans-5-Methyl-3-heptene . . .					
cis-6-Methyl-3-heptene	1,8,12	1,8,12	1,8,12		14
trans-6-Methyl-3-heptene . . .					

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 10a (Part 3), 10a-E (Part 3), and 10b (Part 3)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
2-Ethyl-1-hexene	1,2,3	1,2,3	1,2,3		3,16,17
3-Ethyl-1-hexene	1,2	1,2	1,2		17
4-Ethyl-1-hexene	1	1	1		17
2,3-Dimethyl-1-hexene	1,4,5,15	1,4,5,15	1,4,5,15		17
2,4-Dimethyl-1-hexene	1,4	1,4	1,4		17
2,5-Dimethyl-1-hexene	1,4	1,4	1,4		17
3,3-Dimethyl-1-hexene	1,5,6	1,5,6	1,5,6		17
3,4-Dimethyl-1-hexene	1,7	1,7	1,7		17
3,5-Dimethyl-1-hexene	1,7	1,7	1,7		17
4,4-Dimethyl-1-hexene	1,7	1,7	1,7		17
4,5-Dimethyl-1-hexene	1,5	1,5	1,5		17
5,5-Dimethyl-1-hexene	1,6	1,6	1,6		17
cis-3-Ethyl-2-hexene trans-3-Ethyl-2-hexene	1,8	1,8	1,8		17
cis-4-Ethyl-2-hexene trans-4-Ethyl-2-hexene	1,7	1,7	1,7		17
2,3-Dimethyl-2-hexene	1,5,9,10,11,12	1,5,9,10,11,12	1,5,9,11,12	9	17
2,4-Dimethyl-2-hexene	1,5,10,13	1,5,10	1,5,10		17
2,5-Dimethyl-2-hexene	1,6,8,14	1,6,8,14	1,6,8,14		17

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American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 10a (Part 4), 10a-E (Part 4), and 10b (Part 4)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
cis-3,4-Dimethyl-2-hexene. . .	1,2	1,2	1,2		9
trans-3,4-Dimethyl-2-hexene. .					
cis-3,5-Dimethyl-2-hexene. . .	1,2,3,4	1,2,3,4	1,3,4		9
trans-3,5-Dimethyl-2-hexene. .					
cis-4,4-Dimethyl-2-hexene. . .	1,5	1,5	1,5		9
trans-4,4-Dimethyl-2-hexene. .					
cis-4,5-Dimethyl-2-hexene. . .	1,6	1,6	1,6		9
trans-4,5-Dimethyl-2-hexene. .					
cis-5,5-Dimethyl-2-hexene. . .	1	1	1		9
trans-5,5-Dimethyl-2-hexene. .					
3-Ethyl-3-hexene	1	1	1		9
cis-2,2-Dimethyl-3-hexene. . .	1,5,7	1,5,7	1,5,7		9
trans-2,2-Dimethyl-3-hexene. .					9
cis-2,3-Dimethyl-3-hexene. . .	1	1	1		9
trans-2,3-Dimethyl-3-hexene. .					
cis-2,4-Dimethyl-3-hexene. . .	1	1	1		9
trans-2,4-Dimethyl-3-hexene. .					
cis-2,5-Dimethyl-3-hexene. . .	1,8	1,8	1,8		9
trans-2,5-Dimethyl-3-hexene. .					
cis-3,4-Dimethyl-3-hexene. . .	1	1	1		9
trans-3,4-Dimethyl-3-hexene. .					

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American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

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(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
2-n-Propyl-1-pentene	1,2	1,2	1,2		22
2-Isopropyl-1-pentene	1,2	1,2	1,2		22
3-Methyl-2-ethyl-1-pentene	1,2	1,2	1,2		22
4-Methyl-2-ethyl-1-pentene	1,2,3	1,2,3	1,2,3		22
2-Methyl-3-ethyl-1-pentene	1,2	1,2	1,2		22
3-Methyl-3-ethyl-1-pentene	1,4	1,4	1,4		22
4-Methyl-3-ethyl-1-pentene	1	1	1		22
2,3,3-Trimethyl-1-petnene	1,2,5,7,10	1,2,5,7,10	1,2,5,7,10	10	22
2,3,4-Trimethyl-1-pentene	1,2	1,2	1,2		22
2,4,4-Trimethyl-1-pentene	8,9,11,12,13	8,9,11,12,13	8,9	8,9,14	22
3,3,4-Trimethyl-1-pentene	1,15	1,15	1,15		22
3,4,4-Trimethyl-1-pentene	1,16	1,16	1,16		22
2-Methyl-3-ethyl-2-pentene	1,4,17	1,4,17	1,4,17		22
cis-4-Methyl-3-ethyl-2-pentene	1,4	1,4	1,4		22
trans-4-Methyl-3-ethyl-2-pentene					
2,3,4-Trimethyl-2-pentene	6,9,18	6,9,18	9,18		22
2,4,4-Trimethyl-2-pentene	8,9,11,13,19,20	8,9,11,13,19,20.	8,9,19,20	8,9,14	20,22
cis-3,4,4-Trimethyl-2-pentene	5,7,9,19	5,7,9,19	7,9,19		22
trans-3,4,4-Trimethyl-2-pentene					
3-Methyl-2-isopropyl-1-butene	1,2,6,18	1,2,6,18	1,2,18		22
3,3-Dimethyl-2-ethyl-1-butene	1,21	1	1		22

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES
FOR TABLES 11a (Part 1), 11a-E (Part 1), and 11b (Part 1)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Propadiene	1,2,3,4			1,4	
1,2-Butadiene	5		5,33	6	
1,3-Butadiene	1,2,7,10,11		7,10,12,18	1,6;10,13	
1,2-Pentadiene	14,33	14,33	14,33		14
cis-1,3-Pentadiene	8,9,15,16,17, 19	8,9,15,16,19, 20	8,9,16,19,20		9,33
trans-1,3-Pentadiene	8,9,15,16	8,9,15,16,20	8,9,16,20	15	9,33
1,4-Pentadiene	1,2,21,22,23	21,22	21,22,23	1,24	
2,3-Pentadiene	33	33	33		
3-Methyl-1,2-butadiene	25	25,33	25,33		25
2-Methyl-1,3-butadiene	9,26,27,28,29	9,26,29,30,31	9,26,29,31	6,26,29	9,26,29,31

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES
FOR TABLES 11a (Part 2), 11a-E (Part 2), and 11b (Part 2)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
1,2-Hexadiene	1	1	1		1
cis-1,3-Hexadiene	2,3,4	2,3,4	2,3,4		2,26
trans-1,3-Hexadiene	2,3,4	2,3,4	2,3,4		2,26
cis-1,4-Hexadiene	4,5	4,5	4,5		
trans-1,4-Hexadiene	4,5	4,5	4,5		
1,5-Hexadiene	6,7,8,9,10	7,9	7,9,10	6,7	
2,3-Hexadiene	11	11	11		11
cis,cis-2,4-Hexadiene	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17		13,14,26
cis,trans-2-4-Hexadiene	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17		13,14,26
trans,trans-2,4-Hexadiene	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17	3,4,12,13,14, 15,16,17		13,14,26
3-Methyl-1,2-pentadiene	26	26	26		
4-Methyl-1,2-pentadiene	1	1	1		1
cis-2-Methyl-1,3-pentadiene	2,12,13,14	2,12,13,14	2,12,13,14		2,13,14,26
trans-2-Methyl-1,3-pentadiene	2,12,13,14	2,12,13,14	2,12,13,14		2,13,14,26
cis-3-Methyl-1,3-pentadiene	12,13,18	12,13,18	12,13		13,26
trans-3-Methyl-1,3-pentadiene	12,13,18	12,13,18	12,13		13,26
4-Methyl-1,3-pentadiene	12,13,19,20	12,13,19,20	12,13,19,20		13,26
2-Methyl-1,4-pentadiene	19	19,26	19,26		
3-Methyl-1,4-pentadiene	26	26	26		
2-Methyl-2,3-pentadiene	26	26	26		
2-Ethyl-1,3-butadiene	21,26	26	26		26
2,3-Dimethyl-1,3-butadiene	8,12,13,14, 22,23,24,25	12,13,14,22,25	12,13,14,25	14,22	13,14,26

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SPECIFIC REFERENCES

FOR TABLES 12a, 12a-E, and 12b

(Applicable as of the date of issue of the numerical table)

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Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Ethyne	1,3			1,4	
Propyne	1,5,7,8,9,10, 11,12			1,5,6,8	
1-Butyne	1,11,12,13,14, 15		1,15	1,6,14,15	
2-Butyne	2,5,6,10,16,17	16	2,16	2,6,16,18	
1-Pentyne	2,11,19,20,21, 22	11,19,22	2,11,19,20,22	2,20,22	
2-Pentyne	6,22,23,24	6,22,23,24	6,22,23,24	6,23	23
3-Methyl-1-butyne	26	26	26		

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SPECIFIC REFERENCES

FOR TABLES 13a, 13a-E, and 13b

(Applicable as of the date of issue of the numerical table)

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Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
Styrene	1,2,3,4,5	1,2,3,5,6	1,2,3,5,7	6,8,9	2,17
α-Methylstyrene	2,10,11,12,13	2,11,12,13	2,11,12,13	13	2
cis-β-Methylstyrene	2,14,15,16	2,14,16	2,14,16		2
trans-β-Methylstyrene					

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SPECIFIC REFERENCES

FOR TABLES 14a, 14a-E, and 14b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Butylbenzene	1,2,3,4,5,7	1,2,3,4,5,8,10, 11,12	2,3,4,11,12,13	1,2,3,6,7	50
Isobutylbenzene.	1,2,3,4,5,8,14, 15,51	1,2,4,5,8,10,11 14,16,51	2,4,11,14,15,51	1,2,6,51	50
sec-Butylbenzene	1,2,3,4,5,17,18, 19,51	1,2,4,5,10,11, 17,19,51	2,4,11,17,51	1,2,6,18,51	50
tert-Butylbenzene.	2,3,4,5,8,17,19, 20,21,22,23,24, 25,26,51	1,2,4,5,8,10,11, 16,17,19,20,24, 25,51	2,4,11,17,20, 21,22,24,25,51	1,2,6,22,51	50
1-Methyl-2-propylbenzene . .	9	27,28	9,28		9,50
1-Methyl-3-propylbenzene . .	9	27	9		9,27,50
1-Methyl-4-propylbenzene . .	3,29	3,27,29	3,9,29	3,29	9,27,50
1-Methyl-2-isopropylbenzene.	2,9,30	2,9,30	2,9,30	2	9,50
1-Methyl-3-isopropylbenzene.	2,8,9,31,32	2,8,9,31,32	2,9,31,32	2	9,50
1-Methyl-4-ispopropylbenzene.	2,3,7,9,19,26, 32,33,34,35,36, 37,38,51	2,9,14,19,26,27, 32,33,34,36,38, 39,51	2,9,14,26,32, 33,34,36,51	2,7,32,51	9,50
1,2-Diethylbenzene	2,3,40,52,54	2,3,40,52	2,3,40,52	2,52	50
1,3-Diethylbenzene	2,3,41,42,53,54	2,3,4,41,42,53	2,3,41,42,53	2,3,53	50
1,4-Diethylbenzene	2,3,52,54	2,3,52	2,3,52	2,3	9,50
1,2-Dimethyl-3-ethylbenzene.	2,3,4	2,3,4	2,3,4	2,3	50
1,2-Dimethyl-4-ethylbenzene.	2,4,43	2,4	2,4,43	2	50
1,3-Dimethyl-2-ethylbenzene.	2,4	2,4,44	2,4	2	50
1,3-Dimethyl-4-ethylbenzene.	2,4	2,4,44	2,4	2	50
1,3-Dimethyl-5-ethylbenzene.	2,4	2,4	2,4	2	50
1,4-Dimethyl-2-ethylbenzene.	2,4	2,4,44	2,4	2	50
1,2,3,4-Tetramethylbenzene .	45,46	38,44,46,47	46	7,46,48	9,50
1,2,3,5-Tetramethylbenzene .	3,45,54	3,38,47	3	3,7.47,48	50
1,2,4,5-Tetramethylbenzene .	45	50	50	38,48,49	50

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SPECIFIC REFERENCES

FOR TABLES 14a, 14a-E, and 14b (Continued)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

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SPECIFIC REFERENCES

FOR TABLES 15a, 15a-E, and 15-b

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR				
	Boiling Point	Refractive Index	Density	Freezing Point	Refractive Dispersion
n-Propylcyclopentane	1,4,5,6,8,10, 11,12,15	1,3,4,5,6,8,11, 12,13,15	3,4,5,6,8,11, 12,13,14,15	1,3,4,6,16	1
Isopropylcyclopentane.	1,4,5,6,8,10,17	1,3,5,6,8,13,17	3,5,6,8,13,14, 17	1,3,4,6	13
1-Methyl-1-ethylcyclopentane..	2,24	2,7,24	2	7	2
cis-1-Methyl-2-ethylcyclopentane.	2,9,24	7,9,24	2,9	7,9	2,9
trans-1-Methyl-2-ethylcyclopentane.	7,9,24	7,9,24	2,9	9	
cis-1-Methyl-3-ethylcyclopentane.	2,18,19,24	7,18,24	2,18		
trans-1-Methyl-3-ethylcyclopentane.	7,24	7,24	2	7	
1,1,2-Trimethylcyclopentane. .	1,2,5,19,20,24	1,2,5,19,20,24	2,5,20	1,5	
1,1,3-Trimethylcyclopentane. .	1,2,4,5,21,22	1,2,4,5,21,22	2,4,5,21,22	1	
cis,cis,cis-1,2,3-Trimethylcyclopentane.	7,19,24	7,19,24	2,19	7	
cis,cis,trans-1,2,3-Trimethylcyclopentane.	7,24	7,24	2	7	
cis,trans,cis-1,2,3-Trimethylcyclopentane.	2,24	7,24	2	7	
cis,cis,cis-1,2,4-Trimethylcyclopentane.	23	23	23		
cis,cis,trans-1,2,4-Trimethylcyclopentane.	1,2,24	1,2,24	2	1	
cis,trans,cis-1,2,4-Trimethylcyclopentane.	1,2,24	1,2,24	2	1	

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 20c, 20c-E, and 20c-K

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Viscosity	Compound	REFERENCES FOR Viscosity
Methane	1,6,8,10,11	n-Undecane	1,4,15,17
Ethane	1,6,7,8	n-Dodecane	1,4,17,21,22
Propane	1,6,7,9	n-Tridecane	1,15,21
n-Butane	1,9	n-Tetradecane	1,21,23
n-Pentane	1,2,3,4,5,12	n-Pentadecane	1,21
n-Hexane	1,2,3,4,12,13,19,20	n-Hexadecane	1,21,22,23
n-Heptane	1,2,3,4,5,12,16,18	n-Heptadecane	1,15,21,24
n-Octane	1,2,3,4,13,14,15	n-Octadecane	1,21,23,25
n-Nonane	1,4,17	n-Nonadecane	1
n-Decane	1,4,17	n-Eicosane	1,21

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17. Bingham and Fornwalt[1]
18. Lewis[1]
19. Andrade and Rotherham[1]
20. Drapier[1]
21. American Petroleum Institute Research Project 42[1]
22. Evans[1]
23. Engler-Höfer[1]
24. Karrer and Ferri[1]
25. Dover and Hensley[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 1k

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
Methane	1,2,3	2-Methylpropane	1,8
Ethane	1,4	n-Pentane	9,12
Propane	1,5	2-Methylbutane	9,10
n-Butane	1,7	2,2-Dimethylpropane	6,11

REFERENCES

1. Cragoe[2]
2. Freeth and Verschoyle[1]
3. Clusius and Weigand[1]
4. Loomis and Walters[1]
5. Kemp and Egan[1]
6. Aston and Messerly[1]
7. Aston and Messerly[2]
8. Aston, Kennedy, and Schumann[1]
9. Willingham, Taylor, Pignocco, and Rossini[1]
10. Schumann, Aston, and Sagenkahn[1]
11. Benoliel[1]
12. Messerly and Kennedy[1]

SPECIFIC REFERENCES

FOR TABLE 2k (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
n-Hexane	1	2,2-Dimethylbutane	1
2-Methylpentane	1	2,3-Dimethylbutane	1
3-Methylpentane	1		

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 2k (Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
n-Heptane	1,2,6	2,3-Dimethylpentane	3,6
2-Methylhexane	3,4,6	2,4-Dimethylpentane	3,4,6
3-Methylhexane	3,4,6	3,3-Dimethylpentane	1,6
3-Ethylpentane	3,5,6	2,2,3-Trimethylbutane	3,5,6
2,2-Dimethylpentane	1,6		

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]
2. Smith, E.R.[1]
3. American Petroleum Institute Research Project 44[1]
4. Calingaert and Thomson[1]
5. Smith, E.R.[2]
6. Calingaert[1]

SPECIFIC REFERENCES

FOR TABLE 3k

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
n-Octane	1	3,3-Dimethylhexane	1
2-Methylheptane	1	3,4-Dimethylhexane	1
3-Methylheptane	1	2-Methyl-3-ethylpentane	1
4-Methylheptane	1	3-Methyl-3-ethylpentane	1
3-Ethylhexane	1	2,2,3-Trimethylpentane	1
2,2-Dimethylhexane	1	2,2,4-Trimethylpentane	1,2
2,3-Dimethylhexane	1	2,3,3-Trimethylpentane	1
2,4-Dimethylhexane	1	2,3,4-Trimethylpentane	1
2,5-Dimethylhexane	1	2,2,3,3-Tetramethylbutane	3

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]
2. Smith, E.R.[1]
3. Calingaert, Soroos, Hnizda, and Shapiro[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 5k

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
Benzene	1,2,3,4,5,6,7,8,9,10	Isopropylbenzene	1,13
Methylbenzene	1,2,3	1-Methyl-2-ethylbenzene	14
Ethylbenzene	1,5,11	1-Methyl-3-ethylbenzene	14
1,2-Dimethylbenzene	1,2,5,12	1-Methyl-4-ethylbenzene	14
1,3-Dimethylbenzene	1,2,12	1,2,3-Trimethylbenzene	14,15
1,4-Dimethylbenzene	1,2,12	1,2,4-Trimethylbenzene	14,16
n-Propylbenzene	1	1,3,5-Trimethylbenzene	12,14

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]
2. Pitzer and Scott[1]
3. Thomson[1]
4. Smith, E.R.[2]
5. Stuckey and Saylor[1]
6. Stull[1]
7. International Critical Tables[1]
8. Huffman, Parks, and Daniels[1]
9. Fiock, Ginnings, and Holton[1]
10. Osborne and Ginnings[1]
11. Guttman, Westrum, and Pitzer[1]
12. Kassel[4]
13. Kobe, Okabe, Ramstad, and Huemmer[1]
14. American Petroleum Institute Research Project 44[1]
15. Smith and Spillane[1]
16. Smith and Lund[1]

SPECIFIC REFERENCES

FOR TABLE 6k

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
Cyclopentane	1,2	Ethylcyclopentane	4
Methylcyclopentane	1,3		

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]
2. Aston, Fink, and Schumann[1]
3. Schmitt[1]
4. American Petroleum Institute Research Project 44[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 7k

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
Cyclohexane	1,2,3,4	trans-1,2-Dimethylcyclohexane	1
Methylcyclohexane	1,6	cis-1,3-Dimethylcyclohexane	1
Ethylcyclohexane	1	trans-1,3-Dimethylcyclohexane	1
1,1-Dimethylcyclohexane	5,7	cis-1,4-Dimethylcyclohexane	1
cis-1,2-Dimethylcyclohexane	1	trans-1,4-Dimethylcyclohexane	1

REFERENCES

1. Willingham, Taylor, Pignocco, and Rossini[1]
2. Scatchard, Wood, and Mochel[1]
3. Aston, Szasz, and Fink[1]
4. International Critical Tables[1]
5. American Petroleum Institute Research Project 44[1]
6. Stuckey and Saylor[1]
7. Forziati and Rossini[1]

SPECIFIC REFERENCES

FOR TABLE 8k (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Vapor Pressures and Boiling Points	Compound	REFERENCES FOR Vapor Pressures and Boiling Points
Ethene	1,2,3	cis-2-Butene	1,5,7
Propene	1,4,5	trans-2-Butene	1,5,7,8
1-Butene	1,5,6	2-Methylpropene	1,5

REFERENCES

1. Cragoe[2]
2. Egan and Kemp[1]
3. Henning and Stock[1]
4. Powell and Giauque[1]
5. Lamb and Roper[1]
6. Benoliel[1]
7. Kistiakowsky, Ruhoff, Smith, and Vaughan[1]
8. Guttman and Pitzer[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 1m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
Methane	1,2	2-Methylpropane	6,13,14
Ethane	3	n-Pentane	7,8,9,10,13
Propane	4,13,14	2-Methylbutane	11,13
n-Butane	5,13,14	2,2-Dimethylpropane	12,13

REFERENCES

1. Frank and Clusius[2]
2. Osborne and others[1]
3. Witt and Kemp[1]
4. Kemp and Egan[1]
5. Aston,and Messerly[2]
6. Aston, Kennedy, and Schumann[1]
7. Osborne and Ginnings[1]
8. Messerly and Kennedy[1]
9. Pitzer[5]
10. Sage, Evans, and Lacey[1]
11. Schumann, Aston, and Sagenkahn[1]
12. Aston and Messerly[1]
13. American Petroleum Institute Research Project 44[1]
14. Dana, Jenkins, Burdick, and Timm[1]

SPECIFIC REFERENCES

FOR TABLE 2m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
n-Hexane	1,2,3,4,9	3-Methylhexane	9
2-Methylpentane	1,3,5,9	3-Ethylpentane	1,9
3-Methylpentane	1,5,9	2,2-Dimethylpentane	1,9
2,2-Dimethylbutane	1,2,6,7,9	2,3-Dimethylpentane	1,9
2,3-Dimethylbutane	1,3,5,9	2,4-Dimethylpentane	1,9
n-Heptane	1,8,9,10	3,3-Dimethylpentane	1,9
2-Methylhexane	9	2,2,3-Trimethylbutane	1,9,10

REFERENCES

1. Osborne and Ginnings[1]
2. Waddington and Douslin[1]
3. Lemons and Felsing[1]
4. Mathews[1]
5. Huffman and others[1]
6. Pitzer[5]
7. Kilpatrick and Pitzer[1]
8. Pitzer[4]
9. American Petroleum Institute Research Project 44[1]
10. Waddington, Todd, and Huffman[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 3m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
n-Octane	1,5	3,3-Dimethylhexane	1,5
2-Methylheptane.	1,5	3,4-Dimethylhexane	1,5
3-Methylheptane.	1,5	2-Methyl-3-ethylpentane. .	1,5
4-Methylheptane.	1,2,5	3-Methyl-3-ethylpentane. .	1,5
3-Ethylhexane.	1,5	2,2,3-Trimethylpentane . .	1,5
2,2-Dimethylhexane	1,5	2,2,4-Trimethylpentane . .	1,3,5
2,3-Dimethylhexane	1,5	2,3,3-Trimethylpentane . .	1,5
2,4-Dimethylhexane	1,5	2,3,4-Trimethylpentane . .	1,4,5
2,5-Dimethylhexane	1,5	2,2,3,3-Tetramethylbutane.	5

REFERENCES

1. Osborne and Ginnings[1]
2. Mathews[1]
3. Pitzer[4]
4. Pitzer and Scott[1]
5. American Petroleum Institute Research Project 44[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 4m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
n-Nonane	1,2	3-Methyl-4-ethylhexane	2
2-Methyloctane	2	2,2,3-Trimethylhexane	2
3-Methyloctane	2	2,2,4-Trimethylhexane	2
4-Methyloctane	2	2,2,5-Trimethylhexane	1,2
3-Ethylheptane	2	2,3,3-Trimethylhexane	2
4-Ethylheptane	2	2,3,4-Trimethylhexane	2
2,2-Dimethylheptane	2	2,3,5-Trimethylhexane	1,2
2,3-Dimethylheptane	2	2,4,4-Trimethylhexane	2
2,4-Dimethylheptane	2	3,3,4-Trimethylhexane	2
2,5-Dimethylheptane	2	3,3-Diethylpentane	2
2,6-Dimethylheptane	2	2,2-Dimethyl-3-ethylpentane	2
3,3-Dimethylheptane	2	2,3-Dimethyl-3-ethylpentane	2
3,4-Dimethylheptane	2	2,4-Dimethyl-3-ethylpentane	2
3,5-Dimethylheptane	2	2,2,3,3-Tetramethylpentane	2
4,4-Dimethylheptane	2	2,2,3,4-Tetramethylpentane	2
2-Methyl-3-ethylhexane	2	2,2,4,4-Tetramethylpentane	2
2-Methyl-4-ethylhexane	2	2,3,3,4-Tetramethylpentane	2
3-Methyl-3-ethylhexane	2		

REFERENCES

1. Osborne and Ginnings[1]
2. American Petroleum Institute Research Project 44[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 5m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
Benzene	1,2,3,4,5,8	Isopropylbenzene	1,8
Methylbenzene	1,4,5,8	1-Methyl-2-ethylbenzene	8
Ethylbenzene	1,4,6,8	1-Methyl-3-ethylbenzene	8
1,2-Dimethylbenzene	1,4,7,8	1-Methyl-4-ethylbenzene	8
1,3-Dimethylbenzene	1,4,7,8	1,2,3-Trimethylbenzene	1,8
1,4-Dimethylbenzene	1,4,7,8	1,2,4-Trimethylbenzene	1,8
n-Propylbenzene	1,8	1,3,5-Trimethylbenzene	1,8

REFERENCES

1. Osborne and Ginnings[1]
2. Waddington and Douslin[1]
3. Fiock, Ginnings, and Holton[1]
4. Mathews[1]
5. Kolossovsky and Theodorowitsch[1]
6. Scott and Brickwedde[1]
7. Pitzer and Scott[2]
8. American Petroleum Institute Research Project 44[1]

SPECIFIC REFERENCES

FOR TABLE 6m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
Cyclopentane	1,2,3,5	cis-1,2-Dimethylcyclopentane	5
Methylcyclopentane	4,5	trans-1,2-Dimethylcyclopentane	5
Ethylcyclopentane	5	cis-1,3-Dimethylcyclopentane	
1,1-Dimethylcyclopentane	5	trans-1,3-Dimethylcyclopentane	5

REFERENCES

1. Aston, Fink, and Schumann[1]
2. Spitzer and Pitzer[1]
3. Huffman and others[1]
4. Osborne and Ginnings[1]
5. American Petroleum Institute Research Project 44[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 7m

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
Cyclohexane	1,2,3,4,5	trans-1,2-Dimethylcyclohexane	1,5
Methylcyclohexane	1,2,4,5	cis-1,3-Dimethylcyclohexane	1,5
Ethylcyclohexane	1,5	trans-1,3-Dimethylcyclohexane	1,5
1,1-Dimethylcyclohexane	5	cis-1,4-Dimethylcyclohexane	1,5
cis-1,2-Dimethylcyclohexane	1,5	trans-1,4-Dimethylcyclohexane	1,5

REFERENCES

1. Osborne and Ginnings[1]
2. Spitzer and Pitzer[1]
3. Aston, Szasz, and Fink[1]
4. Mathews[1]
5. American Petroleum Institute Research Project 44[1]

SPECIFIC REFERENCES

FOR TABLE 8m (Part 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR Heat of Vaporization	Compound	REFERENCES FOR Heat of Vaporization
Ethene	1	cis-2-Butene	4,7
Propene	2	trans-2-Butene	5,7
1-Butene	3,7	2-Methylpropene	6,7

REFERENCES

1. Egan and Kemp[1]
2. Powell and Giauque[1]
3. Aston, Fink, Bestul, Pace, and Szasz[1]
4. Scott, Ferguson, and Brickwedde[1]
5. Guttman and Pitzer[1]
6. Rands, Scott, and Brickwedde[1]
7. American Petroleum Institute Research Project[44]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES FOR THE "n" TABLES

(Applicable as of the date of issue of the numerical table)

May 31, 1947

The values of the heats of combustion, $-\Delta Hc^{o}$, at 25°C, in the n tables are calculated from the selected values of the standard heats of formation, ΔHf^{o}, at 25°C, for the hydrocarbons and for carbon dioxide (CO_2) and water (H_2O), as given in the p tables. The specific references for the p tables are given in the appropriate place in this section. The specific references for those n tables for which the corresponding p tables have not yet been issued are as follows: Table 9n, Prosen and Rossini[10]; Tables 22n and 23n, Prosen, Johnson, and Rossini[2].

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE Op

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	Formula	REFERENCES FOR		
		Heat of Formation	Entropy	Free Energy of Formation
		At 25°C		
Oxygen	O_2	3	1	2
Hydrogen	H_2	3	1	2
Water	H_2O	3,6	1,6	2,6
Nitrogen	N_2	3	1	2
Carbon (graphite)	C	3,4,5	1	2
Carbon Monoxide	CO	3,6	1,6	2,6
Carbon dioxide	CO_2	3,4,5,6	1,6	2,6

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Wagman, Kilpatrick, Taylor, Pitzer, and Rossini[1]
4. Prosen, Jessup, and Rossini[1]
5. Prosen and Rossini[5]
6. National Bureau of Standards[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 1p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Methane	3,4,5,6,15	1	2
Ethane	3,4,5,6,15	1	2
Propane	3,4,5,6,15	1	2
n-Butane	3,4,5,6,15	1	2
2-Methylpropane	3,4,5,6,9,10,11,12	1	2
n-Pentane	3,4,5,6,8,15	1	2
2-Methylbutane	3,4,5,6,7,13,14	1	2
2,2-Dimethylpropane	3,4,5,6,7,9,10,11,12	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Rossini[4]
4. Rossini[8]
5. Rossini[18]
6. Rossini[21]
7. Knowlton and Rossini[1]
8. Prosen and Rossini[4]
9. Thomsen[1]
10. Thomsen[2]
11. Thomsen[3]
12. Thomsen[4]
13. Roth and Macheleidt[1]
14. Roth and Pahlke[1]
15. Prosen and Rossini[8]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 2p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
n-Hexane	3,5,6,10,11,13	1	2
2-Methylpentane	3	1	2
3-Methylpentane	3	1	2
2,2-Dimethylbutane	3	1	2
2,3-Dimethylbutane	3,4,12	1	2
n-Heptane	4,5,6,7,8,9,13	1	2
2-Methylhexane	4,7,8	1	2
3-Methylhexane	4,7,8	1	2
3-Ethylpentane	4,7,8	1	2
2,2-Dimethylpentane	4,7,8	1	2
2,3-Dimethylpentane	4,7,8	1	2
2,4-Dimenthylpentane	4,7,8	1	2
3,3-Dimethylpentane	4,7,8	1	2
2,2,3-Trimethylbutane	4,7,8	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen and Rossini[2]
4. Prosen and Rossini[3]
5. Prosen and Rossini[4]
6. Jessup[1]
7. Jessup[4]
8. Davies and Gilbert[1]
9. Louguinine[1]
10. Stohmann, Kleber, and Langbein[3]
11. Zubow[1]
12. Thomsen[4]
13. Prosen and Rossini[8]

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SPECIFIC REFERENCES

FOR TABLE 3p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
n-Octane	3,4,5,6,7,8,9	1	2
2-Methylheptane	5,7	1	2
3-Methylheptane	5	1	2
4-Methylheptane	5	1	2
3-Ethylhexane	5,7	1	2
2,2-Dimethylhexane	5	1	2
2,3-Dimethylhexane	5	1	2
2,4-Dimethylhexane	5	1	2
2,5-Dimethylhexane	5,7	1	2
3,3-Dimethylhexane	5	1	2
3,4-Dimethylhexane	5,7	1	2
2-Methyl-3-ethylpentane	5	1	2
3-Methyl-3-ethylpentane	5	1	2
2,2,3-Trimethylpentane	5	1	2
2,2,4-Trimethylpentane	5,8	1	2
2,3,3-Trimethylpentane	5	1	2
2,3,4-Trimethylpentane	5	1	2
2,2,3,3-Tetramethylbutane	5,8	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Jessup[1]
4. Prosen and Rossini[4]
5. Prosen and Rossini[7]
6. Zubow[1]
7. Richards and Jesse[1]
8. Jessup[4]
9. Banse and Parks[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 5p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Benzene	3,4,6,7,8,9,10,11,12,13,14,15,16	1	2
Methylbenzene	3,4,12,13,14,17,18,19	1	2
Ethylbenzene	3,4,13,20,21,22	1	2
1,2-Dimethylbenzene	3,4,13,17	1	2
1,3-Dimethylbenzene	3,4,11,12,17	1	2
1,4-Dimethylbenzene	3,4,11,17	1	2
n-Propylbenzene	3,4,5,13,23,24	1	2
Isopropylbenzene	3,5,13,23,24	1	2
1-Methyl-2-ethylbenzene	3,5	1	2
1-Methyl-3-ethylbenzene	3,5	1	2
1-Methyl-4-ethylbenzene	3,5	1	2
1,2,3-Trimethylbenzene	3,5	1	2
1,2,4-Trimethylbenzene	3,5,13	1	2
1,3,5-Trimethylbenzene	3,5,13,17	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen, Johnson, and Rossini[1]
4. Prosen, Gilmont, and Rossini[1]
5. Johnson, Prosen, and Rossini[1]
6. Berthelot[1]
7. Stohmann, Rodatz, and Herzberg[1]
8. Stohmann, Kleber, and Langbein[1]
9. Richards, Henderson, and Frevert[1]
10. Richards, Henderson, and Frevert[2]
11. Richards and Jesse[1]
12. Roth and von Auwers[1]
13. Richards and Barry[1]
14. Richards and Davis[2]
15. Berthelot[3]
16. Thomsen[4]
17. Stohmann, Rodatz, and Herzberg[2]
18. Schmidlin[1]
19. Richards and Davis[1]
20. Jesse[1]
21. Moureu and Andre´[1]
22. von Auwers and Kolligs[2]
23. Genvresse[1]
24. Huffman and others[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES
FOR TABLE 8p (Part 1)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Ethene	3,4,8,9,11,13,15	1	2
Propene	3,5,8,9,11,13	1	2
1-Butene	3,5	1	2
cis-2-Butene	3,5	1	2
trans-2-Butene	3,5	1	2
2-Methylpropene	3,5,10,11,12,13	1	2
1-Pentene	3	1	2
cis-2-Pentene	3	1	2
trans-2-Pentene	3	1	2
2-Methyl-1-butene	3,6	1	2
3-Methyl-1-butene	3,7	1	2
2-Methyl-2-butene	3,6,10,11,12,13,14	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen and Rossini[9]
4. Kistiakowsky, Romeyn, Ruhoff, Smith, and Vaughan[1]
5. Kistiakowsky, Ruhoff, Smith, and Vaughan[1]
6. Kistiakowsky, Ruhoff, Smith, and Vaughan[2]
7. Dolliver, Gresham, Kistiakowsky, and Vaughan[1]
8. Berthelot and Matignon[1]
9. Rossini and Knowlton[1]
10. Thomsen[1]
11. Thomsen[2]
12. Thomsen[3]
13. Thomsen[4]
14. Zubow[1]
15. Mixter[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES
FOR TABLE 8p (Part 2)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
1-Hexene	3	1	2
cis-2-Hexene	3	1	2
trans-2-Hexene	3	1	2
cis-3-Hexene	3	1	2
trans-3-Hexene	3	1	2
2-Methyl-1-pentene	3	1	2
3-Methyl-1-pentene	3	1	2
4-Methyl-1-pentene	3	1	2
2-Methyl-2-pentene	3	1	2
cis-3-Methyl-2-pentene	3	1	2
trans-3-Methyl-2-pentene	3	1	2
cis-4-Methyl-2-pentene	3	1	2
trans-4-Methyl-2-pentene	3	1	2
2-Ethyl-1-butene	3	1	2
2,3-Dimethyl-1-butene	3,4	1	2
3,3-Dimethyl-1-butene	3,4	1	2
2,3-Dimethyl-2-butene	3,4	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen and Rossini[9]
4. Kistiakowsky, Ruhoff, Smith, and Vaughan[2]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 12p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Ethyne	3,4,5,6,7,8,9,10,11	1	2
Propyne	3,11	1	2
1-Butyne	3,11	1	2
2-Butyne	3,11	1	2
1-Pentyne	3,11	1	2
2-Pentyne	3,11	1	2
3-Methyl-1-butyne	3,11	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen and Rossini[10]
4. Berthelot[2]
5. Thomsen[1]
6. Thomsen[2]
7. Thomsen[3]
8. Thomsen[4]
9. Berthelot and Matignon[1]
10. Mixter[2]
11. Wagman, Kilpatrick, Pitzer, and Rossini[1]

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 20p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Methane	3,4,5,6,8	1	2
Ethane	3,4,5,6,8	1	2
Propane	3,4,5,6,8	1	2
n-Butane	3,4,5,6,8	1	2
n-Pentane	3,4,5,6,7,8	1	2
n-Hexane	7,8,9,10,11,12	1	2
n-Heptane	7,8,9,13,14,15	1	2
n-Octane	7,8,9,12,13,16,17,18	1	2
n-Nonane	7,8,9	1	2
n-Decane	7,8,9	1	2
n-Undecane	8,9	1	2
n-Dodecane	7,8,9	1	2
n-Tridecane	8	1	2
n-Tetradecane	8	1	2
n-Pentadecane	8	1	2
n-Hexadecane	7,8,19	1	2
n-Heptadecane	8	1	2
n-Octadecane	8	1	2
n-Nonadecane	8	1	2
n-Eicosane	8	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Rossini[4]
4. Rossini[8]
5. Rossini[18]
6. Rossini[21]
7. Prosen and Rossini[4]
8. Prosen and Rossini[8]
9. Jessup[1]
10. Prosen and Rossini[2]
11. Stohmann, Kleber, and Langbein[3]
12. Zubow[1]
13. Jessup[4]
14. Davies and Gilbert[1]
15. Louguinine[1]
16. Prosen and Rossini[7]
17. Richards and Jesse[1]
18. Banse and Parks[1]
19. Richardson and Parks[1]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 21p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Benzene	3,4	1	2
Methylbenzene	3,4	1	2
Ethylbenzene	3,4	1	2
n-Propylbenzene	3,4	1	2
n-Butylbenzene	3	1	2
n-Amylbenzene	3	1	2
n-Hexylbenzene	3	1	2
n-Heptylbenzene	3	1	2
n-Octylbenzene	3	1	2
n-Nonylbenzene	3	1	2
n-Decylbenzene	3	1	2
n-Undecylbenzene	3	1	2
n-Dodecylbenzene	3	1	2
n-Tridecylbenzene	3	1	2
n-Tetradecylbenzene	3	1	2
n-Pentadecylbenzene	3	1	2
n-Hexadecylbenzene	3	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen, Johnson, and Rossini[1]
4. For additional references, see references for Table 5p.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 24p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Ethene	3,4	1	2
Propene	3,4	1	2
1-Butene	3,4	1	2
1-Pentene	3	1	2
1-Hexene	3	1	2
1-Heptene	3,5	1	2
1-Octene	3	1	2
1-Nonene	3	1	2
1-Decene	3	1	2
1-Undecene	3	1	2
1-Dodecene	3	1	2
1-Tridecene	3	1	2
1-Tetradecene	3	1	2
1-Pentadecene	3	1	2
1-Hexadecene	3	1	2
1-Heptadecene	3	1	2
1-Octadecene	3	1	2
1-Nonadecene	3	1	2
1-Eicosene	3	1	2

REFERENCES

1. See references given for the " t" table.
2. See references given for the " x" table.
3. Prosen and Rossini[9]
4. For additional references, see references for Table 8p (Part 1).
5. Kistiakowsky, Ruhoff, Smith, and Vaughan[2]

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLE 25p

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Heat of Formation	Entropy	Free Energy of Formation
	At 25°C		
Ethyne	3	1	2
Propyne	3	1	2
1-Butyne	3	1	2
1-Pentyne	3	1	2
1-Hexyne	3	1	2
1-Heptyne	3,4	1	2
1-Octyne	3	1	2
1-Nonyne	3	1	2
1-Decyne	3	1	2
1-Undecyne	3	1	2
1-Dodecyne	3	1	2
1-Tridecyne	3	1	2
1-Tetradecyne	3	1	2
1-Pentadecyne	3	1	2
1-Hexadecyne	3	1	2
1-Heptadecyne	3	1	2
1-Octadecyne	3	1	2
1-Nonadecyne	3	1	2
1-Eicosyne	3	1	2

REFERENCES

1. See references given for the "t" table.
2. See references given for the "x" table.
3. Prosen and Rossini[10]
4. Moureau and Andre[1]
5. For additional references, see references for Table 12p.

American Petroleum Institute Research Project 44

National Bureau of Standards Washington, D. C.

SPECIFIC REFERENCES FOR THE "q" TABLES

(Applicable as to the date of issue of the numerical table)

May 31, 1947

The values of the standard heat of vaporization, ΔHv^o, standard entropy of vaporization, ΔSv^o, and standard free energy of vaporization, ΔFv^o, all at 25°C, given in the q tables are calculated from the values of the heats of vaporization, ΔHv, at saturation pressure and 25°C, given in the corresponding m tables, the values of the vapor pressures at 25°C derived from the corresponding k tables, and unpublished calculations of the American Petroleum Institute Research Project 44 [1]. The specific references for the k and m tables are given in the appropriate places in this section.

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — **Washington, D. C.**

SPECIFIC REFERENCES

FOR TABLES 00r, 00s, 00t, 00u, 00v, 00w, 00x, and 00y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound (gas, monatomic)	Formula	REFERENCES FOR TABLE 00							
		r	s	t	u	v	w	x	y
		$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf	ΔFf^o	$\log_{10}Kf$
Oxygen	O	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Hydrogen	H	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Nitrogen	N	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Carbon	C	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2

REFERENCES

1. American Petroleum Institute Research Project 44[1]
2. National Bureau of Standards[1]

SPECIFIC REFERENCES

FOR TABLES Or, Os, Ot, Ou, Ou-E, Ou-G, Ov, Ov-E, Ov-G, Ow, Ox, and Oy.

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	Formula	REFERENCES FOR TABLE O							
		r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
		$(H - H^o_0)/T$	$(F^o - H^o_0)/T$	S^o	$(H^o - H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10} Kf$
Oxygen	O_2	1,4,7,42	1,3,4,5,6,42	1,3,4,5,42	1,4,7,42	1,3,4,5,8,42	1,42	1,42	1,42
Hydrogen	H_2	1,7,9,11,42	1,9,10,11,42	1,9,11,12,13,42	1,7,9,11,42	1,9,11,12,42	1,42	1,42	1,42
Hydroxyl	OH	2,7,14,42	2,14,42	2,13,14,15,42	2,7,14,42	2,14,42	2,14,16,17,18,19,20,42	2,42	2,42
Water	H_2O	1,7,23,24,42	1,10,21,22,23,24,42	1,12,13,21,22,23,24,25,42	1,7,23,24,42	1,8,12,22,23,24,42	1,42	1,42	1,42
Nitrogen	N_2	1,7,27,42	1,26,42	1,26,27,42	1,7,27,42	1,42	1,42	1,42	1,42
Nitric Oxide	NO	2,42	2,5,28,29,42	2,5,28,29,42	2,42	2,5,28,29,42	2,28,29,42	2,42	2,42
Carbon (graphite)	C	1,42	1,42	1,42	1,42	1,30,31,32,33,34,35,42	1,42	1,42	1,42
Carbon Monoxide	CO	1,7,27,37,42	1,5,36,37,42	1,5,12,13,27,36,37,42	1,7,27,37,42	1,5,12,27,37,42	1,42	1,42	1,42
Carbon Dioxide	CO_2	1,7,38,42	1,21,38,42	1,12,21,39,40,41,42	1,7,38,42	1,12,38,42	1,42	1,42	1,42

REFERENCES

1. Wagman, Kilpatrick, Taylor, Pitzer, and Rossini[1]
2. American Petroleum Institute Research Project 44[1]
3. Johnston and Walker[1]
4. Johnston and Walker[2]
5. Gordon and Barnes[2]
6. Shand and Spurr[1]
7. Lewis and von Elbe[1]
8. Trautz and Adler[1]
9. Giauque[1]
10. Libby[1]
11. Davis and Johnston[1]
12. Gordon and Barnes[1]
13. Zeise[1]
14. Johnston and Dawson[1]
15. Villars[1]
16. Tanaka and Koana[1]
17. Johnston, Dawson, and Walker[1]
18. Riechemeier, Seuftleben, and Pastorff[1]
19. Lewis and von Elbe[2]
20. Dwyer and Oldenberg[1]
21. Gordon[1]
22. Gordon[2]
23. Wilson[1]
24. Gordon[3]
25. Giauque and Ashley[1]
26. Giauque and Clayton[1]
27. Johnston and Davis[1]
28. Johnston and Chapman[1]
29. Witmer[1]
30. Nernst[1]
31. Worthing[1]
32. Magnus[2]
33. Schlapfer and Debrunner[1]
34. Jacobs and Parks[1]
35. Magnus[1]
36. Clayton and Giauque[1]
37. Kassel[1]
38. Kassel[3]
39. Badger and Woo[1]
40. Giauque and Egan[1]
41. Rodebush[1]
42. National Bureau of Standards[1]

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 1r, 1s, 1t, 1u, 1u-E, 1u-G, 1v, 1v-E, 1v-G, 1w, 1x, and 1y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 1							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Methane	1	1	1,4	1	1,13,14,15,16	3,27,28	3	34
Ethane	1	1	1,5	1	1,17,18,19	3,27,28	3	34
Propane	1	1	1,6	1	1,19,20,21	3,27,28	3	34
n-Butane	1,2	1	1,2,7	1,2	1,2,19,22	3,27,28	3	29,30,31,32,34
2-Methylpropane	2	2	2,8	2	2,23	3,27,28	3	29,30,31,32,34
n-Pentane	1,2	1	1,2,9	1,2	1,2,24,25,26	3,27,28	3	29,32,33,34
2-Methylbutane	2	2	2,10,11	2	2	3,27,28	3	29,32,33,34
2,2-Dimethylpropane	2	2	2,12	2	2	3,27,28	3	34

REFERENCES

1. Pitzer[7]
2. Pitzer and Kilpatrick[1]
3. Prosen, Pitzer, and Rossini[2]
4. Frank and Clusius[1]
5. Witt and Kemp[1]
6. Kemp and Egan[1]
7. Aston and Messerly[2]
8. Aston, Kennedy, and Schumann[1]
9. Messerly and Kennedy[1]
10. Schumann, Aston, and Sagenkahn[1]
11. Guthrie and Huffman[1]
12. Aston and Messerly[1]
13. Eucken and Fried[1]
14. Heuse[1]
15. Eucken and Lude[1]
16. Millar[1]
17. Wiebe, Hubbard, and Brevoort[1]
18. Eucken and Weigert[1]
19. Dailey and Felsing[1]
20. Kistiakowsky and Rice[1]
21. Kistiakowsky, Lacher, and Ransom[1]
22. Templeton, Davies, and Felsing[1]
23. Dailey and Felsing[2]
24. Bennewitz and Rossner[1]
25. Pitzer[5]
26. Eucken and Sarstedt[1]
27. Prosen and Rossini[8]
28. See references given for the "p" table.
29. Montgomery, McAteer, and Franke[1]
30. Montgomery, McAteer, and Horne[1]
31. Moldavskii and Nizovkina[1]
32. Schuit, Hoog, and Verheus[1]
33. Moldavskii and Nizovkina[2]
34. American Petroleum Institute Research Project 44[1]

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — **Washington, D. C.**

SPECIFIC REFERENCES

FOR TABLES 2r, 2s, 2t, 2u, 2u-E, 2u-G, 2v, 2v-E, 2v-G, 2w, 2x, and 2y (Parts 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 2 (Part 1)							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
n-Hexane	1	1	1,3	1	1,5,6	1,2,9	12,13	10,12
2-Methylpentane.	1	1	1,3	1	1,	1,2,9	12,13	10,11,12
3-Methylpentane.	1	1	1	1	1	1,2,9	12,13	10,11,12
2,2-Dimethylbutane	1	1	1,3,4	1	1,6,7,8	1,2,9	12,13	12
2,3-Dimethylbutane	1	1	1,3	1	1	1,2,9	12,13	10,12

REFERENCES

1. Pitzer and Kilpatrick[1]
2. Prosen and Rossini[8]
3. Douslin and Huffman[2]
4. Kilpatrick and Pitzer[1]
5. Bennewitz and Rossner[1]
6. Waddington and Douslin[1]
7. Pitzer[5]
8. Eucken and Sarstedt[1]
9. See references given for the "p" table.
10. Schuit, Hoog, and Verheus[1]
11. Montgomery[1]
12. American Petroleum Institute Research Project 44[1]
13. Prosen, Pitzer, and Rossini[2]

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 2r, 2s, 2t, 2u, 2u-E, 2u-G, 2v, 2v-E, 2v-G, 2w, 2x, and 2y (Parts 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 2 (PART 2)							
	r	s	t	u,u-E,u-G	v,v-E,v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10} Kf$
n-Heptane	1	1	1,5,6,7	1	1,8,9	4,10,11	4	2
2-Methylhexane	2,3	2,3	2,3,7	2,3	2,3	4,10,11	4	2
3-Methylhexane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
3-Ethylpentane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
2,2-Dimethylpentane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
2,3-Dimethylpentane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
2,4-Dimethylpentane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
3,3-Dimethylpentane	2,3	2,3	2,3,6	2,3	2,3	4,10,11	4	2
2,2,3-Trimethylbutane	2,3	2,3	2,3,6	2,3	2,3,9	4,10,11	4	2

REFERENCES

1. Pitzer[7]
2. American Petroleum Institute Research Project 44[1]
3. Pitzer[3]
4. Prosen, Pitzer, and Rossini[2]
5. Pitzer[4]
6. Huffman, Parks, and Thomas[1]
7. Parks, Huffman, Thomas[1]
8. Bennewitz and Rossner[1]
9. Waddington, Todd, and Huffman[1]
10. Prosen and Rossini[8]
11. See references given for the "p" table.

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SPECIFIC REFERENCES

FOR TABLES 3r, 3s, 3t, 3u, 3u-E, 3u-G, 3v, 3v-E, 3v-G, 3w, 3x, and 3y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 3							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10} Kf$
n-Octane	1	1	1,6,7	1	1	5,10,11	5	2
2-Methylheptane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
3-Methylheptane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
4-Methylheptane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
3-Ethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,2-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,3-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,4-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,5-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
3,3-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
3,4-Dimethylhexane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2-Methyl-3-ethylpentane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
3-Methyl-3-ethylpentane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,2,3-Trimethylpentane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,2,4-Trimethylpentane	2,3	4	2,3,6,8	2,3	2,3	5,10,11	5	2
2,3,3-Trimethylpentane	2,3	4	2,3	2,3	2,3	5,10,11	5	2
2,3,4-Trimethylpentane	2,3	4	2,3,9	2,3	2,3	5,10,11	5	2
2,2,3,3-Tetramethylbutane	2,3	4	2,3,6	2,3	2,3	5,10,11	5	2

REFERENCES

1. Pitzer[7]
2. American Petroleum Institute Research Project 44[1]
3. Pitzer[3]
4. Prosen, Pitzer, and Rossini[1]
5. Prosen, Pitzer, and Rossini[2]
6. Parks, Huffman, and Thomas[1]
7. Huffman, Parks, and Barmore[1]
8. Pitzer[4]
9. Pitzer and Scott[1]
10. Prosen and Rossini[8]
11. See references given for the "p" table

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — **Washington, D. C.**

SPECIFIC REFERENCES

FOR TABLES 5r, 5s, 5t, 5u, 5u-E, 5u-G, 5v, 5v-E, 5v-G, 5w, 5x, and 5y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 5							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^\circ-H^\circ_0)/T$	$(F^\circ-H^\circ_0)/T$	S°	$(H^\circ-H^\circ 0)$	$C_p{}^\circ$	ΔHf°	ΔFf°	$\log_{10}Kf$
Benzene	1	1	1,2	1	1,6,7	1,9,10	1	1
Toluene	1	1	1,3	1	1,6,7	1,9,10	1	1
Ethylbenzene	1	1	1,4,5	1	1,8	1,9,10	1	1
1,2-Dimethylbenzene	1	1	1,6	1	1,6	1,9,10	1	1
1,3-Dimethylbenzene	1	1	1,6	1	1,6	1,9,10	1	1
1,4-Dimethylbenzene	1	1	1,6	1	1,6	1,9,10	1	1
n-Propylbenzene	1	1	1	1	1	1,9,10	1	1
Isopropylbenzene	1	1	1	1	1	1,9,10	1	1
1-Methyl-2-ethylbenzene	1	1	1	1	1	1,9,10	1	1
1-Methyl-3-ethylbenzene	1	1	1	1	1	1,9,10	1	1
1-Methyl-4-ethylbenzene	1	1	1	1	1	1,9,10	1	1
1,2,3-Trimethylbenzene	1	1	1	1	1	1,9,10	1	1
1,2,4-Trimethylbenzene	1	1	1	1	1	1,9,10	1	1
1,3,5-Trimethylbenzene	1	1	1	1	1	1,9,10	1	1

REFERENCES

1. Taylor, Wagman, Williams, Pitzer, and Rossini[1]
2. Ahlberg, Blanchard, and Lundberg[1]
3. Kelley[1]
4. Guthrie, Spitzer, and Huffman[1]
5. Scott and Brickwedde[1]
6. Pitzer and Scott[2]
7. Montgomery and De Vries[1]
8. Scott and Mellors[1]
9. Prosen, Johnson, and Rossini[3]
10. See references given for the "p" table.

SPECIFIC REFERENCES

FOR TABLES 7r, 7s, 7t, 7u, 7v, 7w, 7x, and 7y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 7							
	r	s	t	u	v	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Cyclohexane	1	1	1,4,5,6	1	1,10,11,12	2,14	13	13,15,16,17,18
Methylcyclohexane	1	1	1,7,8	1	1,10,11,12	2,14	13	13
Ethylcyclohexane.	1	1	1,9	1	1	2,14	13	13
1,1-Dimethylcyclohexane . . .	1	1	1,9	1	1	3,14	13	13
cis-1,2-Dimethylcyclohexane .	1	1	1,9	1	1	3,14	13	13
trans-1,2-Dimethylcyclohexane	1	1	1,9	1	1	3,14	13	13
cis-1,3-Dimethylcyclohexane .	1	1	1,9	1	1	3,14	13	13
trans-1,3-Dimethylcyclohexane	1	1	1,9	1	1	3,14	13	13
cis-1,4-Dimethylcyclohexane .	1	1	1,9	1	1	3,14	13	13
trans-1,4-Dimethylcyclohexane	1	1	1,9	1	1	3,14	13	13

REFERENCES

1. Beckett, Pitzer, and Spitzer[1]
2. Prosen, Johnson, and Rossini[2]
3. Prosen, Johnson, and Rossini[3]
4. Ruehrwein and Huffman[1]
5. Aston, Szasz, and Fink[1]
6. Parks, Huffman, and Thomas[1]
7. Douslin and Huffman[1]
8. Parks and Huffman[1]
9. Oliver, Todd, and Huffman[1]
10. Montgomery and De Vries[1]
11. Bennewitz and Rossner[1]
12. Spitzer and Pitzer[1]
13. Kilpatrick, Werner, Beckett, Pitzer, and Rossini[1]
14. See references for the "p" table.
15. Schuit, Hoog, and Verheus[1]
16. Glasebrook and Lovell[1]
17. Arbuzov and Zelinski[1]
18. Mizusima, Morino, and Huzisino[1]

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 8r, 8s, 8t, 8u, 8u-E, 8u-G, 8v, 8v-E, 8v-G, 8w, 8x, and 8y (Parts 1)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 8 (Part 1)							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10} Kf$
Ethene	1	1	1,3	1	1,8	2,12,13	2	2
Propene	1	1	1,4	1	1,9	2,12,13	2	2
1-Butene	1	1	1,18	1	1,18	2,12,13	2	2,14,15,16,17
cis-2-Butene	1	1	1,5	1	1,5,10	2,12,13	2	2,14,15,17
trans-2-Butene	1	1	1,6	1	1,10	2,12,13	2	2,14,15,17
2-Methyl propene	1	1	1,7	1	1,11	2,12,13	2	2,14

REFERENCES

1. Kilpatrick and Pitzer[2]
2. Kilpatrick, Prosen, Pitzer, and Rossini[1]
3. Egan and Kemp[1]
4. Powell and Giauque[1]
5. Scott, Ferguson, and Brickwedde[1]
6. Guttman and Pitzer[1]
7. Rands, Scott, and Brickwedde[1]
8. Burcik, Eyster, and Yost[1]
9. Kistiakowsky and Rice[1]
10. Kistiakowsky and Rice[2]
11. Scott and Mellors[1]
12. Prosen and Rossini[9]
13. See references for the "p" table.
14. Frey and Huppke[1]
15. Shell Development Company[1]
16. Kistiakowsky[1]
17. Turkevich[1]
18. Aston, Fink, Bestul, Pace, and Szasz[1]

SPECIFIC REFERENCES

FOR TABLES 8r, 8s, 8t, 8u, 8u-E, 8u-G, 8v, 8v-E, 8v-G, 8w, 8x, and 8y (Parts 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 8 (Part 2)							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10} Kf$
1-Pentene	1	1	1	1	1	1,2,3	1	1,4
cis-2-Pentene	1	1	1	1	1	1,2,3	1	1,4
trans-2-Pentene	1	1	1	1	1	1,2,3	1	1,4
2-Methyl-1-butene	1	1	1	1	1	1,2,3	1	1,4
3-Methyl-1-butene	1	1	1	1	1	1,2,3	1	1,4
2-Methyl-2-butene	1	1	1	1	1	1,2,3	1	1,4

REFERENCES

1. Kilpatrick, Prosen, Pitzer, and Rossini[1]
2. Prosen and Rossini[9]
3. See references for the "p" table
4. Ewell and Hardy[1]

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SPECIFIC REFERENCES

FOR TABLES 8r, 8s, 8t, 8u, 8u-E, 8u-G, 8v, 8v-E, 8v-G, 8w, 8x and 8y (Parts 3)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 8 (Part 3)							
	r	s	t	u, u-E, u-G	v, v-E, v-G	w	x	y
	$(H^\circ-H^\circ_0)/T$	$(F^\circ-H^\circ_0)/T$	S°	$(H^\circ-H^\circ_0)$	C_p°	ΔHf°	ΔFf°	$\log_{10}Kf$
1-Hexene	1	1	1	1	1	1,2,3	1	1
cis-2-Hexene	1	1	1	1	1	1,2,3	1	1
trans-2-Hexene	1	1	1	1	1	1,2,3	1	1
cis-3-Hexene	1	1	1	1	1	1,2,3	1	1
trans-3-Hexene	1	1	1	1	1	1,2,3	1	1
2-Methyl-1-pentene	1	1	1	1	1	1,2,3	1	1
3-Methyl-1-pentene	1	1	1	1	1	1,2,3	1	1
4-Methyl-1-pentene	1	1	1	1	1	1,2,3	1	1
2-Methyl-2-pentene	1	1	1	1	1	1,2,3	1	1
cis-3-Methyl-2-pentene	1	1	1	1	1	1,2,3	1	1
trans-3-Methyl-2-pentene	1	1	1	1	1	1,2,3	1	1
cis-4-Methyl-2-pentene	1	1	1	1	1	1,2,3	1	1
trans-4-Methyl-2-pentene	1	1	1	1	1	1,2,3	1	1
2-Ethyl-1-butene	1	1	1	1	1	1,2,3	1	1
2,3-Dimethyl-1-butene	1	1	1	1	1	1,2,3	1	1,4,5,6
3,3-Dimethyl-1-butene	1	1	1	1	1	1,2,3	1	1,4,5,6
2,3-Dimethyl-2-butene	1	1	1	1	1	1,2,3	1	1,4,5,6

REFERENCES

1. Kilpatrick, Prosen, Pitzer, and Rossini[1]
2. Prosen and Rossini[9]
3. See references for the "p" table
4. Whitmore and Meunier[1]
5. Cramer and Glasebrook[1]
6. Brooks, Howard, and Crafton[2]

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SPECIFIC REFERENCES

FOR TABLES 12r, 12s, 12t, 12u, 12u-E, 12u-G, 12v, 12v-E, 12v-G, 12w, 12x, and 12y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 12							
	r	s	t	u,u-E,u-G	v,v-E,v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Ethyne	1	1	1	1	1	1,4,5	1	1
Propyne	1	1	1	1	1,3	1,4,5	1	1
1-Butyne	1	1	1	1	1	1,4,5	1	1
2-Butyne	1	1	1,2	1	1,3	1,4,5	1	1
1-Pentyne	1	1	1	1	1	1,4,5	1	1
2-Pentyne	1	1	1	1	1	1,4,5	1	1
3- Methyl-1-butyne	1	1	1	1	1	1,4,5	1	1

REFERENCES

1. Wagman, Kilpatrick, Pitzer, and Rossini[1]
2. Osborne, Garner, and Yost[1]
3. Kistiakowsky and Rice[2]
4. Prosen and Rossini[10]
5. See references for the "p" table

SELECTED VALUES OF PROPERTIES OF HYDROCARBONS

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 20r, 20s, 20t, 20u, 20u-E, 20u-G, 20v, 20v-E, 20v-G, 20w, 20x, and 20y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 20							
	r	s	t	u,u-E,u-G	v,v-E,v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Methane	1,6	1,6	1,6	1,6	1,6	2,3,4	2	5
Ethane	1,6	1,6	1,6	1,6	1,6	2,3,4	2	5
Propane	1,6	1,6	1,6	1,6	1,6	2,3,4	2	5
n-Butane	1,6	1,6	1,6	1,6	1,6	2,3,4	2	5
n-Pentane	1,6	1,6	1,6	1,6	1,6	2,3,4	2	5
n-Hexane	1,7	1,7	1,7	1,7	1,7	2,3,4	2	5
n-Heptane	1,7	1,7	1,7	1,7	1,7	2,3,4	2	5
n-Octane	1,8	1,8	1,8	1,8	1,8	2,3,4	2	5
n-Nonane	1	1	1	1	1	2,3,4	2	5
n-Decane	1	1	1	1	1	2,3,4	2	5
n-Undecane	1	1	1	1	1	2,3,4	2	5
n-Dodecane	1	1	1	1	1	2,3,4	2	5
n-Tridecane	1	1	1	1	1	2,3,4	2	5
n-Tetradecane	1	1	1	1	1	2,3,4	2	5
n-Pentadecane	1	1	1	1	1	2,3,4	2	5
n-Hexadecane	1	1	1	1	1	2,3,4	2	5
n-Heptadecane	1	1	1	1	1	2,3,4	2	5
n-Octadecane	1	1	1	1	1	2,3,4	2	5
n-Nonadecane	1	1	1	1	1	2,3,4	2	5
n-Eicosane	1	1	1	1	1	2,3,4	2	5

REFERENCES

1. Pitzer[7]
2. Prosen, Pitzer, and Rossini[2]
3. Prosen and Rossini[8]
4. See references for the "p" table.
5. American Petroleum Institute Research Project 44[1]
6. See references for tables 1r, 1s, 1t, 1u, and 1v.
7. See references for tables 2r, 2s, 2t, 2u, and 2v.
8. See references for tables 3r, 3s, 3t, 3u, and 3v.

American Petroleum Institute Research Project 44

National Bureau of Standards — Washington, D. C.

SPECIFIC REFERENCES

FOR TABLES 21r, 21s, 21t, 21u, 21u-E, 21u-G, 21v, 21v-E, 21v-G, 21w. 21x, and 21y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 21							
	r	s	t	u,u-E,u-G	v,v-E,v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Benzene	1	1	1	1	1	1	1	1
Methylbenzene	1	1	1	1	1	1	1	1
Ethylbenzene	1	1	1	1	1	1	1	1
n-Propylbenzene	1	1	1	1	1	1	1	1
n-Butylbenzene	2	2	2	2	2	2,3,4	2	2
n-Amylbenzene	2	2	2	2	2	2,3,4	2	2
n-Hexylbenzene	2	2	2	2	2	2,3,4	2	2
n-Heptylbenzene	2	2	2	2	2	2,3,4	2	2
n-Octylbenzene	2	2	2	2	2	2,3,4	2	2
n-Nonylbenzene	2	2	2	2	2	2,3,4	2	2
n-Decylbenzene	2	2	2	2	2	2,3,4	2	2
n-Undecylbenzene	2	2	2	2	2	2,3,4	2	2
n-Dodecylbenzene	2	2	2	2	2	2,3,4	2	2
n-Tridecylbenzene	2	2	2	2	2	2,3,4	2	2
n-Tetradecylbenzene	2	2	2	2	2	2,3,4	2	2
n-Pentadecylbenzene	2	2	2	2	2	2,3,4	2	2
n-Hexadecylbenzene	2	2	2	2	2	2,3,4	2	2

REFERENCES

1. See references for tables 5r, 5s, 5t, 5u, 5v, 5w, 5x, and 5y.
2. Taylor, Wagman, Williams, Pitzer, and Rossini[1]
3. Prosen, Johnson, and Rossini[3]
4. See references for the "p" table.

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American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLES 22r, 22s, 22t, 22u, 22v, 22w, 22x, and 22y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 22							
	r	s	t	u	v	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	C_p^o	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Cyclopentane	1	1	1,4,5	1	1,7	1,3,8	1	1
Methylcyclopentane	2	2	2,4,6	2	2	2,3,8	2	2,9,10,11
Ethylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Propylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Butylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Pentylcylopentane	2	2	2	2	2	2,3,8	2	2
n-Hexylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Heptylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Octylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Nonylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Decylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Undecylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Dodecylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Tridecylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Tetradecylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Pentadecylcyclopentane	2	2	2	2	2	2,3,8	2	2
n-Hexadecylcyclopentane	2	2	2	2	2	2,3,8	2	2

REFERENCES

1. Kilpatrick, Spitzer, and Pitzer[1]
2. Kilpatrick, Werner, Beckett, Pitzer, and Rossini[1]
3. Prosen, Johnson, and Rossini[2]
4. Douslin and Huffman[1]
5. Aston, Fink, and Schumann[1]
6. Huffman, Parks, and Barmore[1]
7. Spitzer and Pitzer[1]
8. See references for the "p" table.
9. Glasebrook and Lovell[1]
10. Arbuzov and Zelinskii[1]
11. Mizusima, Morino, and Huzisino[1]

SPECIFIC REFERENCES

FOR TABLES 23r, 23s, 23t, 23u, 23v, 23w, 23x, and 23y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 23							
	r	s	t	u	v	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Cyclohexane	1	1	1	1	1	1	1	1
Methylcyclohexane	1	1	1	1	1	1	1	1
Ethylcyclohexane	1	1	1	1	1	1	1	1
n-Propylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Butylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Pentylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Hexylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Heptylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Octylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Nonylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Decylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Undecylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Dodecylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Tridecylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Tetradecylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Pentadecylcyclohexane	2	2	2	2	2	2,3,4	2	2
n-Hexadecylcyclohexane	2	2	2	2	2	2,3,4	2	2

REFERENCES

1. See references for Tables 7r, 7s, 7t, 7u, 7v, 7w, 7x, and 7y.
2. Kilpatrick, Werner, Beckett, Pitzer, and Rossini[1]
3. Prosen, Johnson, and Rossini[2]
4. See references for the "p" table.

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SPECIFIC REFERENCES

FOR TABLES 24r, 24s, 24t, 24u, 24v, 24w, 24x, and 24y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLE 24							
	r	s	t	u	v	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Ethene	1	1	1	1	1	1	1	1
Propene	1	1	1	1	1	1	1	1
1-Butene	1	1	1	1	1	1	1	1
1-Pentene	1	1	1	1	1	1	1	1
1-Hexene	1	1	1	1	1	1	1	1
1-Heptene	2	2	2	2	2	2,3,4	2	2
1-Octene	2	2	2	2	2	2,3,4	2	2
1-Nonene	2	2	2	2	2	2,3,4	2	2
1-Decene	2	2	2	2	2	2,3,4	2	2
1-Undecene	2	2	2	2	2	2,3,4	2	2
1-Dodecene	2	2	2	2	2	2,3,4	2	2
1-Tridecene	2	2	2	2	2	2,3,4	2	2
1-Tetradecene	2	2	2	2	2	2,3,4	2	2
1-Pentadecene	2	2	2	2	2	2,3,4	2	2
1-Hexadecene	2	2	2	2	2	2,3,4	2	2
1-Heptadecene	2	2	2	2	2	2,3,4	2	2
1-Octadecene	2	2	2	2	2	2,3,4	2	2
1-Nonadecene	2	2	2	2	2	2,3,4	2	2
1-Eicosene	2	2	2	2	2	2,3,4	2	2

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2. Kilpatrick, Prosen, Pitzer, and Rossini[1]
3. Prosen and Rossini[9]
4. See references for the "p" table.

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FOR TABLES 25r, 25s, 25t, 25u, 25u-E, 25u-G, 25v, 25v-E, 25v-G, 25w, 25x, and 25y

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR TABLES 25							
	r	s	t	u,u-E,u-G	v,v-E,v-G	w	x	y
	$(H^o-H^o_0)/T$	$(F^o-H^o_0)/T$	S^o	$(H^o-H^o_0)$	$C_p{}^o$	ΔHf^o	ΔFf^o	$\log_{10}Kf$
Ethyne	1	1	1	1	1	1	1	1
Propyne	1	1	1	1	1	1	1	1
1-Butyne	1	1	1	1	1	1	1	1
1-Pentyne	1	1	1	1	1	1	1	1
1-Hexyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Heptyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Octyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Nonyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Decyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Undecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Dodecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Tridecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Tetradecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Pentadecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Hexadecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Heptadecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Octadecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Nonadecyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5
1-Eicosyne	2,5	2,5	2,5	2,5	2,5	3,4,5	2,5	2,5

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1. See references for Tables 12r, 12s, 12t, 12u, 12v, 12w, 12x, and 12y.
2. Wagman, Kilpatrick, Pitzer, and Rossini[1]
3. Prosen and Rossini[10]
4. See references for the "p" table.
5. American Petroleum Institute Research Project 44[1]

American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES
FOR TABLE 1z
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
Methane	1,16,20	1	15
Ethane	2,3,16	2,3	15
Propane	4,20	4	15
n-Butane	5,6,17	5,6	15
2-Methylpropane	7,8,17	7,8	15
n-Pentane	9,10,18,20	9,10	15
2-Methylbutane	11,12,13,18,19,20	11,12,13	15
2,2-Dimethylpropane	14,19,20	14	15

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13. Parks, Huffman, and Thomas[1]
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15. American Petroleum Institute Research Project 44[1]
16. Clusius and Weigand[1]
17. Glasgow and Rossini[1]
18. Glasgow, Murphy, Willingham, and Rossini[1]
19. Howard, Mears, Fookson, Pomerantz, and Brooks[1]
20. For additional references, see references to Table 1a.

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SPECIFIC REFERENCES
FOR TABLE 2z (Part 1)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
n-Hexane	1,2,3,4,6,9	1,2,3,4	8
2-Methylpentane.	1,4,6,7	1,4	8
3-Methylpentane.			
2,2-Dimethylbutane	1,4,5,6,7,9	1,4,5	8
2,3-Dimethylbutane	1,6,9	1	8

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2. Huffman, Parks, and Barmore[1]
3. Parks, Huffman, and Thomas[1]
4. Stull[1]
5. Kilpatrick and Pitzer[1]
6. Glasgow, Murphy, Willingham, and Rossini[1]
7. Howard, Mears, Fookson, Pomerantz, and Brooks[1]
8. American Petroleum Institute Research Project 44[1]
9. For additional references, see references to Table 2a (Part 1).

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SPECIFIC REFERENCES

FOR TABLE 2z (Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
n-Heptane	1,2,4,6,7,9	1,2	8
2-Methylhexane	1,5,7,9	1	8
3-Methylhexane			
3-Ethylpentane	3,5,6	3	8
2,2-Dimethylpentane	3,5,7,9	3	8
2,3-Dimethylpentane			
2,4-Dimethylpentane	3,5,7,9	3	8
3,3-Dimethylpentane	3,5,7,9	3	8
2,2,3-Trimethylbutane	3,4,6,7,9	3	8

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3. Huffman, Parks, and Thomas[1]
4. Glasgow, Murphy, Willingham, and Rossini[1]
5. Streiff, Murphy, Sedlak, Willingham, and Rossini[1]
6. Brooks, Howard, and Crafton[2]
7. Edgar and Calingaert[1]
8. American Petroleum Institute Research Project 44[1]
9. For additional reference, see references to Table 2a (Part 2).

American Petroleum Institute Research Project 44

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SPECIFIC REFERENCES

FOR TABLE 3z

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
n-Octane	1,2,3,8	1,2	7
2-Methylheptane	3	7	3
3-Methylheptane	3	7	3
4-Methylheptane	3,8	7	3
3-Ethylhexane			
2,2-Dimethylhexane	3	7	3
2,3-Dimethylhexane			
2,4-Dimethylhexane			
2,5-Dimethylhexane	3	7	3
3,3-Dimethylhexane	3	7	7
3,4-Dimethylhexane			
2-Methyl-3-ethylpentane	3,8	7	3
3-Methyl-3-ethylpentane	3,8	7	3
2,2,3-Trimethylpentane	3,8	7	3
2,2,4-Trimethylpentane	1,4,8,9	1	7
2,3,3-Trimethylpentane	3	7	3
2,3,4-Trimethylpentane	3,5,9	5	7
2,2,3,3-Tetramethylbutane	6,10	6	7

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3. Streiff, Murphy, Sedlak, Willingham, and Rossini[1]
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5. Pitzer and Scott[1]
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7. American Petroleum Institute Research Project 44[1]
8. For additional references, see references to Table 3a.
9. Brooks, Howard, and Crafton[2]
10. Calingaert, Soroos, Hnizda, and Shapiro[1]

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SPECIFIC REFERENCES
FOR TABLE 5z
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
Benzene	1,2,3,12,13	1,2,3	11
Methylbenzene	2,3,4,12,13	2,3,4	11
Ethylbenzene	1,5,6,12,13	1,5,6	11
1,2-Dimethylbenzene	1,7,12,13	1,7	11
1,3-Dimethylbenzene	1,7,12,13	1,7	11
1,4-Dimethylbenzene	1,7,12,13	1,7	11
n-Propylbenzene	8,13		8
Isopropylbenzene	12,13		11
1-Methyl-2-ethylbenzene	8,13		8
1-Methyl-3-ethylbenzene	8,13		8
1-Methyl-4-ethylbenzene	8,13		8
1,2,3-Trimethylbenzene	8,9,13	9	8
1,2,4-Trimethylbenzene	8,9,10,13	9,10	8
1,3,5-Trimethylbenzene	8,9,13	9	11

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3. Ziegler and Andrews[1]
4. Kelley[1]
5. Guthrie, Spitzer, and Huffman[1]
6. Scott and Brickwedde[1]
7. Fitzer and Scott[2]
8. Streiff, Murphy, Sedlak, Willingham, and Rossini[1]
9. Rossini[12]
10. Huffman, Parks, and Barmore[1]
11. American Petroleum Institute Research Project 44[1]
12. Glasgow, Murphy, Willingham, and Rossini[1]
13. For additional references, see references to Table 5a.

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SPECIFIC REFERENCES

FOR TABLE 6z

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
Cyclopentane	1,2,3,5,9	1,2,3	8
Methylcyclopentane	3,4,5,9	3,4	8
Ethylcyclopentane.	5,6,7,9	6	7
1,1-Dimethylcyclopentane	7,9		7
cis-1,2-Dimethylcyclopentane . .	7,9		7
trans-1,2-Dimethylcyclopentane .	4,7,9	4	8
cis-1,3-Dimethylcyclopentane . .			
trans-1,3-Dimethylcyclopentane .	7,9		7

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5. Glasgow, Murphy, Willingham, and Rossini[1]
6. Huffman and others[1]
7. Streiff, Murphy, Cahill, Flanagan, Sedlak, Willingham, and Rossini[1]
8. American Petroleum Institute Research Project 44[1]
9. For additional references, see references to Table 6a.

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SPECIFIC REFERENCES

FOR TABLE 7z

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
Cyclohexane	1,2,3,4,8,12	1,2,3,4	11
Methylcyclohexane	5,6,8	5,6	11
Ethylcyclohexane	7,8,9	7	9
1,1-Dimethylcyclohexane	7,9,12	7	9
cis-1,2-Dimethylcyclohexane	7,9,12	7	9
trans-1,2-Dimethylcyclohexane	7,9,12	7	9
cis-1,3-Dimethylcyclohexane	7,10,12	7	10
trans-1,3-Dimethylcyclohexane	7,10,12	7	10
cis-1,4-Dimethylcyclohexane	7,9,12	7	9
trans-1,4-Dimethylcyclohexane	7,9,12	7	9

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2. Ziegler and Andrews[1]
3. Aston, Szasz, and Fink[1]
4. Ruehrwein and Huffman[1]
5. Parks and Huffman[1]
6. Douslin and Huffman[1]
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8. Glasgow, Murphy, Willingham, and Rossini[1]
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11. American Petroleum Institute Research Project 44[1]
12. For additional references, see references to Table 7a.

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SPECIFIC REFERENCES
FOR TABLE 8z (Part 1)
(Applicable as of the date of issue of the numerical table)
May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
Ethene	1,2	1,2	10
Propene	3,4	3,4	10
1-Butene	5	5	10
cis-2-Butene	6,7,11	6,7	10
trans-2-Butene	6,8,11	6,8	10
2-Methylpropene	6,9,11	6,9	10

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10. American Petroleum Institute Research Project 44[1]
11. For additional references, see references to Table 8a (Part 1).

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SPECIFIC REFERENCES

FOR TABLE 8z (Part 2)

(Applicable as of the date of issue of the numerical table)

May 31, 1947

Compound	REFERENCES FOR		
	Freezing Point	Heat of Fusion	Cryoscopic Constants
1-Pentene.	1,2	1	2
cis-2-Pentene.	1,2,5	1	2
trans-2-Pentene.	1,2,5	1	2
2-Methyl-1-butene.	1,2,5	1	2
3-Methyl-1-butene.	1,2,5	1	2
2-Methyl-2-butene.	1,2,3,5	1,3	4

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