NBSIR 80-2118

Tables of Rate Constants for Gas Phase Chemical Reactions of Sulfur Compounds (1971-1979)

Francis Westley

Chemical Kinetics Division
Center for Thermodynamics and Molecular Science
National Measurement Laboratory
National Bureau of Standards
U.S. Department of Commerce
Washington, D.C. 20234

July 1980

Interim Report

Prepared for
Morgantown Energy Technology Center
Department of Energy
Morgantown, West Virginia 26505

and

Office of Standard Reference Data
National Bureau of Standards
Washington, D.C. 20234

NBSIR 80-2118

TABLES OF RATE CONSTANTS FOR GAS PHASE CHEMICAL REACTIONS OF SULFUR COMPOUNDS (1971-1979)

Francis Westley

Chemical Kinetics Division
Center for Thermodynamics and Molecular Science
National Measurement Laboratory
National Bureau of Standards
U.S. Department of Commerce
Washington, D.C. 20234

July 1980

Interim Report

Prepared for
Morgantown Energy Technology Center
Department of Energy
Morgantown, West Virginia 26505

and

Office of Standard Reference Data
National Bureau of Standards
Washington, D.C. 20234

U.S. DEPARTMENT OF COMMERCE, Philip M. Klutznick, *Secretary*

Luther H. Hodges, Jr., *Deputy Secretary*
Jordan J. Baruch, *Assistant Secretary for Productivity, Technology, and Innovation*

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

Table of Contents

TABLES OF RATE CONSTANTS FOR GAS PHASE CHEMICAL REACTIONS OF SULFUR COMPOUNDS (1971-1979)*

Francis Westley

National Bureau of Standards
Chemical Kinetics Division
Center for Thermodynamics and Molecular Science
Washington, DC 20234

A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation $k = AT^{B}\exp(-E/RT)$. The table covers the reactions of sulfur containing molecules and free radicals - S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, CH_3SH, cy-CH_2CH_2S, $CH_3SCH_2\cdot$ and a number of thiols, thioethers and thioesters - with other compounds. The table includes 16 unimolecular, 187 bimolecular, and 11 termolecular reactions totalling 214 distinct chemical reactions. There are 348 distinct entries, distributed as follows: 26 for first order reactions, 294 for second order reactions and 28 for third order reactions. The kinetic data were compiled from 109 experimental papers and 6 critical reviews published between 1970 and 1979.

Key words: Arrhenius parameters, chemical kinetics, combustion, decomposition, free radicals, gas phase, hydrocarbons, hydrogen, nitrogen oxygen, rate of reaction, sulfur.

---

* This work was supported by the Department of Energy and by the Office of Standard Reference Data of the National Bureau of Standards.

INTRODUCTION

This publication consists of a table of rate constants for reactions of inorganic and organic sulfur compounds in the gas phase, as well as of their reactions with other bodies. The table is a compilation of rate constants given in 109 experimental papers and 6 critical reviews published between 1970 and 1979. Its purpose is to provide the kineticist and combustion modeler with a comprehensive and easy-to-use source on kinetic data for chemical processes involving sulfur compounds. The table gives 348 distinct reaction rate constants from the above mentioned sources. A list of references including the 115 papers, arranged alphabetically by author for each separate year, is appended at the end of the table.

For ease of reference the sulfur-containing reactant in a bimolecular or termolecular reaction is always placed first, so that a grouping of the reactions according to the standard order of sulfur compounds is obtained. However, 14 bimolecular reactions and one termolecular reaction involve two sulfur-containing reactants. For that reason, these 15 reactions are listed twice, the second time with the order of the sulfur-containing reactants reversed. (E.g.: $COS + S \rightarrow CO + S_2$ is also listed as: $S + COS \rightarrow S_2 + CO$.) As a result, the total number of tabulated entries is 363, although the real number of distinct entries is only 347. The arrangement of the tables and the standard order of chemical compounds are described in detail below, in the "Guidelines for the User".

The presentation of kinetic data is standardized and simplified as much as possible. Rate constants are expressed in terms of the modified Arrhenius equation $k = AT^B\exp(-E/RT)$. In general uncertainties are given only for the rate constant k itself and not for the individual

parameters in this equation. Sometimes an uncertainty is given for the value E/R and has been included in the uncertainty stated for the value of the rate constant. Rate constants are expressed in units of s^{-1}, $cm^3mol^{-1}s^{-1}$, and $cm^6mol^{-2}s^{-1}$ for reactions of first, second and third order respectively. Conversion tables for other units are appended at the end of this publication.

This publication is not the result of the effort of a single person, but of the whole staff of the Chemical Kinetics Division. My thanks to all of them. In particular, I wish to thank Dr. David Garvin, Deputy Director of the Center for Thermodynamics and Molecular Science, and Dr. Robert F. Hampson, Jr., Director of the Chemical Kinetics Information Center, for their more than helpful suggestions and constant guidance; Dr. Wing Tsang, Chief of the Chemical Kinetics Division, and Dr. John T. Herron of the Chemical Kinetics Division, for their encouragement; Dr. Bert R. Staples, Chief of the Electrolyte Data Center, for allowing us to program the tables through a computer; Mrs. Bettijoyce Molino and Mrs. Carla G. Messina from the Office of Standard Reference Data for applying the OMNIDATA and GPSDIC programs to the present tables; and Mrs. Janice L. Jones and Mrs. Delores E. Dorman for typing a difficult typescript with particular care.

GUIDELINES FOR THE USER

General

As pointed out above, the presentation of the kinetic data in this publication is an attempt to simplify and standardize them. Units of rate constants used in this table are the cubic centimeter, the mole and the second. The choice of a standard form for uncertainty limits is somewhat more complicated, but when a series of recommended rate constants is to be presented in a tabular form, the uncertainty limits can not be omitted, for an uncertainty assigned to the recommended value of a rate constant is an estimate by the evaluator of the absolute accuracy of the preferred value. It is to be emphasized that in the present tables the concern is with the overall uncertainty of a reaction rate constant and not with the expression of precision of a set of experimental measurements. Most of the uncertainty limits included in this table are uniform within the respective temperature range indicated. However, for a limited number of reactions, the data warrant or require variable limits. In such cases, a note under the respective data indicates for which interval of the temperature range there is a change in the uncertainty limits.

It is thought that the uncertainty limits expressed in the form of lower and upper k factors - f and F, respectively - are the most suitable for tabulation. Thus, if k_o is the central value of a rate constant the limits of reliability for the rate constant k_o are defined by the relationship:

$$fk_o < k < Fk_o \qquad (1)$$

i.e. multiplication of the central value k_o by f and F gives respectively the lower and upper reliability limits of the rate constant. In this

standardized formulation of uncertainty limits, the value of f is less than unity and the value of F is greater than unity.

However the k factors are not the only way to express the uncertainty limits of a rate constant and different authors use different forms to indicate the degree of reliability of a recommended rate constant. It follows that certain mathematical relationships are needed to translate the different forms of uncertainty limits into the standard form used in this table (lower and upper k factors). The formulas used to transform any form of uncertainty limits into the standard form were given and discussed at length in the introduction of a previous publication* and will not be repeated here.

Arrangement of the table

This publication is in two parts:

Part I. The table arranged in nine columns gives the chemical reaction, the order of reaction n, the "third body" collision partner M, the rate constants ratio k/k_{ref}, the temperature range in kelvins, the parameters A, B and E/R for the modified Arrhenius equation $k = AT^{B}exp(-E/RT)$ and the uncertainty limits expressed as k factors f and F.

Part II. The bibliography of part I, including the full references for the 109 experimental papers and 6 critical reviews from which the present table was compiled. Following the bibliography, two conversion tables for equivalent second and third order rate constant units are appended.

The arrangement of the table in part I is as follows:

Column 1 the chemical reaction indicating both the reactants and the products. In the same column, under each chemical reaction, the

---

* Westley, Francis, "Tables of Recommended Rate Constants for Chemical Reactions Occurring in Combustion", NBSIR 79-1941 (1979) (1st ed.); NSRDS-NBS 67 (1980) (2nd ed.).

names of the reactants are given. The chemical nomenclature adopted is the one used in the Chemical Substance Indexes of Chemical Abstracts. Alternative names are not given. The chemical names of the products are not given. The line with chemical names is indented with respect to the line above it. Under the chemical names, the short reference to the reviewer's book or article is given. It includes the last two digits of the year of the publication followed by the first three letters of the author's name. If two authors are given, a slash separates each author's three letters. Again, the short reference line is indented with respect to the line above it. e.g.:

78 MAR/HER indicates the experimental rate constant for the reaction between dimethyl sulfide and ozone, published by Martinez and Herron in 1978.

The last line of column 1, placed under the line including the short reference, begins with the heading NOTE:. It is given only when necessary and might include information about the dependence of k factors on temperature range, or the reaction taken as reference when a value for the ratio k/k_{ref} is given in column 3, or other information pertinent to the reaction indicated above. For a couple of reactions taken from Baulch, et al. (76 BAU/DRY) the relationship $k_1 = Kk_{-1}$ included in the note indicates that the rate constant was calculated from the equilibrium constant K and the rate constant k_{-1} of the reverse reaction. In such cases, the author usually gives the rate constant of the reverse reaction immediately after the data for the forward reaction. The arrangement of the present table based on the standard order, does not allow the forward rate constant of a reaction to be followed immediately by its reverse rate constant. The reader will have to locate the rate constant of a reverse in its proper place in the table.

Column 2, with the heading n, indicates the order of the reaction displayed in column 1. The value of n is 1, 2, or 3, which defines the proper standard units for the reactions, as follows:

1	for first order reactions	s^{-1}
2	for second order reactions	$cm^3mol^{-1}s^{-1}$
3	for third order reactions.	$cm^6mol^{-2}s^{-1}$

The reaction order is indicated for every reaction included in the table and the digit indicating its value is aligned with the short reference.

Column 3, with the heading M, defines the inert reaction partner ("third body") when the chemical reaction displayed in column 1 includes the letter M. Most of the third bodies displayed in column 3 include no more than three characters (e.g.: Ar, He, H_2O, N_2, N_2O, SO_2, SO_3, CO_2). For the reaction $SO_2 + OH + M \rightarrow HOSO_2 + M$ the third body, a mixture of N_2 and O_2, is indicated in the note, in column 1. No indication is given if M is undefined in the paper. When displayed, the third body is aligned with the short reference and the reaction order.

Column 4, with the heading k/k_{ref}, gives the ratio of the rate constant of the reaction indicated in column 1 and the rate constant of a reference reaction. In most cases this ratio is a dimensionless number. However, when the order of the reaction indicated in column 1 is different from the order of the reference reaction, the ratio of the rate constants is no longer dimensionless and the expression for the ratio of rate constants is not given in column 3 (for lack of space), but in the note, at the end of column 1. The reference reaction is always indicated in the notes. The dimensionless rate ratios given in column 3 are aligned with the short reference given in column 1 and with the reaction order given in column 2.

Column 5, with the heading T/K, gives the temperature range of validity for the corresponding rate parameters. For some reactions only one temperature is given, meaning that the reaction was studied only at one temperature. If no temperature is indicated, it means that the kinetic parameters of the corresponding reaction are valid throughout. The data estimated by Benson and Golden in their report "Estimating the Kinetics of Combustion" (75 BEN/GOL) are in this category. The temperatures are aligned with the short references given in column 1, as well as with the reaction order given in column 2.

Column 6, with the heading A, gives the value of A for the equation $k = AT^{B}\exp(-E/RT)$. A is expressed as a number less than 10 followed by the exponent in parenthesis. e.g., 3.5 (+ 14) should be read as $3.5 \times 10^{+14}$. The coefficient of the A factor has no more than one digit after the decimal point. The units of the A factor are the same as for the rate constant. For those cases when the recommended value is only for one temperature, the entry under this column is in fact the value of the rate constant k at this temperature. The data for the A factor are aligned with the short reference and reaction order information. If a dash appears in this column, it means that no A factor value was reported by the evaluator for the corresponding reaction. In such a case a rate ratio is given in column 4.

Column 7, with the heading B, gives the value of B for the equation $k = AT^{B}\exp(-E/RT)$. The value of B usually lies between 0 and 4, negative or positive. No more than one digit is given after the decimal dot. A dash in this column means that no B value was reported by the evaluator. The data for B are aligned with the short reference and reaction order information.

Column 8, with the heading E/R, indicates the value of E/R for the equation $k = AT^{B}\exp(-E/RT)$. Since E is the activation energy in cal mol^{-1} and R the gas constant with a value of 1.987 cal mol^{-1} K^{-1}, it follows that the units of E/R are kelvins. The values given in column 5 for E/R may vary from 0 to over 100000 kelvins. The E/R values may be positive or negative. Some of the E/R values included in the table are followed by an uncertainty with plus or minus signs. As pointed out in the introduction, these uncertainties may be ignored, as they are included in the lower and upper k factors indicated in the right column of the table. A dash in this column means that no E/R value was reported by the evaluator. The values for the E/R factor are aligned with the short reference and reaction order information.

Column 9, with the heading "k factors" and two subheadings, "f" and "F", indicates the two uncertainty k factors, the lower factor f in the left subcolumn and the upper factor F in the right subcolumn. To find the uncertainty limits of a reaction, its rate constant is to be multiplied by the two factors, as shown in (1): $fk_0 < k < Fk_0$. The values of both factors are always positive. If no uncertainty limits are indicated by the evaluator, both subcolumns of the column 6 are left blank. The k factors are aligned with the short reference and reaction order information.

Ordering of chemical reactions.

The general rule for ordering the chemical reactions listed in column 1 of the table is the standard order of arrangement as described in NBS Technical Note 270-3*. A detailed discussion of this rule was presented in the introduction to the publication noted in the preceding footnote (NBSIR 79-1941/1979, or NSRDS-NBS 67/1980) - and will

* Wagman, D.D., Evans, W.H., Parker, V.B., Halow, I., Bailey, S.M., and Schumm, R.H., "Selected Values of Chemical Thermodynamic Properties," NBS Tech. Note 270-3 pgs. 5, 16, 22 (1968).

not be repeated here. It suffices to say that this rule is applied to the first reactants of the reactions listed in this table, as well as to the reactants following the first, and that the first reactant of a reaction takes precedence over the following ones. The compounds listed in the Table of Contents, which give only the first reactants of the chemical reactions included in this work, are in the standard order (S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, cy-CH_2CH_2S, etc.) and are each part of the S-O-H-C system. (The first reactant always includes an S atom, and may include any of the O, H, or C atoms). The second, or the third reactants may include any of the O, H, S, N, or C atoms, and this sequence - arranged according to the standard order - defines the O-H-S-N-C system.

A number of second and third order reactions includes a second and - respectively - third body M. For this type reactions, M will always be placed after all other reactants. (e.g.: $SO_3 + M \rightarrow SO_2 + O + M$, or $SO + O + M \rightarrow SO_2 + M$).

Most of the chemical reactions included in the table are balanced. There are a number of reactions with unspecified products. In such a case, the word "products" appears after the arrow (e.g.: $SO_2 + HO_2 \rightarrow$ products).

Display of Chemical Reactions and Formulae

In order to define the reaction products, the reactants are written using semi-structural formulas. All saturated normal hydrocarbons are written so as to show separately each methyl and methylene group in the chain: CH_4, CH_3CH_3, $CH_3CH_2CH_3$. Unsaturated hydrocarbons are written so as to show the position of double or triple bonds. The unpaired electron

of an alkyl radical is always indicated, with the exception of Methyl free radical, e.g.:

Methyl free radical	CH_3 (no dot)
Ethyl, 1-methyl-, free radical (Isopropyl)	$(CH_3)_2CH\cdot$
Methyl, hydroxy-, free radical	$\cdot CH_2OH$
Methylthio free radical	$CH_3S\cdot$

If the unpaired electron of an alkyl radical belongs to a carbon in the middle of the chain, it is indicated inside a parenthesis following the carbon atom, e.g.:

Propyl, 1-methyl-, free radical (sec-Butyl) $CH_3CH_2CH(\cdot)CH_3$

If the oxygen atom of an oxy radical is attached to the terminal carbon atom, the radical is written in the usual manner: CH_3O. If the oxygen atom of the oxy radical is attached to a C atom in the middle of the chain, then the oxygen atom, together with the unpaired electron, are inside a parenthesis following the C atom: $(CH_3)_2C(O\cdot)CH_2CH_3$. The rules for writing peroxo, and other free radicals are the same as for the oxy free radicals: $CH_3O_2\cdot$, CH_3S.

Atoms, like O, H, S, N, C, and simple radicals like OH, HO_2, SH, NH, CH, CH_2, CH_3, CS, CN are written without dot.

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (ln K)	k factors f	k factors F
$S + O_2 \rightarrow SO + O$									
Sulfur atom + Oxygen molecule									
72 DAV/KLE1	2			252-423	1.3(+12)	0	0±50 1	0.9	1.2
72 DON/LII	2			295	1.0(+12)	-	-	0.8	1.2
75 CLY/IOW	2			298	9.0(+11)	-	-	0.8	1.2
76 BOU/DRY	2			250-450	1.4(+12)	0	0±50	0.5	1.5
NOTE: Recommended k.									
72 CLY/WHI	2			296-410	1.0(+12)	0	-153±108	0.7	1.3

$S + O_3 \rightarrow SO + O_2$									
Sulfur atom + Ozone									
75 CLY/IOW	2			298	7.2(+12)	-	-	0.7	1.3

$S + H_2 \rightarrow SH + H$									
Sulfur atom + Hydrogen molecule									
76 BOU/DRY	2			298	1.3(-1)	-	-	0.5	1.5
NOTE: $k_1 = Kk_{-1}$. Recommended k.									
75 BEN/GOL	2				2.5(+12)	0.5	13640		
NOTE: Semi-empirical evaluation.									

$S^*(^1D) + H_2 \rightarrow$ products									
Sulfur atom + Hydrogen molecule									
72 LII/DOL	2		0.22	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products.									

$S + OH \rightarrow SO + H$									
Sulfur atom + Hydroxyl free radical									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
72 JOU/LEE	2			298	4.0(+13)	-	-	0.8	1.2

$S + OH \rightarrow SH + O$									
Sulfur atom + Hydroxyl free radical									
75 BEN/GOL	2				1.3(+12)	0.5	12700		
NOTE: Semi-empirical evaluation.									

$S + S_2 \rightarrow S_2 + S$									
Sulfur atom + Sulfur dimer									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									

$S + SO \rightarrow S_2 + O$									
Sulfur atom + Sulfur monoxide									
75 BEN/GOL	2				6.3(+11)	0.5	11500		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$S + SO \rightarrow SO + S$									
Sulfur atom + Sulfur monoxide									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + SH \rightarrow S_2 + H$									
Sulfur atom + Mercapto free radical									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-emprical evaluation.									
$S + SH \rightarrow SH + S$									
Sulfur atom + Mercapto free radical									
75 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$S + N_2 \rightarrow NS + N$									
Sulfur atom + Nitrogen molecule									
75 BEN/GOL	2				4.0(+12)	0.5	55200		
NOTE: Semi-empirical evaluation.									
$S^*(^1D) + N_2 \rightarrow$ products									
Sulfur atom + Nitrogen molecule									
72/LIT/DAL	2		0.062	300	-	-	-		
E: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products									
$S + NO \rightarrow SO + N$									
Sulfur atom + Nitrogen oxide(NO)									
75 BEN/GOL	2				4.0(+11)	0.5	17260		
NOTE: Semi-empirical evaluation.									
$S + NO \rightarrow NS + O$									
Sulfur atom + Nitrogen oxide(NO)									
75 BEN/GOL	2				1.0(+12)	0.5	17365		
NOTE: Semi-empirical evaluation.									
$S^*(^1D) + NO \rightarrow$ products									
Sulfur atom + Nitrogen oxide(NO)									
72 LIT/DAL	2		0.68		-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products									
$S + NO + M \rightarrow SNO + M$									
Sulfur atom + Nitrogen oxide(NO)									
70 VAN/ORI	2	CO_2		298	9.3(+12)	-	-	0.8	1.2
NOTE: Limiting high-pressure k.									
	3	CO_2		298	1.9(+17)	-	-		
NOTE: k_0 (low pressure).									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$S + NO_2 \rightarrow SO + NO$									
Sulfur atom + Nitrogen oxide(NO_2)									
ZS CLY/10W	2			298	3.7(+13)	-	-	0.8	1.2
ZZ CLY/WUY	2			296-410	3.0(+13)	0	-84±60	0.8	1.2
$S^*(^1D) + N_2O \rightarrow NS + NO$									
Sulfur atom + Nitrogen oxide(N_2O)									
ZZ LII/DOL	2		0.1	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products (Approximate ratio).									
$S + NH \rightarrow SH + N$									
Sulfur atom + Imidogen free radical									
ZS BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$S^*(^1D) + CO \rightarrow$ products									
Sulfur atom + Carbon monoxide									
ZZ LII/DOL	2		0.19	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S^*(^1D) + CO_2 \rightarrow$ products									
Sulfur atom + Carbon dioxide									
ZZ LII/DOL	2		0.24	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S^*(^1D) + CH_4 \rightarrow CH_3SH$									
Sulfur atom + Methane									
ZZ LII/DOL	2		0.076	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S + CS \rightarrow CS + S$									
Sulfur atom + Carbon monosulfide free radical									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + CS \rightarrow S_2 + C$									
Sulfur atom + Carbon monosulfide free radical									
ZS BEN/GOL	2				1.6(+12)	0.5	40463		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$S + CS + M \rightarrow CS_2 + M$									
Sulfur atom + Carbon monosulfide free radical									
Z6 BA00/DRY	3			1500 ±700	8.7(+13)	0	-4370	0.5	1.5
NOTE: $k_1 = Kk_{-1}$. Recommended k									
$S + CS_2 \rightarrow S_2 + CS$									
Sulfur atom + Carbon disulfide									
Z6 BA00/DRY	2			298	3.9(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
$S + CDS \rightarrow S_2 + CO$									
Sulfur atom + Carbon oxide sulfide									
Z2 JAK/AUG	2			298	1.1(+10)	-	-		
NOTE: Evaluation.									
Z4 KLE/DAV	2			233-245	9.2(+11)	0	1025±60	0.9	1.1
Z6 BA00/DRY	2			230-2600	1.7(+12)	0	2050±230	0.3	3.0
NOTE: Recommended k.									
$S^*(^1D) + COS \rightarrow S_2 + CO$									
Sulfur atom + Carbon oxide sulfide									
Z2 LLI/DAL	2		1.5	300	-	-	-	0.7	1.3
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products									
$S + CN \rightarrow CS + N$									
Sulfur atom + Cyanogen free radical									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + C_2 \rightarrow CS + C$									
Sulfur atom + Carbon dimer									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + CH{=}CH \rightarrow cy\text{-}CH{=}CHS$									
Sulfur atom + Ethyne									
Z1 SIE/ZAC	2			298-450	-	-	-		
NOTE: $k/k_{ref} = 6.2\exp(-1007/T)$.									
k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$									
Conventional photolysis method.									
Z2 KLE/DAR	2			298	1.7(+11)	-	-		
NOTE: Recommended k.									
$S + CH{\equiv}CH \rightarrow$ products									
Sulfur atom + Ethyne									
Z8 VAN/SAE	2			298-484	3.4(+13)	0	1510±200	0.4	1.6
$S + CD{\equiv}CD \rightarrow$ products									
Sulfur atom + Ethyne-d_2									
Z8 VAN/SAE	2			298	2.3(+11)	-	-	0.0	1.2

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$									
Sulfur atom + Ethene									
Z1 CDN/YAN	2			298	9.0(+11)	-	-	0.9	1.1
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2		1.0	298-450	-	-	-		
NOTE: k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									
Z2 DAV/KLE2	2			218-442	4.3(+12)	0	795±40	0.9	1.1
Z2 KER/ROB	2			298	8.1(+11)	-	-		
NOTE: Recommended k.									

$S + CD_2{=}CH_2 \rightarrow cy\text{-}CD_2CH_2S$									
Sulfur atom + Ethene-1,1-d_2									
Z1 SIR/O'C	2		1.07	298-450	-	-	-		
NOTE: k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									

$S + cis\text{-}CHD{=}CHD \rightarrow cy\text{-}CHDCHDS$									
Sulfur atom + cis-Ethene-1,2-d_2									
Z1 SIR/O'C	2		1.04	298-450	-	-	-		
NOTE: k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									

$S + CD_2{=}CD_2 \rightarrow cy\text{-}CD_2CD_2S$									
Sulfur atom + Ethene-d_4									
Z1 SIR/O'C	2		1.14	298-450	-	-	-		
NOTE: k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									

$S^*(^1D) + CH_3CH_3 \rightarrow$ products									
Sulfur atom + Ethane									
Z2 LII/DOL	2		0.17	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products									

$S + cy\text{-}CH_2CH_2S \rightarrow S_2 + CH_2{=}CH_2$									
Sulfur atom + Thiirane									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.3exp(+906/T)									
k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									
Z3 KLE/DAV1	2			298-355	2.7(+13)	0	0	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
S + $CH_3C{\equiv}CH$ → cy-$(CH_3)C{=}CHS$									
Sulfur atom + 1-Propyne									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 6.2exp(-453/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.1(+12)	-	-		
NOTE: Recommended k.									
S + $CH_3C{\equiv}CH$ → products									
Sulfur atom + Propyne									
Z0 YAN/SAE	2			298-449	2.0(+13)	0	453±100	0.4	1.6
S + $CH_3CH{=}CH_2$ → cy-$(CH_3)CHCH_2S$									
Sulfur atom + Propene									
Z1 COH/YAN	2			298	6.0(+12)	-	-	0.8	1.2
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 1.0exp(+574/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	5.0(+12)	-	-		
NOTE: Recommended k.									
Z2 KER/PAR	2		6.9	298	-	-	-		
NOTE: k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Z3 KLE/DAV2	2			214-500	3.6(+12)	0	190±45	0.2	5.2
$S^*(^1D)$ + $CH_3CH{=}CH_2$ → cy-$(CH_3)CHCH_2S$									
Sulfur atom + Propene									
Z2 KER/PAR	2		1.7	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
S + cy-$(CH_3)CHCH_2S$ → S_2 + $CH_3CH{=}CH_2$									
Sulfur atom + Thiirane,methyl-									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.4exp(+1057/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
S + $CH_3CH_2C{\equiv}CH$ → products									
Sulfur atom + 1-Butyne									
Z0 YAN/SAE	2			298	3.3(+12)	-	-	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
S + $CH_3C{\equiv}CCH_3$ → cy-$(CH_3)C{=}C(CH_3)S$									
Sulfur atom + 2-Butyne									
Z1 SIR/O'C				298-450	–	–	–		
NOTE: k/k_{ref}: 2.7exp(+654/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.9(+13)	–	–		
NOTE: Recommended k.									
S + $CH_3C{\equiv}CCH_3$ → products									
Sulfur atom + 2-Butyne									
Z0 VAN/SAF	2			298	1.6(+13)	–	–	0.9	1.1
S + $CH_2{=}CHCH{=}CH_2$ → cy-$(CH_2{=}CH)CHCH_2S$									
Sulfur atom + 1,3-Butadiene									
Z1 SIR/O'C	2			298-450	–	–	–		
NOTE: k/k_{ref}: 2.4exp(+102?/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	6.0(+13)	–	–		
NOTE: Recommended k.									
S + $CH_3CH_2CH{=}CH_2$ → cy-$(CH_3CH_2)CHCH_2S$									
Sulfur atom + 1-Butene									
Z1 CON/VAN	2			298	9.0(+12)	–	–	0.9	1.1
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2			298-450	–	–	–		
NOTE: k/k_{ref}: 0.75exp(+866/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	9.3(+12)	–	–		
NOTE: Recommended k.									
	2		10.0	298	–	–	–		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
Z3 KLE/DAV2	2			216-475	4.5(+12)	0	180±45	0.1	4.0
S + cis-$CH_3CH{=}CHCH_3$ → cy-$(CH_3)CHCH(CH_3)S$									
Sulfur atom + cis-2-Butene									
Z1 SIR/O'C	2			298 450	–	–	–		
NOTE: k/k_{ref}: 0.53exp(+1050/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.4(+13)	–	–		
NOTE: Recommended k.									
	2		16.0	298	–	–	–		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
S + cis-$CH_3CH{=}CHCH_3$ → products									
Sulfur atom + cis-2-Butene									
Z1 DAV/KLE	2			219-500	2.8(+12)	0	-116±45	0.9	1.1
S + trans-$CH_3CH{=}CHCH_3$ → cy-$(CH_3)CHCH(CH_3)$B									
Sulfur atom + trans-2-Butene									
Z1 CON/VAN	2			298	1.2(+13)	-	-	0.8	1.2
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.65exp(+1010/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.4(+13)	-	-		
NOTE: Recommended k.									
	2		20.0	298	-	-	-		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
S + $(CH_3)_2C{=}CH_2$ → cy-$(CH_3)_2CCH_2$B									
Sulfur atom + 1-Propene,2-methyl-									
Z1 CON/VAN	2			298	3.6(+13)	-	-	0.9	1.1
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.97exp(+1190/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Conventional photolysis method.									
Z2 KER/PAR	2			298	4.0(+13)	-	-		
NOTE: Recommended k.									
	2		50.0	298	-	-	-		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
$S^*(^1D)$ + $(CH_3)_2C{=}CH_2$ → cy-$(CH_3)_2CCH_2$B									
Sulfur atom + 1-Propene, 2-methyl-									
Z2 KER/PAR	2		3.5	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
S + $CH_3CH_2C{\equiv}CCH_3$ → products									
Sulfur atom + 2-Pentyne									
Z1 VAN/SAE	2			298	1.8(+13)	-	-	0.8	1.2
S + $CH_3CH_2CH_2CH{=}CH_2$ → cy-$(CH_3CH_2CH_2)CHCH_2$B									
Sulfur atom + 1-Pentene									
Z2 KER/PAR	2			298	8.1(+12)	-	-		
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
S + $CH_3CH_2C(CH_3)=CH_2$ → cy-$(CH_3CH_2)C(CH_3)CH_2$S									
Sulfur atom + 1-Butene, 2-methyl-									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.78exp(+1424/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	7.4(+13)	-	-		
NOTE: Recommended k.									
S + $CH_3CH=C(CH_3)_2$ → cy-$(CH_3)CHC(CH_3)_2$S									
Sulfur atom + 2-Butene, 2-methyl-									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.51exp(+1515/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	6.5(+13)	-	-		
NOTE: Recommended k.									
	2		56.0	298	-	-	-		
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
S + $(CH_3)_2C=C(CH_3)_2$ → cy-$[(CH_3)_2]CC[(CH_3)_2]$S									
Sulfur atom + 2-Butene, 2,3-dimethyl-									
71 CON/VAN	2			298	>6.2(+13)	-	-	0.9	1.1
NOTE: Lower limit k.									
Flash photolysis method.									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.50exp(+1690/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	8.5(+13)	-	-		
NOTE: Recommended k.									
S + $(CH_3)_2C=C(CH_3)_2$ → products									
Sulfur atom + 2-Butene, 2,3-dimethyl-									
73 DAV/KLE	2			252-500	2.8(+12)	0	-650±115	0.6	1:4
S_2 + O → S + SO									
Sulfur dimer + Oxygen atom									
75 BEN/COL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
S_2 + H → S + SH									
Sulfur dimer + Oxygen atom									
75 BEN/COL	2				7.9(+12)	0.5	8355		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$S_2 + S \rightarrow S + S_2$									
Sulfur dimer + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S_2 + S_2 + M \rightarrow S_4 + M$									
Sulfur dimer									
Z2 LAN/OLD	3	CO_2		293	9.1(+17)	-	-	0.1	10.
Z3 LAN/OLD	3	CO_2		293	3.6(+18)	-	-		
NOTE: Given with caution.									
$S_2 + N \rightarrow S + NS$									
Sulfur dimer + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$S_2 + C \rightarrow S + CS$									
Sulfur dimer + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO + O \rightarrow O + SO$									
Sulfur monoxide + Oxygen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO + O \rightarrow S + O_2$									
Sulfur monoxide + Oxygen atom									
Z5 BEN/GOL	2				2.0(+11)	0.5	2770		
NOTE: Semi-empirical evaluation.									
$SO + O + M \rightarrow SO_2 + M$									
Sulfur monoxide + Oxygen atom									
Z1 MIY/IAK1	3	Ar		298	7.3(+16)	-	-	0.9	1.1
Z6 BAU/DRY	3			298	6.7(+13)	-	-	0.7	1.3
NOTE: Recommended k.									
$SO + O_2 \rightarrow SO_2 + O$									
Sulfur monoxide + Oxygen molecule									
Z6 BAU/DRY	2			440-2100	4.5(+11)	0	3250±590	0.3	1.7
NOTE: Recommended k.									
$SO + O_3(v=n) \rightarrow SO_2^* + O_2$									
Sulfur monoxide + Ozone									
Z4 KAL/DRA	2		2.4	300	-	-	-	0.8	1.3
NOTE: k_{ref}: $SO + O_3 \rightarrow SO_2^* + O_2$									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
SO + H → O + SH									
Sulfur monoxide + Hydrogen atom									
ZS BEN/GOL	2				6.3(+11)	0.5	19930		
NOTE: Semi-empirical evaluation.									
SO + H → S + OH									
Sulfur monoxide + Hydrogen atom									
ZS BEN/GOL	2				4.0(+12)	0.5	11200		
NOTE: Semi-empirical evaluation.									
SO + OH → SO$_2$ + H									
Sulfur monoxide + Hydroxyl free radical									
ZZ JOU/LEB	2			298	5.1(+13)	-	-	0.8	1.2
SO + S → O + S$_2$									
Sulfur monoxide + Sulfur atom									
ZS BEN/GOL	2				6.3(+11)	0.5	11500		
NOTE: Semi-empirical evaluation.									
SO + S → S + SO									
Sulfur monoxide + Sulfur atom									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
SO + SO → SO$_2$ + S									
Sulfur monoxide									
ZS CUU/CAL	2			298	5.0(+8)	-	-	0.2	1.8
SO + SO$_3$ → SO$_2$ + SO$_2$									
Sulfur monoxide + Sulfur trioxide									
ZS CUU/CAL	2			298	1.2 +9)	-	-	0.4	1.6
SO + N → O + NS									
Sulfur monoxide + Nitrogen atom									
ZS BEN/GOL	2				1.6(+12)	0.5	8254		
NOTE: Semi-empirical evaluation.									
SO + N → S + NO									
Sulfur monoxide + Nitrogen atom									
ZS BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
SO + NO$_2$ → SO$_2$ + NO									
Sulfur monoxide + Nitrogen oxide(NO$_2$)									
ZA MIY/IOK2	2			890	1.2(+16)	-	-	0.9	1.1
SO + C → O + CS									
Sulfur monoxide + Carbon atom									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									

NOTE: Semi-empirical evaluation.

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$SO + C \rightarrow S + CO$									
Sulfur monoxide + Carbon atom									
ZS MCN/COL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO_2 + O \rightarrow SO + O_2$									
Sulfur dioxide + Oxygen atom									
ZG BAU/DRY	2			440-2100	1.3(+14)	-0.5	9980	0.3	1.7
NOTE: Recommended k. $k_1 = Kk_{-1}$									
$SO_2 + O + M \rightarrow SO_3 + M$									
Sulfur dioxide + Oxygen atom									
ZA BIK/PII3	3	N_2O		299-392	3.3(+16)	0	1000±200		
ZS WES/DEU2	3	He		248-415	3.3(+16)	0	1400±50	0.8	1.2
	3	He		297	3.0(+14)	-	-	0.9	1.1
NOTE: M_{eff}: He(1.0)									
M_{eff}: SO_2(9.5)	3	SO_2		297	2.9(+15)	-	-	0.7	1.3
M_{eff}: N_2(2.4)	3	N_2		297	7.2(+14)	-	-	0.9	1.1
ZU BIK/PII4	3	Ar		299-400	1.1(+16)	0	1010±150		
	3	N_2		300	5.0(+14)	-	-	0.8	1.2
	3	SO_2		299	3.4(+15)	-	-	0.7	1.3
ZZ MER/LEV	3			1685	7.4(+14)	-	-		
$SO_2 + O_2^*(^1\Delta_g) \rightarrow SO_3 + O$									
Sulfur dioxide + Oxygen molecule									
ZG DUM	2			298	1.3(+8)	-	-		
$SO_2^* + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
ZU PAR/UEI	2		0.05	298	-	-	-		
NOTE: k_{ref}: $SO_2^* \rightarrow {}^1SO_2$, or SO_2 (SO_2^* is a singlet formed on absorption).									
$^1SO_2 + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
ZU PAR/UEI	2		0.29	298	-	-	-		
NOTE: k_{ref}: $^1SO_2 + SO_2 \rightarrow$ products ($^1SO_2$ is a fluorescent singlet).									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
$SO_2{}^*(^3B_1) + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
70 PAR/HEI	2		0.36	298	-	-	-		
NOTE: k_{ref}: $SO_2{}^*(^3B_1) + SO_2 \rightarrow$ products									
$SO_2 + O_3 \rightarrow SO_3 + O_2$									
Sulfur dioxide + Ozone									
74 DAV/PRU	2			300	(6.0(+1)	-	-		
NOTE: Upper limit k.									
$SO_2 + H + M \rightarrow HSO_2 + M$									
Sulfur dioxide + Hydrogen atom									
76 FAU/DRY	3			1660-2120	5.1(+15)	-	-	0.5	1.5
NOTE: Recommended k.									
$SO_2 + OH(v=9) \rightarrow HSO_3$									
Sulfur dioxide + Hydroxyl free radical									
72 WOR/COL	2			298	)1.4(+10)	-	-	0.8	1.2
NOTE: Lower limit k. Unreported T assumed to be 298K.									
$SO_2 + OH + M \rightarrow HOSO_2 + M$									
Sulfur dioxide + Hydroxyl free radical									
74 COX2	2			294	3.6(+11)	-	-	0.9	1.1
NOTE: Evaluation. Rate constant expressed as k[M] with M = $N_2 + O_2$ at 1 atm.									
75 COS/DAV	2	N_2		298	3.6(+11)	-	-		
NOTE: Limiting high-pressure k (760 torr).									
	3	N_2		298	5.8(+16)	-	-		
k_0 (low pressure: (20 torr).									
75 COR/MUL1	2	H_2O		435	1.1(+12)	-	-	0.9	1.1
NOTE: In an atmosphere of water vapor.									
75 HAR/WAY	3	Ar		298	1.6(+17)	-	-	0.7	1.3
	3	N_2		298	2.6(+17)	-	-	0.9	1.1
76 AIK/PER3	2	Ar		298	4.0(+11)	-	-	0.9	1.1
NOTE: At 760 torr.									
	2	Ar		298	5.0(+11)	-	-		
Limiting high-pressure k.									
	3	Ar		298	5.9(+16)	-	-	0.8	1.2
k_0 (low-pressure k).									
77 COV/ION	2	N_2		297	3.6(+11)	-	-		
NOTE: Limiting high-pressure k (760 torr).									
	3	N_2		297	5.8(+16)	-	-		
k_0 (low-pressure k).									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
	3	N_2		253-297	5.0(+14)	0	-1410		
k_0 (low pressure). On the basis of k_0(297) and E_a experimental values.									
	3	N_2		253-297	2.5(+29)	-5.1	0		
k_0 (low-pressure k). Alternative T-dependent expression.									
22 DAV/RAV	2	N_2		298	5.4(+11)	-	-	0.8	1.3
NOTE: Unreported T assumed to be 298K.									
$SO_2 + HO_2 \rightarrow SO_3 + OH$									
Sulfur dioxide + Hydroperoxyl free radical									
23 PAY/SII	2			300	5.2(+8)	-	-	0.8	1.2
NOTE: Evaluation.									
24 LLO	2			300	5.2(+8)	-	-	0.9	1.2
NOTE: Evaluation. Ratio data versus k_{ref} for reaction $HO_2 + HO_2 \rightarrow H_2O_2 + O_2$									
22 BUR/CLI				298	(1.2(+7)	-	-		
NOTE: Upper limit k.									
$SO_2 + HO_2 \rightarrow$ products									
Sulfur dioxide + Hydroperoxyl free radical									
22 GRA/WIN	2			300	(6.0(+5)	-	-		
NOTE: Upper limit k.									
$SO_2 + HO_2 + M \rightarrow HO_2SO_2 + M$									
Sulfur dioxide + Hydroperoxyl free radical									
22 BUR/CLI	3	He		298	(1.5(+17)	-	-		
NOTE: Upper limit k.									
$SO_2 + SO_2^*(^1B_1) \rightarrow SO^*(^1\Delta_g, ^3\Sigma^-) + SO_3$									
Sulfur dioxide									
25 CHO/CAL	2			298	2.2(+12)	-	-	0.8	1.2
$SO_2 + SO_2^*(^3B_1) \rightarrow SO + SO_3$									
Sulfur dioxide									
20 MAR/BLI	2			298	2.0(+14)	-	-		
NOTE: In an atmosphere of water vapor. (Approximate k).									
$SO_2 + SO_2^*(^3B_1) \rightarrow SO^*(^3\Sigma^-) + SO_3$									
Sulfur dioxide									
25 CHO/CAL	2			298	4.2(+10)	-	-	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f F
$SO_2 + NO_2 \rightarrow SO_3 + NO$								
Sulfur dioxide + Nitrogen oxide(NO_2)								
71 ARM/CUL	2			703-1193	6.3(+12)	0	13950	
77 EBE/COL	2			430-1850	6.3(+12)	0	16000	
NOTE: Extended validity of k reported in 71 ARM/CUL (above), up to 2000K.								
$SO_2 + NO_2^* \rightarrow$ products								
Sulfur dioxide + Nitrogen oxide(NO_2)								
70 IWA/PRE	2			298	8.2(+10)	-	-	
NOTE: At 50 torr.								
$SO_2 + NO_3 \rightarrow SO_3 + NO_2$								
Sulfur dioxide + Nitrogen oxide(NO_3)								
75 DOU/COL	2			300	(4.2(+3)	-	-	
NOTE: Upper limit k.								
$SO_2 + N_2O_5 \rightarrow SO_3 + N_2O_4$								
Sulfur dioxide + Nitrogen oxide(N_2O_4)								
75 DOU/COL	2			300	(2.5(+1)	-	-	
NOTE: Upper limit k.								
$^1SO_2^* + CO \rightarrow SO + CO_2$								
Sulfur dioxide + Carbon monoxide								
73 CEH/DEI	2			300	-	-	-	
NOTE: k_{ref}: $^1SO_2^* + SO_2 \rightarrow$ products.								
$k/k_{ref} = 5.0 \times 10^{-3}$ (at 2537 A^0)	2			300	-	-	-	
$k/k_{ref} = 1.5 \times 10^{-3}$ (at 3130 A^0)								
$SO_2^* + CO \rightarrow SO + CO_2$								
Sulfur dioxide + Carbon monoxide								
73 CEH/DEI	2			300	-	-	-	
NOTE: k_{ref}: $SO_2^* \rightarrow$ products								
$k/k_{ref} = 2.2 \times 10^{-5}$ (3130 to 3261 A^0)								
(SO_2^* is a vibrationally excited singlet).								

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$SO_2^{**} + CO \rightarrow SO + CO_2$									
Sulfur dioxide + Carbon monoxide									
73 CEH/UEI	2			300	-	-	-	0.7	1.4
NOTE: k_{ref}: $SO_2^{**} \rightarrow SO_2$									
$k_{ref} = 1.8 \times 10^{-5}$ (2537 to 3261 A°)									
(SO_2^{**} is a chemically active triplet).									
$SO_2 + CO + M \rightarrow$ products									
Sulfur dioxide + Carbon monoxide									
71 BAU/JEE	2	Ar		1770-2453	2.7(+12)	0	24300±600	0.8	1.3
NOTE: At 27-170 torr pressure.									
$SO_2 + CH_3 + M \rightarrow CH_3SO_2 + M$									
Sulfur dioxide + Methyl free radical									
73 JAM/KER	2			298	1.8(+11)	-	-	0.9	1.1
NOTE: Limiting high-pressure k.									
$SO_2 + CH_3O_2 \cdot \rightarrow CH_3O_2SO_2$									
Sulfur dioxide + Methyldioxy free radical									
72 SAN/GIM	2			298	4.9(+9)	-	-	0.9	1.1
72 SIM/UEI	2		0.0025	296	-	-	-	0.8	1.2
NOTE: k_{ref}: $NO + CH_3O_2 \cdot \rightarrow NO_2 + CH_3O \cdot$									
$SO_2 + CH_3O_2 \cdot \rightarrow$ products									
Sulfur dioxide + Methyldioxy free radical									
72 KAN/NCO	2			296	3.2(+9)	-	-	0.8	1.2
NOTE: Best k estimate, based on apparent rate constant ($k_{app} \approx 2k$).									
$SO_2 + CH{\equiv}CH \rightarrow$ products									
Sulfur dioxide + Ethyne									
71 EIE/NOR	2			1550-2150	3.2(+10)	0.5	20535		
NOTE: Given with caution.									
$SO_2^{**} + CH_2{=}C{=}CH_2 \rightarrow$ products									
Sulfur dioxide + 1,2-Propadiene									
70 PAR/UEI	2		4.0	298	-	-	-		
NOTE: k_{ref}: $SO_2^{**} + CH_2{=}C{=}CH_2 \rightarrow$ CO + other products									
(SO_2^{**} is a non-emitting triplet).									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
$SO_2^*(^3B_1) + cis\text{-}CH_3CH{=}CHCH_3 \rightarrow [cis\text{-}CH_3CH{=}CHCH_3.SO_2]^*$									
Sulfur dioxide + cis-2-Butene									
Z4 DEM/CAL	2			294	1.3(+14)	-	-	0.9	1.1
$SO_2^*(^3B_1) + trans\text{-}CH_3CH{=}CHCH_3 \rightarrow [trans\text{-}CH_3CH{=}CHCH_3.SO_2]^*$									
Sulfur dioxide + trans-2-Butene									
Z4 DEM/CAL	2			294	1.2(+14)	-	-	0.9	1.1
$SO_2^*(^1B_1) + (CH_3)_3CH \rightarrow$ products									
Sulfur dioxide + Propane, 2-methyl-									
Z0 SU /CAL	2			298	8.4(+12)	-	-		
NOTE: Evaluation.									
$SO_2^*(^3B_1) + (CH_3)_3CH \rightarrow$ products									
Sulfur dioxide + Propane, 2-methyl-									
Z0 SU /CAL	2			298	8.7(+11)	-	-		
NOTE: Evaluation.									
$SO_2^*(^3B_1) + cis\text{-}CH_3CH_2CH{=}CHCH_3 \rightarrow [SO_2.CH_3CH_2CH{=}CHCH_3]^*$									
Sulfur dioxide + cis-2-Pentene									
Z6 WAM	2			295	6.3(+13)	-	-	0.8	1.2
$SO_2^*(^3B_1) + trans\text{-}CH_3CH_2CH{=}CHCH_3 \rightarrow [SO_2.CH_3CH_2CH{=}CHCH_3]^*$									
Sulfur dioxide + trans-2-Pentene									
Z6 WAM	2			295	1.0(+14)	-	-	0.7	1.3
$SO_2 + M \rightarrow SO + O + M$									
Sulfur dioxide									
Z9 GRI/REE	2	Ar		2800-3800	8.0(+15)	0	54350	0.7	1.3
$SO_3 + O \rightarrow SO_2 + O_2$									
Sulfur trioxide + Oxygen atom									
Z1 MER/LEV	2			1100-1400	6.5(+14)	0	5435		
NOTE: k determined in H_2S flame.									
k determined in COS flame.	2			900-1600	2.8(+14)	0	6040		
Z6 JAC/WIN	2			300-500	1.5(+8)	0	500		
Z9 MER/LEV	2			1685	1.5(+11)	-	-		

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$SO_3 + O + M \rightarrow SO_2 + O_2 + M$									
Sulfur trioxide + Oxygen atom									
Z9 WES/DEU1	3	He		290-507	5.0(+16)	0	-705	0.9	1.1
	3	He		298	7.3(+17)	-	-	0.9	1.1
NOTE: M_{eff}: He(1.0)									
	3	SO_3		298	(7.3(+18)	-	-		
M_{eff}: SO_3((10.0) Upper limit ratio.									
	3	N_2		298	1.0(+18)	-	-	0.9	1.1
M_{eff}: N_2(1.4)									
$SO_3 + H_2O \rightarrow H_2SO_4$									
Sulfur trioxide + Water									
Z5 COS/DAV	2			298	5.5(+11)	-	-	0.8	1.2
$SO_3 + SO \rightarrow SO_2 + SO_2$									
Sulfur trioxide + Sulfur monoxide									
Z5 CUV/GAL	2			298	1.2(+9)	-	-	0.4	1.6
$SO_3 + N \rightarrow SO_2 + NO$									
Sulfur trioxide + Nitrogen atom									
Z2 JAC/WIN	2			300	3.0(+8)	-	-		
Z5 WES/DEU1	2			298	(6.0(+6)	-	-		
NOTE: Upper limit k.									
$SO_3 + M \rightarrow SO_2 + O + M$									
Sulfur trioxide									
Z2 OSI/GLA	2	Ar		1700-2500	3.2(+15)	0	31900±300	0.6	1.6
$S_2O + O \rightarrow SO + SO$									
Sulfur oxide(S_2O) + Oxygen atom									
Z4 SIE/OLV	2			298	9.0(+11)	-	-	0.9	1.1
NOTE: Evaluation.									
$SH + O \rightarrow S + OH$									
Mercapto free radical + Oxygen atom									
Z5 WEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$SH + O \rightarrow SO + H$									
Mercapto free radical + Oxygen atom									
Z5 WEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
Z5 CUP/GLA	2			295	9.6(+13)	-	-	0.7	1.3

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
SH + H → S + H_2									
Mercapto free radical + Hydrogen atom									
Z2 LAU/OLD	2			293	(6.0(+12)	-	-		
Z3 BRA/IRU	2			298	2.5(+13)	-	-		
Z5 CUP/GLA	2			298	1.5(+13)	-	-	0.7	1.3
Z6 BAU/DBY	2			298	1.5(+13)	-	-	0.5	1.5
NOTE: Recommended k.									
SH + H → H + SH									
Mercapto free radical + Hydrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
SH + S → H + S_2									
Mercapto free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation									
SH + S → S + SH									
Mercapto free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
SH + SH → H_2S + S									
Mercapto free radical									
Z2 LAN/OLD	2			293	(1.8(+13)	-	-		
NOTE: Upper limit k.									
Z3 BRA/IRU	2			298	7.8(+12)	-	-		
Z6 BAU/DBY	2			295	7.8(+12)	-	-	0.5	1.5
NOTE: Recommended k.									
SH + N → H + NS									
Mercapto free radical + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	403		
NOTE: Semi-empirical evaluation.									
SH + N → S + NH									
Mercapto free radical + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	9060		
NOTE: Semi-empirical evaluation.									
SH + NO → products									
Mercapto free radical + Nitrogen oxide(NO)									
Z3 BRA/IRU	2			298	6.3(+11)	-	-		
SH + C → H + CS									
Mercapto free radical + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
SH + C → S + CH									
Mercapto free radical + Carbon atom									
Z5 DEN/GOL	2				4.0(+11)	0.5	6090		
NOTE: Semi-empirical evaluation.									
H_2S + O → SH + OH									
Hydrogen sulfide + Oxygen atom									
Z6 WHY/TIM	2			263-495	4.4(+12)	0	1660±50	0.9	1.1
Z9 WUY/TIN	2			263-495	4.4(+12)	0	1660±50	0.8	1.2
D_2S + O → SD + OD									
Hydrogen sulfide(D_2S) + Oxygen atom									
Z6 WUY/TIN	2			298-450	6.3(+12)	0	2145±155	0.5	1.5
H_2S + O → products									
Hydrogen sulfide + Oxygen atom									
Z0 SLA/BAL	2			281-497	1.5(+13)	0	1920±45	0.9	1.1
NOTE: k based on editor's least square fit of 6 given experimental points.									
Z2 GIN/IRW	2			297-502	1.6(+13)	0	2171±202	0.5	1.5
H_2S + O_3 → SO_2 + H_2O									
Hydrogen sulfide + Ozone									
Z5 BCC/LNO	2			298	(1.2(+4)	-	-		
NOTE: Upper limit k. Unreported T assumed to be 298K.									
Z5 GLA/TOR1	2			293-343	4.9(+10)	0	3420		
NOTE: Estimated k.									
Z5 GLA/TOR2	2			298-343	1.6(+12)	0	2620±600	0.2	6.3
Z5 BAU/DRY	2			298	4.0(+2)	-	-	0.1	10.0
NOTE: Recommended k.									
H_2S + H → SH + H_2									
Hydrogen sulfide + Hydrogen atom									
Z1 KUR/PET	2			190-464	7.8(+12)	0	860±30	0.9	1.1
Z2 BOH/SCH	2			298	2.3(+11)	-	-	0.8	1.3
Z3 BRA/TRU	2			298	5.0(+11)	-	-		
Z6 BAU/DRY	2			190-470	7.0(+12)	0	860±50	0.5	1.5
NOTE: Recommended k.									
H_2S + OH → SH + H_2O									
Hydrogen sulfide + Hydroxyl free radical									
Z3 WES/DEU3	2			298-885	1.4(+13)	0	443		
Z4 SIU	2			298	1.9(+12)	-	-	0.8	1.2
Z6 BAU/DRY	2			298-900	6.3(+12)	0	200±150	0.7	1.3
NOTE: k factors changing to: f = 0.5 and F = 1.5 at 900K. Recommended k.									
Z6 PUB/OIK1	2			397-427	3.1(+12)	0	0	0.8	1.2

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$H_2S + OH \rightarrow$ products (overall)									
Hydrogen sulfide + Hydroxyl free radical									
Z2 NIK/MOR1	2			300	5.2(+12)	-	-		
NOTE: Approximate k.									
$H_2S + OH(v=9) \rightarrow$ products									
Hydrogen sulfide + Hydroxyl free radical									
Z2 WOR/COL	2			298	>1.5(+11)	-	-	0.6	1.4
NOTE: Lower limit k.									
. Unreported T assumed to be 298K.									
$H_2S + CH_3 \rightarrow SH + CH_4$									
Hydrogen sulfide + Methyl free radical									
Z6 KER/PAR	2			300-600	2.0(+11)	0	2065±150	0.4	2.5
NOTE: Tentative k value.									
$H_2S + M \rightarrow SH + H + M$									
Hydrogen sulfide									
Z6 WIG/SAI	2	Ar		2300-3000	1.3(+16)	0	46300		
Z2 BOW/DOD	2	Ar		2700-3800	2.0(+13)	0	37300±960	0.7	1.5
CS + O → S + CO									
Carbon monosulfide free radical + Oxygen atom									
Z1 HAN/SMI	2			298	8.4(+12)	-	-		
NOTE: Evaluation.									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
Z0 KOL	2			300	1.3(+13)	-	-	0.8	1.2
NOTE: Unreported T assumed to be 300K.									
CS + O → S + CO(v=n)									
Carbon monosulfide free radical + Oxygen atom									
Z2 HAN/RID	2		0.1	298	-	-	-		
NOTE: k_{ref}: CS + O → S + CO(v=13)									
Ratio increasing from 0.1 to 0.9 between v=7 and v=12, then decreasing to 0.3 from v=14 to v=15.									
Unreported T assumed to be 298K.									
Z5 SLA/GRA1	2			305	1.2(+13)	-	-	0.9	1.1
Z4 RID/BRE	2			300	1.4(+13)	-	-	0.8	1.2
CS + O → SH + C									
Carbon monosulfide free radical + Oxygen atom									
Z5 BEN/GOL	2				1.6(+12)	0.5	28940		
NOTE: Semi-empirical evaluation.									
CS + H → S + CH									
Carbon monosulfide free radical + Hydrogen atom									
Z5 BEN/GOL	2				1.3(+13)	.0.5	50930		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
CS + H → SH + C									
Carbon monosulfide free radical + Hydrogen atom									
Z5 BEN/GOL	2				2.0(+13)	0.5	40870		
NOTE: Semi-empirical evaluation.									
CS + S → S + CS									
Carbon monosulfide free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
CS + S → C + S_2									
Carbon monosulfide free radical + Sulfur atom									
Z5 BEN/GOL	2				1.6(+12)	0.5	40463		
NOTE: Semi-empirical evaluation.									
CS + S + M → CS_2 + M									
Carbon monosulfide free radical + Sulfur atom									
Z6 BOU/DRY	3			1800-3700	8.7(+13)	0	4370	0.5	1.5
NOTE: $k_1 = Kk_{-1}$									
Recommended k.									
CS + N → S + CN									
Carbon monosulfide free radical + Nitrogen atom									
Z5 BEN/GOL	2				1.3(+12)	0.5	1160		
NOTE: Semi-empirical evaluation.									
CS + N → C + NS									
Carbon monosulfide free radical + Nitrogen atom									
Z5 BEN/GOL	2				4.0(+12)	0.5	37200		
NOTE: Semi-empirical evaluation.									
CS + C → S + C_2									
Carbon monosulfide free radical + Carbon atom									
Z5 BEN/GOL	2				5.0(+11)	0.5	20435		
NOTE: Semi-empirical evaluation.									
CS + C → C + CS									
Carbon monosulfide free radical + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
CS_2 + O → CS + SO									
Carbon disulfide + Oxygen atom									
Z1 IAK	2			298	1.4(+12)	-	-	0.9	1.1
Z5 WEI/TIM	2			210-293	1.7(+13)	0	645±35	0.9	1.1
Z6 BOU/DRY	2			200-1000	2.2(+13)	0	700	0.7	1.3
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$CS_2 + O \rightarrow COS + S$									
Carbon disulfide + Oxygen atom									
Z4 SLA/GIL	2		0.093	302	-	-	-		
NOTE: k_{ref}: $CS_2 + O \rightarrow$ products									
Z6 DAU/DRY	2			302	2.2(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
Z7 GRA/GUT	2		0.090	249-500	-	-	-		
NOTE: k_{ref}: $CS_2 + O \rightarrow$ products									
within the given T range, the k/k_{ref} ratio decreases from 0.090±0.004 at 249K to 0.081±0.007 at 500K.									
	2			249-500	1.7(+11)	-	-	0.9	1.2
NOTE: Within the given T range, k increases from 1.7×10^{11} at 249K to 5.5×10^{11} $cm^3 mol^{-1} s^{-1}$ at 500K.									
$CS_2 + O \rightarrow$ products									
Carbon disulfide + Oxygen atom									
Z4 SLA/GIL	2			302	2.4(+12)	-	-		
Z4 GRA/GUT	2			249-500	1.7(+12)	-	-	0.9	1.1
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increases from 1.7×10^{12} at 249K to 6.7×10^{12} $cm^3 mol^{-1} s^{-1}$ at 500K.									
$CS_2 + OH \rightarrow$ products									
Carbon disulfide + Hydroxyl free radical									
Z0 AIK/PLR1	2			300	(4.2(+10)	-	-		
NOTE: Upper limit k.	2			425	(6.0(+10)	-	-		
NOTE: Upper limit k.									
Z0 KUR2	2			296	1.1(+11)	-	-	0.8	1.2
$CS_2 + S \rightarrow CS + S_2$									
Carbon disulfide + Sulfur atom									
Z6 DAU/DRY	2			298	3.9(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
$CS_2 + M \rightarrow CS + S + M$									
Carbon disulfide									
Z6 DAU/DRY	2	Ar		1800-3700	2.6(+15)	0	30960±9000	0.5	1.5
NOTE: Recommended k.									
$CS_2 + M \rightarrow$ products									
Carbon disulfide									
Z4 IRA	2				6.8(+14)	0	36000±700		
NOTE: k measured in shock tube. Unspecified high T range.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
COS + O → SO + CO									
Carbon oxide sulfide + Oxygen atom									
Z1 KRE	2			300-523	9.8(+12)	0	2265		
Z1 KRE/SIM	2			300-523	9.8(+12)	0	2265		
Z4 KLE/SII	2			263-502	9.9(+12)	0	2167±20	0.9	1.1
Z5 WEI/IIM	2			239-404	1.2(+13)	0	2150±35	0.8	1.2
Z4 BAU/DRY	2			190-1200	1.6(+13)	0	2250±250	0.5	1.5
NOTE: k factors changing to: f = 0.3 and F = 3.0 above 300K. Recommended k.									
COS + $O^*(^1D)$ → SO + CO									
Carbon oxide sulfide + Oxygen atom									
Z5 GU/SNE	2		4.1	300	-	-	-		
NOTE: k_{ref}: $O_2 + O^*(^1D) \rightarrow O_2^*(^1\Sigma_g^+) + O$									
	2			300	1.8(+14)	-	-		
NOTE: Evaluation.									
COS + H → CO + SH									
Carbon oxide sulfide + Hydrogen atom									
Z2 ROD/SGU	2			298	1.3(+10)	-	-	0.8	1.3
Z5 ISU/YOK	2			300-525	9.1(+12)	0	1965±105	0.9	1.1
Z6 BAU/DRY	2			298	1.3(+10)	-	-	0.8	1.3
NOTE: Recommended k.									
Z4 LEE	2			298-478	9.8(+13)	0	2775±40	0.9	1.1
Z2 LEE/SII	2			261-500	5.5(+12)	0	1940±55	0.8	1.2
COS + OH → products									
Carbon oxide sulfide + Hydroxyl free radical									
Z0 AIK/PER1	2			299	(4.2(+9)	-	-		
NOTE: Upper limit k.									
	2			430	(1.2(+10)	-	-		
NOTE: Upper limit k.									
Z0 KUR2	2			296	3.4(+10)	-	-		
COS + OH(v=9) → products									
Carbon oxide sulfide + Hydroxyl free radical									
Z2 WOR/COL	2			298	1.5(+10)	-	-	0.4	1.6
NOTE: Unreported T assumed to be 298K.									
COS + S → CO + S_2									
Carbon oxide sulfide + Sulfur atom									
Z2 JAK/AUM	2			298	1.1(+10)	-	-		
NOTE: Evaluation.									
Z4 KLE/DAV	2			233-245	9.2(+11)	0	1025±60	0.9	1.1
Z4 BAU/DRY	2			230-2600	1.7(+12)	0	2050±230	0.3	3.0
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$COS + S^*(^1D) \rightarrow CO + S_2$									
Carbon oxide sulfide + Sulfur atom									
Z2 LII/DAL	2		1.5	300	-	-	-		
NOTE: k_{ref}: $CH_2=CH_2 + S^*(^1D) \rightarrow$ products									
$COS + CD_3 \rightarrow CO + CD_3S$									
Carbon oxide sulfide + Methyl-d_3 free radical									
Z2 JAK/AUM	2			354-490	3.8(+11)	0	5710±175	0.6	1.0
NOTE: Evaluation.									
$COS + CN \rightarrow SCN + CO$									
Carbon oxide sulfide + Cyanogen free radical									
Z2 ADD/LEI	2			295	>1.8(+13)	-	-		
NOTE: Lower limit k.									
$COS + M \rightarrow$ products									
Carbon oxide sulfide									
Z4 IBA	2				8.3(+14)	0	31700±650		
NOTE: k measured in shock tube. Unspecified, high T range.									
$CH_3S^* + CH{\equiv}CH \rightarrow CH_3SCH{=}CH^*$									
Methylthio free radical + Ethyne									
Z2 KER/PAR	2			298-333	7.9(+7)	-	-		
NOTE: Recommended k.									
$CH_3S^* + CH_2=CH_2 \rightarrow CH_3SCH_2CH_2^*$									
Methylthio free radical + Ethene									
Z2 KER/PAR	2			298	4.8(+8)	-	-		
NOTE: Recommended k.									
$CH_3S^* + cy\text{-}CH_2CH_2S \rightarrow CH_3S_2^* + CH_2=CH_2$									
Methylthio free radical + Thiirane									
Z2 JAK/AUM	2			304-478	3.2(+11)	0	4430		
NOTE: Approximate k.									
$CH_3S^* + CH_3CH{=}CHCH_3 \rightarrow CH_3CH(SCH_3)CH(^*)CH_3$									
Methylthio free radical + 2-Butene									
Z2 KER/PAR	2			298-333	1.6(+9)	-	-		
NOTE: cis-trans equilibrium-weighted k.									
$CH_3SH \rightarrow CH_3 + SH$									
Methanethiol									
Z0 PEN/O'N	1			1005-1102	3.2(+15)	0	38550		
NOTE: Critical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
$CH_3SH + O \rightarrow CH_3^{\cdot} + HS(O)^{\cdot} + CH_3S(O)^{\cdot} + H + CH_3S^{\cdot} + CH_3O^{\cdot}$									
Methanethiol + Oxygen atom									
Z6 SLA/GRA	2			300	1.1(+12)	-	-		
Z0 SLA/POL	2			254-495	1.1(+12)	-	-		
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increasing from 1.1×10^{12} at 254K to 2.6×10^{12} $cm^3mol^{-1}s^{-1}$ at 495K.									
$CH_3SH + CH_3^{\cdot} \rightarrow {}^{\cdot}CH_2SH + CH_4$									
Methanethiol + Methyl free radical									
Z6 KER/POR	2			303	1.2(+8)	-	-	0.5	2.0
NOTE: Recommended k.									
$CD_3SH + CH_3^{\cdot} \rightarrow CD_3S^{\cdot} + CH_4$									
Methane-d_3-thiol + Methyl free radical									
Z6 KER/POR	2			400-500	1.1(+11)	0	2065±500	0.5	2.0
NOTE: Recommended k.									
$CD_3SH + CH_3^{\cdot} \rightarrow {}^{\cdot}CD_2SH + CH_3D$									
Methane-d_3-thiol + Methyl free radical									
Z6 KER/POR	2			400-500	7.6(+10)	0	4200±250	0.5	2.0
NOTE: Recommended k.									
$cy\text{-}CH_2CH_2S + O \rightarrow CH_2{=}CH_2 + SO$									
Thiirane + Oxygen atom									
Z6 LLE/TIM	2			260-424	8.1(+12)	0	10±20	0.9	1.1
$cy\text{-}CH_2CH_2S + H \rightarrow CH_2{=}CH_2 + SH$									
Thiirane + Hydrogen atom									
Z6 YOK/OUM	2			300-425	5.7(+13)	0	978±00	0.9	1.1
$cy\text{-}CH_2SCH_2 + H \rightarrow cy\text{-}CH_2SCH^{\cdot} + H_2$									
Thiirane + Hydrogen atom									
Z6 LEE	2			298	7.1(+11)	-	-	0.8	1.2
$cy\text{-}CH_2CH_2S + S \rightarrow CH_2{=}CH_2 + S_2$									
Thiirane + Sulfur atom									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref} = 0.3exp(+906/T) k_{ref}: $CH_2{=}CH_2 + S \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									
Z1 KLE/DAV1	2			298-355	2.7(+13)	0	0	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$cy\text{-}CH_2CH_2S + CH_3 \rightarrow CH_2{=}CH_2 + CH_3S^{\cdot}$									
Thiirane + Methyl free radical									
Z2 JAK/AUM	2			304-478	7.1(+10)	0	3370±400	0.3	3.3
$cy\text{-}CH_2CH_2S + CD_3 \rightarrow CH_2{=}CH_2 + CD_3S^{\cdot}$									
Thiirane + Methyl-d_3 free radical									
Z2 JAK/AUM	2			303-477	5.9(+10)	0	3270±500	0.2	4.4
NOTE: Evaluation.									
$cy\text{-}CH_2CH_2S + CD_3 \rightarrow cy\text{-}CH_2CH(^{\cdot})S + CD_3H$									
Thiirane + Methyl-d_3 free radical									
Z2 JAK/AUM	2			303-477	2.2(+11)	0	4800±500	0.3	4.0
NOTE: Evaluation.									
Z0 KER/CAR	2			300-500	2.2(+11)	0	4800±500	0.5	2.0
NOTE: Recommended k.									
$cy\text{-}CH_2CH_2S + CH_3S^{\cdot} \rightarrow CH_2{=}CH_2 + CH_3S_2^{\cdot}$									
Thiirane + Methylthio free radical									
Z2 JAK/AUM	2			304-478	3.2(+11)	0	4430		
NOTE: Approximate k.									
$CH_3SCH_2^{\cdot} + CH_4 \rightarrow (CH_3)_2S + CH_3$									
Methyl, (methylthio)-, free radical + Methane									
Z0 ABI/LLE	2			393-518	6.3(+11)	0	7662		
NOTE: Evaluation based on k_{-1} and thermodynamic data.									
$CH_3CH_2SH \rightarrow CH_2{=}CH_2 + H_2S$									
Ethanethiol									
Z0 BEN/D'N	1			785-930	1.0(+13)	0	25900		
NOTE: Critical evaluation.									
$CH_3CH_2SH \rightarrow CH_3CH_2^{\cdot} + SH$									
Ethanethiol									
Z0 BEN/D'N	1			785-930	6.3(+15)	0	36336		
NOTE: Critical evaluation.									
$CH_3CH_2SH + O \rightarrow CH_3CH_2^{\cdot} + HS(O)^{\cdot} + CH_3CH_2S(O)^{\cdot} + H$									
Ethanethiol + Oxygen atom									
Z0 SLO/GRO	2			300	1.7(+12)	-	-		
Z0 SLO/PLO	2			257-495	1.9(+12)	-	-		
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increasing from 1.9×10^{12} at 257K to 3.2×10^{12} $cm^3mol^{-1}s^{-1}$ at 495K.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
$H_3CH_2SH + CH_3 \rightarrow$ products									
Ethanethiol + Methyl free radical									
Z6 KER/POR				304	3.5(+7)	–	–	1.5	2.0
NOTE: Tentative k.									
$(CH_3)_2S + O \rightarrow CH_3S(O)^{\cdot} + CH_3$									
Methane, thiobis-, + Oxygen atom									
Z6 LEE/LIM	2			260-424	0.6(+12)	0	-366±16	1.9	1.1
Z6 SLA/GKD				300	3.0(+13)	–	–		
Z6 SLA/BAL	2			252-493	3.0(+13)	–	–		
NOTE: Possible non-linear Arrhenius behavior within the given T range, k decreasing from 3.8×10^{13} at 252K to 2.2×10^{13} $cm^3 mol^{-1} s^{-1}$ at 493K.									
$(CH_3)_2S + O \rightarrow$ products									
Methane, thiobis-, + Oxygen atom									
Z4 CAD/WIC	2			300	3.3(+11)	–	–		
$(CH_3)_2S + O_3 \rightarrow$ PRODUCTS									
Methane, thiobis-, + Ozone									
Z6 BAR/HER	2			296	<5.0(+5)	–	–		
NOTE: Upper limit k.									
$(CH_3)_2S + H \rightarrow CH_3SH + CH_3$									
Methane, thiobis-, + Hydrogen atom									
Z2 YOK/SIR	2			300-472	1.7(+13)	0	1320±44	1.8	1.2
$(CH_3)_2S + H \rightarrow CH_3SCH_2^{\cdot} + H_2$									
Methane, thiobis-, + Hydrogen atom									
Z6 LEE				300	9.0(+10)	–	–	1.7	1.3
$(CH_3)_2S + OH \rightarrow$ PRODUCTS									
Methane, thiobis-, + Hydroxyl free radical									
Z6 AIK/PER1	2			300	5.9(+12)	–	–	1.9	1.1
	2			299-430	3.3(+12)	0	-179±150		
Z6 KUR1	2			273-426	3.7(+12)	0.	134±135	1.6	1.4
NOTE: Recommended k.									
$(CH_3)_2S + CH_3 \rightarrow CH_3SCH_2^{\cdot} + CH_4$									
Methane, thiobis-, + Methyl free radical									
Z6 ARI/LEE	2			393-510	4.2(+11)	0	4613±82	1.8	1.2
$CH_3SO_2CH_3 \rightarrow CH_3SO_2^{\cdot} + CH_3$									
Methane, sulfonylbis-									
Z6 BEN/O'N	1			783-913	2.0(+14)	0	30500		
NOTE: Critical evaluation									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
cy-$CH_2CH_2CH_2S$ + CH_3 → cy-$CH_2CH(\cdot)CH_2S$ + CH_4									
Thietane + Methyl free radical									
Z6 KER/PAR	1			300-450	3.2(+11)	0	4630±750		
NOTE: Tentative k.									
cy-$(CH_3)CHCH_2S$ + S → $CH_3CH{=}CH_2$ + S_2									
Thiirane, methyl-, + Sulfur atom									
Z1 SIR/OIC	2			290-450	-	-	-		
NOTE: k/k_{ref} = 0.4exp(1057/T)									
k_{ref}: $CH_2{=}CH_2$ + S → cy-CH_2CH_2S									
Conventional photolysis method.									
cy-$(CH_3)CHCH_2S$ + CH_3 → $CH_3CH{=}CH_2$ + CH_3S									
Thiirane, methyl-, + Methyl free radical									
Z2 JAK/AUM	2			339-435	2.1(+11)	0	3750±830	0.1	0.3
NOTE: Evaluation.									
cy-$(CH_3)CHCH_2S$ + CH_3 → cy-$[(CH_2\cdot)CHCH_2]S$ + CH_4									
Thiirane, methyl-, + Methyl free radical									
Z2 JAK/AUM	2			339-435	1.0(+11)	0	4160±440	0.3	3.0
$(CH_3)_2CHSH$ + CH_3 → products									
2-Propanethiol + Methyl free radical									
Z6 KER/PAR	2			303	4.1(+7)	-	-		
NOTE: Tentative k.									
cy-$CH_2CH_2CH_2CH_2S$ + H → $\cdot CH_2CH_2CH_2CH_2SH$									
Thiophene, tetrahydro-, + Hydrogen atom									
Z0 HOR/NIS	2			295-576	0.5(+12)	0	1010		
NOTE: At 5 torr.									
$CH_3C(S)SCH_2CH_3$ → CH_4 + CS_2 + $CH_2{=}CH_2$									
Ethane(dithioic) acid ethyl ester									
Z0 ALA/BIG	1			629	1.8(-3)	-	-		
	1			651-716	9.2(+12)	0	22730		
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$									
$CH_3CH_2CH_2CH_2SH$ + H → $CH_3CH_2CH_2CH_2\cdot$ + H_2S									
Butanethiol + Hydrogen atom									
Z0 HOR/NIS	2			295-576	1.6(+12)	0	1120		
NOTE: At 5 torr.									
$CH_3CH_2CH_2CH_2SH$ + H → $CH_3CH_2CH_2CH_2S\cdot$ + H_2									
Butanethiol + Hydrogen atom									
Z0 HOR/NIS	2			295-576	1.3(+13)	0	1600		
NOTE: At 5 torr.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	-E/R (in K)	k factors f F
$(CH_3)_3CSH \rightarrow (CH_3)_2C{=}CH_2 + H_2S$								
2-Propanethiol, 2-methyl-								
ZQ KEN/O'N	1			950-1230	2.5(+13)	0	27830	
NOTE: Critical evaluation.								
$(CH_3)_3CSH + CH_3^{\cdot} \rightarrow (CH_3)_3CS^{\cdot} + {}^{\cdot}CH_2C(CH_3)_2SH + CH_4$								
2-Propanethiol, 2-methyl-, + Methyl free radical								
ZG KER/PAR	2			303	5.9(+7)	-	-	
NOTE: Tentative k.								
$CH_2{=}CHCH_2SO_2CH_3 \rightarrow CH_2{=}CHCH_2^{\cdot} + CH_3SO_2^{\cdot}$								
1-Propene, 3-methylsulfonyl-								
ZQ KEN/O'N	1			573-633	5.0(+12)	0	20030	
NOTE: Critical evaluation.								
$CH_3SC(O)OCH_2CH_3 \rightarrow CH_3SH + CO_2 + CH_2{=}CH_2$								
Carbonothioic acid O-ethyl S-methyl ester								
ZZ OLA/DIG	1			629	1.0(-4)	-	-	
	1			490-550	1.8(+12)	0	23500	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3OC(O)SCH_2CH_3 \rightarrow CH_3OH + COS + CH_2{=}CH_2$								
Carbonothioic acid S-ethyl O-methyl ester								
ZZ ALA/BIG	1			629	7.8(-7)	-	-	
	1			490-550	1.2(+13)	0	27800	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3OC(O)SCH(CH_3)_2 \rightarrow CH_3OH + COS + CH_3CH{=}CH_2$								
Carbonothioic acid O-methyl S-(1-methylethyl) ester								
ZZ OLA/BIG	1			629	4.6(-5)	-	-	
	1			440-480	8.4(+12)	0	25000	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3SC(O)OCH(CH_3)_2 \rightarrow CH_3SH + CO_2 + CH_3CH{=}CH_2$								
Carbonothioic acid S-methyl O-(1-methylethyl) ester								
ZZ OLA/BIG	1			629	9.4(-3)	-	-	
	1			547-584	6.7(+11)	0	20060	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$. (Evacuated sealed tube method).								
$CH_3SC(O)OC(CH_3)_3 \rightarrow CH_3SH + CO_2 + CH_2{=}C(CH_3)_2$								
Carbonothioic acid O-(1,1-dimethylethyl) S-methyl ester								
ZZ OLA/BIG	1			629	4.2(-1)	-	-	
	1			479-502	5.4(+10)	0	16080	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$. (Inhibited sealed tube method).								

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f F
$CH_3OC(O)SC(CH_3)_3 \rightarrow CH_3OH + COS + CH_2{=}C(CH_3)_2$								
Carbonothioic acid S-(1,1-dimethylethyl) O-methyl ester								
ZZ ALA/BIG	1			629	1.2(-3)	-	-	
	1			370-420	1.4(+12)	0	21800	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SCH_2CH_2CH_2CH_3 \rightarrow CH_4 + CS_2 + CH_2{=}CHCH_2CH_3$								
Ethane(dithioic) acid butyl ester								
ZZ ALA/BIG	1			629	3.3(-3)	-	-	
	1			651-716	1.2(+13)	0	22500	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SCH(CH_3)CH_2CH_3 \rightarrow CH_4 + CS_2 + CH_2{=}CHCH_2CH_3$ + cis-, and trans-$CH_3CH{=}CHCH_3$								
Ethane(dithioic) acid 1-methylpropyl ester								
ZZ ALA/BIG	1			629	7.4(-2)	-	-	
	1			584-639	6.7(+12)	0	20210	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SC(CH_3)_3 \rightarrow CH_4 + CS_2 + (CH_3)_2C{=}CH_2$								
Ethane(dithioic) acid 1,1-dimethylethyl ester								
ZZ ALA/BIG	1			629	3.1(-1)	-	-	
	1			448-502	1.1(+13)	0	19600	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								

Bibliography

1970

70 BEN/O'N Benson, S. W., and O'Neal, H. E., "Kinetic Data on Gas Phase Unimolecular Reactions," NSRDS-NBS 21 (1970). (Supt. Doc., U. S. Govt. Printing Office, Washington, D.C. 20402).

1971

71 ARM/CUL Armitage, J. W., and Cullis, C. F., "Studies of the Reaction between Nitrogen Dioxide and Sulfur Dioxide," Combust. and Flame 16, 125 (1971).

71 BAU/JEF Bauer, S. H., Jeffers, P., Lifshitz, A., and Yadava, B. P., "Reaction between CO and SO_2 at Elevated Temperatures: A Shock-Tube Investigation," Symp. Combust. 13 (Combustion Institute Pittsburgh, Pa., (1971) 417.

71 CON/VAN Connor, J. Van Roodselaar, A., R. W., and Strausz, O. P., "The Addition of Group Via Atoms to Tetramethylthylene. An Addition Reaction with a Negative Activation Energy," J. Am. Chem. Soc., 93, 560 (1971).

71 FIF/MOR Fifer, R., Moreau, R., and Bauer, S. H., "The Reactions between SO_2 and C_2H_2 (and (C_2H_4) at Elevated Temperature. A Single-Pulse Shock Tube Investigation," Int. J. Chem. Kinet. 3, 249 (1971).

71 HAN/SMI Hancock, G., and Smith, I. W. M., "Infra-red Chemiluminescence from Vibrationally Excited CO. Part 1. The Reaction of Atomic Oxygen with Carbon Disulphide," Trans. of Faraday Soc. 67, 2568 (1971).

71 KRE Krezenski, D. C., "Competitive Reaction of $O(^3P)$ with Ozone and Carbonyl Sulfide," Diss. Abstr. Int. B 32, 2633 (1971).

71 KRE/SIM Krezenski, D. C., Simonaitis, R., and Heicklen, J., "The Reactions of $O(^3P)$ with Ozone and Carbonyl Sulfide," Int. J. Chem. Kinet. 3, 467 (1971).

71 KUR/PET Kurylo, M. J., Peterson, N. C., and Braun, W., "Absolute Rate of the Reaction H + H_2S," J. Chem. Phys. 54, 943 (1971).

71 MER/LEV Merryman, E. L., and Levy, A., "Sulfur Trioxide Flame Chemistry-H_2S and COS Flames," Sym. Combust. 13, (Combustion Institute Pittsburgh, Pa., 1971) 427.

71 MIY/TAK1 Miyazaki, S., and Takahashi, S., "On the Reaction of Oxygen Atom with Carbon Disulphide, Part 2. Memoirs of the Defense Acad. (Japan) 11, 307 (1971).

71 MIY/TAK2 Miyazaki, S., and Takahashi, S., "On the Reaction of Oxygen Atom with Carbon Disulphide. Part 3. Memoirs of the Defense Acad. (Japan) 11, 329 (1971).

71 STR/O'C Strausz, O. P., O'Callaghan, W. B., Lown, E. M., and Gunning, H. E., "Reactions of Sulfur Atoms. XII. Arrhenius Parameters for the Addition to Olefins and Acetylenes," J. Am. Chem. Soc. 93, 559 (1971).

71 TAK Takahashi, S., "On the Reaction of Oxygen Atom with Carbon-Disulphide. Part 1," Memoirs of the Defense Acad. (Japan) 11, 191 (1971).

1972

72 DAV/KLE1 Davis, D. D., Klemm, R. B., and Pilling, M., "A Flash Photolysis-Resonance Fluorescence Kinetics Study of Ground-State Sulfur Atoms: I. Absolute Rate Parameters for Reaction of $S(^3P)$ with $O_2(^3\Sigma)$," Int. J. Chem. Kinet. 4, 367 (1972).

72 DAV/KLE2 Davis, D. D., Klemm, R. B., Braun, W., and Pilling, M., "A Flash Photolysis-Resonance Fluorescence Kinetics Study of Ground-State Sulfur Atoms. II. Rate Parameters for Reaction of $S(^3P)$ with C_2H_4," Int. J. Chem. Kinet. 4, 383 (1972).

72 DON/LIT Donovan, R. J., and Little, D. J., "The Rate of the Reaction $S(^3P_j) + O_2$," Chem. Phys. Lett. 13, 488 (1972).

72 HAN/RID Hancock, G., Ridley, B. A., and Smith, I. W. M., "Infra-red Chemiluminescence from Vibrationally Excited CO. Part 2. Product Distribution from the Reaction O + CS → CO + S," Chem. Soc., Faraday Trans. II 68, 2117 (1972).

72 JAC/WIN Jacob, A., and Winkler, C. A., "Kinetics of the Reactions of Oxygen Atoms and Nitrogen Atoms with Sulfur Trioxide," J. Chem. Soc., Faraday Trans. I 68, 2077 (1972).

72 JAK/AHM Jakubowski, E., Ahmed, M. G., Lown, E. M., Sandhu, H. S., Gosavi, R. K., and Strausz, O. P., "Sulfur Atom Abstraction from Episulfides and Carbonyl Sulfide by Methyl Radicals," J. Am. Chem. Soc. 94, 4094 (1972).

72 KER/PAR Kerr, J. A., and Parsonage, M. J., "Evaluated Kinetic Data on Gas Phase Addition Reactions: Reactions of Atoms and Radicals with Alkenes, Alkynes and Aromatic Compounds," (Butterworths, London, 1972).

72 LAN/OLD Langford, R. B., and Oldershaw, G. A., "Flash Photolysis of H_2S," J. Chem. Soc., Faraday Trans. I 68, 1550 (1972).

72 LIT/DAL Little, D. J., Dalgleish, A., and Donovan, R. J., "Relative Rate Data for the Reactions of $S(^1D_2)$ using the NS Radical as Spectroscopic Marker," Faraday Dis. Chem. Soc. 53, 211 (1972).

72 NIK/MOR1 Niki, H., Morris, E. D. Jr., and Breitenbach, L. P., "Reaction of OH with H_2S," Am. Chem. Soc. 164th Meeting (Abstracts of Papers) 164, PHYS-116 (1972).

72 ROM/SCH Rommel, H., and Schiff, H. I., "The Reactions of H Atoms with H_2S and COS," Int. J. Chem. Kinetics 4, 547 (1972).

72 WOR/COL Worley, S. D., Coltharp, R. N., and Potter, A. E. Jr., "Rates of Interaction of Vibrationally Excited Hydroxyl (v = 9) with Diatomic and Small Polyatomic Molecules," J. Phys. Chem. 76, 1511 (1972).

1973

73 BRA/TRU Bradley, J. N., Trueman, S. P., Whytock, D. A., and Zaleski, T. A., "Electron Spin Resonance Study of the Reaction of Hydrogen Atoms with Hydrogen Sulphide," J. Chem. Soc., Faraday Trans. I 69, 416 (1973).

73 CEH/HEI Cehelnik, E., Heicklen, J., Braslavsky, S., Stockburger, L., and Mathias, E., "Photolysis of SO_2 in the Presence of Foreign Gases IV. Wavelength and Temperature Effects with CO," J. Photochem. 2, 31 (1973).

73 DAV/KLE Davis, D. D., and Klemm, R. B., "A Flash Photolysis-Resonance Fluorescence Kinetics Study of the Reactions of Ground-State Sulfur Atoms. V. Rate Parameters for the Reaction of $S(^3P)$ with cis-2-Butene and Tetramethylethylene," Int. J. Chem. Kinet. 5, 841 (1973).

73 JAM/KER James F. C., Kerr, J. A., and Simons, J. P., "Direct Measurement of the Rate of Reaction of the Methyl Radical with Sulphur Dioxide," J. Chem. Soc., Faraday Trans. I 69, 2124 (1973).

73 KLE/DAV1 Klemm, R. B., and Davis, D. D., "A Flash Photolysis Resonance Fluorescence Kinetics Study of Ground-State Sulfur Atoms. III. Rate Parameters for Reaction of $S(^3P)$ with Ethylene Episulfide," Int. J. Chem. Kinet. 5, 149 (1973).

73 KLE/DAV2 Klemm, R. B., and Davis, D. D., "A Flash Photolysis-Resonance Fluorescence Kinetics Study of Ground-State Sulfur Atoms. IV. Rate Parameters for Reaction of $S(^3P)$ with Propene and 1-Butene," Int. J. Chem. Kinet. 5, 375 (1973).

73 LAN/OLD Langford, R. B., and Oldershaw, G. A., "Mechanism of Sulfur Formation in the Flash Photolysis of Carbonyl Sulphide," J. Chem. Soc., Faraday Trans. I 69, 1389 (1973).

73 PAY/STI Payne, W. A., Stief, L. J., and Davis, D. D., "A Kinetics Study of the Reaction of HO_2 and SO_2 and NO," J. Am. Chem. Soc. 95 7614 (1973).

73 WES/DEH3 Westenberg, A. A., and DeHaas, N., "Rate of the Reaction $OH + H_2S \rightarrow SH + H_2O$ over an extended Temperature Range," J. Chem. Phys. 59, 6685 (1973).

1974

74 ATK/PIT3 Atkinson, R., and Pitts, J. N. Jr., "Rate Constants for the Reaction of $O(^3P)$ Atoms with SO_2(M-N_2O) over the Temperature Range 299-392 K," Chem. Phys. Lett. 29, 28 (1974).

74 CAD/WIC Cadle, R. D., Wickman, H. H., Hall, C. B., and Eberle, K. M., "The Reaction of Atomic Oxygen with Formaldehyde, Croton-aldehyde, and Dimethyl Sulfide," Chemosphere 3, 115 (1974).

74 COX2 Cox, R. A., "The Photolysis of Nitrous Acid in the Presence of Carbon Monoxide and Sulphur Dioxide," J. Photochem. 3, 291 (1974).

74 DAV/PRU Davis, D. D., Prusazcyk, J., Dwyer, M., and Kim, P., "A Stop-Flow Time-of-Flight Mass Spectrometry Kinetics Study. Reaction of Ozone with Nitrogen Dioxide and Sulfur Dioxide," J. Phys. Chem. 78, 1775 (1974).

74 DEM/CAL Demerjian, K. L., Calvert, J. G., and Thorsell, D. L., "A Kinetic Study of the Chemistry of the $SO_2(^3B_1)$ Reactions with cis-and trans-2-Butene," Int. J. Chem. Kinet. 6, 829 (1974).

74 KAL/BRA Kaldor, A., Braun, W., and Kurylo, M. J., "Infrared Laser Enhanced Reactions: O_3 + SO," J. Chem. Phys. 61, 2396 (1974).

74 KLE/DAV Klemm, R. B., and Davis, D. D., "A Flash Photolysis-Resonance Fluorescence Kinetics Study of the Reaction $S(^3P)$ + OCS," J. Phys. Chem. 78, 1137 (1974).

74 KLE/STI Klemm, R. B., and Stief, L. J., "Absolute Rate Parameters for the Reaction of Ground State Atomic Oxygen with Carbonyl Sulfide," J. Chem. Phys. 61, 4900 (1974).

74 LLO Lloyd, A. C., "Evaluated and Estimated Kinetic Data for Gas Phase Reactions of the Hydroperoxyl Radical," Int. J. Chem. Kinet. 6, 169-228 (1974).

74 SLA/GIL Slagle, I. R., Gilbert, J. R., and Gutman, D., "Kinetics of the Reaction between Oxygen Atoms and Carbon Disulfide," J. Chem. Phys. 61, 704 (1974).

74 STE/ALV Stedman, D. H., Alvord, H., and Baker-Blocker, A., "Chemiluminescent Reactions of Disulfur Monoxide," J. Phys. Chem. 78, 1248 (1974).

74 STU Stuhl, F., "Determination of the Rate Constant for the Reaction OH + H_2S by a Pulsed Photolysis-Resonance Fluorescence Method," Ber. Bunsenges. Phys. Chem. 78, 230 (1974).

74 TRA Trafton, W. E. Jr., "High Temperature Gas Phase Kinetic Studies of Carbonyl Sulfide, Nitrous Oxide, and Carbon Disulfide in a Shock Tube with Boundary Layer Corrections," Diss. Abstr. Int. B 34, 5935 (1974).

1975

75 BEC/INO Becker, K. H., Inocencio, M. A., and Schurath, U., "The Reaction of Ozone with Hydrogen Sulfide and its Organic Derivatives," Int. J. Chem. Kinet. 7 (Symp. 1), 205 (1975).

75 BEN/GOL Benson, S. W., Golden, D. M., Lawrence, R. W., Shaw, R., and Woolfolk, R. W., "Estimating the Kinetics of Combustion Including Reactions Involving Oxides of Nitrogen and Sulfur," Environmental Protection Agency Report No. EPA-600/2-75-019, August 1975.

75 CAS/DAV Castleman, A. W. Jr., Davis, R. E., Munkelwitz, H. R., Tang, I. N., and Wood, W. P., "Kinetics of Association Reactions Pertaining to H_2SO_4 Aerosol formation," Int. J. Chem. Kinet. 7 (Symp. 1), 629 (1975).

75 CHU/CAL Chung, K., Calvert, J. G., and Bottenhelm, J. W., "The Photochemistry of Sulfur Dioxide Excited within its First Allowed Band (3130 Å) and the "Forbidden" Band (3700-4000 Å)," Int. J. Chem. Kinet. 7, 161 (1975).

75 CLY/TOW Clyne, M. A. A., and Townsend, L. W., "Rate Constant Measurements for Rapid Reactions of Ground State Sulphur $3p^4(^3P_j)$ Atoms," Int. J. Chem. Kinet. 7 (Symp. 1), 73 (1975).

75 CUP/GLA Cupitt, L. T., and Glass, G. P., "Reactions of SH with Atomic Oxygen and Hydrogen," Int. J. Chem. Kinet. 7 (Symp. 1), 39 (1975).

75 DAU/CAL Daubendiek, R. L., and Calvert, J. G., "A Study of the N_2O_5-SO_2-O_3 Reaction System," Environmental Lett. 8, 103 (1975).

75 GAU/SNE Gauthier, M. J. E., and Snelling, D. R., "La Photolyse de L'ozone a 253.7 nm: Desactivation de $O(^1D)$ et de $O_2(^1\Sigma)$ par Les Gaz de L'atmosphere," J. Photochem. 4, 27 (1975).

75 GLA/TOB1 Glavas, S., and Toby, S., "The Reaction between Ozone and Hydrogen Sulfide: Kinetics and Effect of Added Gases," Am. Chem. Soc. ACS Symp. Ser. 17, 122 (1975).

75 GLA/TOB2 Glavas, S., and Toby, S., "Reaction between Ozone and Hydrogen Sulfide," J. Phys. Chem. 79, 779 (1975).

75 GOR/MUL1 Gordon, S., and Mulac, W. A., "Reaction of the $OH(X^2\Pi)$ Radical Produced by the Pulse Radiolysis of Water Vapor," Int. J. Chem. Kinet. (Symp. 1), 289 (1975).

75 HAR/WAY Harris, G. W., and Wayne, R. P., "Reaction of Hydroxyl Radicals with NO, NO_2 and SO_2," J. Chem. Soc., Faraday Trans. I 71, 610 (1975).

75 SLA/GRA1 Slagle, I. R., Graham, R. E., Gilbert, J. R., and Gutman, D., "Direct Atoms with Carbon Monosulphide," Chem. Phys. Lett. 32, 184 (1975).

75 TSU/YOK Tsunashima, Yokota, T., Saferik, I., Gunning, H. E., Strausz, O. P., "Abstraction of Sulfur Atoms from Carbonyl Sulfide by Atomic Hydrogen," J. Phys. Chem. 79, 775 (1975).

75 WEI/TIM Wei, C-N., and Timmons, R. B., "ESR Study of the Kinetics of the Reactions of $O(^3P)$ Atoms with CS_2 and OCS," J. Chem. Phys. 62, 3240 (1975).

75 WES/DEH1 Westenberg, A. A., and DeHaas, N., "Rate of the O + SO_3 Reaction," J. Chem. Phys. 62, 725 (1975).

75 WES/DEH2 Westenberg, A. A., and DeHaas, N., "Rate of the Reaction O + SO_2 + M → SO_3 + M," J. Chem. Phys. 63, 5411 (1975).

75 YOK/AHM Yokota, T., Ahmed, M. G., Safarik, I., Strausz, O. P., and Gunning, H. E., "Reaction of Hydrogen Atoms with Thiirane," J. Phys. Chem. 79, 1758 (1975).

1976

76 ART/LEE Arthur, N. L., and Lee, M-S., "Reactions of Methyl Radicals, I. Hydrogen Abstraction from Dimethyl Sulphide," Aust. J. of Chem. 29, 1483 (1976).

76 ATK/PER3 Atkinson, R., Perry, R. A., and Pitts, J. N. Jr., "Rate Constants for the Reactions of the OH Radical with NO_2(M-Ar and N_2) and SO_2(M-Ar)," J. Chem. Phys. 65, 306 (1976).

76 BAU/DRY Baulch, D. L., Drysdale, D. D., and Horne, D. G., "Evaluated Kinetic Data for High Temperature Reactions, Vol. 2: Homogeneous Gas Phase Reactions of the O_2-O_3 System, the CO-O_2-H_2 System, and Sulphur-Containing Species," (Butterworths, London, 1976).

76 BID/BRE Bida, G. T., Breckenridge, W. H., and Kolin, W. S., "A Kinetic Study of the very Fast Reaction: $O(^3P)$ + CS → CO + $S(^3P)$," H. Chem. Phys. 64, 3296 (1976).

76 DUM Dumas, J. L., "Etude de la Reactivite Chimique de l'oxygene singulet produit en Phase Gazeuse. I. Etudes en Phase Homogene," Bull. Soc. Chim. France, 658 (1976).

76 HIG/SAI Higashihara, R., Saito, Ko., and Yamamura, H., "S_2 Formation during the Pyrolysis of H_2S in Shock Waves," Bull. Chem. Soc. Japan 40, 965 (1976).

76 KER/PAR Kerr, J. A., and Parsonage, M. J., "Evaluated Kinetic Data on Gas Phase Hydrogen Transfer Reactions of Methyl Radicals," (Butterworths, London 1976).

76 LEE Lee, J. H., "Gas Phase Kinetic Study of some Simple Atom-Molecule Reactions using fast flow and Flash Photolysis-Resonance Fluorescence Techniques," Diss. Abstracts Int. 36, 6192 (1976).

76 LEE/TIM Lee, J. H., Timmons, R. B., and Stief, L. J., "Absolute Rate Parameters for the Reaction of Ground State Atomic Oxygen with Dimethyl Sulfide and Episulfide," J. Chem. Phys. 64, 300 (1976).

76 PER/ATKI Perry, R. A., Atkinson, R., and Pitts, J. N. Jr., "Rate Constants for the Reaction OH + $H_2S \rightarrow H_2O$ + SH and OH + $NH_3 \rightarrow H_2O + NH_2$ over the Temperature Range 297-427°K," J. Chem. Phys. 64, 3237 (1976).

76 SLA/GRA Slagle, I. R., Graham, R. E., and Gutman, D., "Direct Identification of Reactive Routes and Measurement of Rate Constants in the Reactions of Oxygen Atoms with Methanethiol, Ethanethiol, and Methylsulfide," Int. J. Chem. Kinet. 8, 451 (1976).

76 WAM Wampler, F. B., "Photochemistry of the SO_2, 2-Pentene System at 3660 Å," Int. J. Chem. Kinet. 8, 935 (1976).

76 WHY/TIM Whytock, D. A., Timmons, R. B., Lee, J. H., Michael, J. V., Payne, W. A., and Stief, L. J., "Absolute Rate of the Reaction of $O(^3P)$ with Hydrogen Sulfide over the Temperature Range 263 to 495 K," J. Chem. Phys. 65, 2052 (1976).

1977

77 BOW/DOD Bowman, C. T., and Dodge, L. G., "Kinetics of the Thermal Decomposition of Hydrogen Sulfide behind Shock Waves," Symp. Combust. 16, (Combustion Institute Pittsburgh, Pa., 1977) 971.

77 CAS/TAN Castleman, A. W. Jr., and Tang, I. N., "Kinetics of the Association Reaction of SO_2 with the Hydroxyl Radical," J. Photochem. 6, 349 (1977).

77 FRE/PAL Freund, H., and Palmer, H. B., "Shock-Tube Studies of the Reactions of NO_2 with NO_2, SO_2, and CO," Int. J. Chem. Kinet. 9, 887 (1977).

77 GRA/GUT Graham, R. E., and Gutman, D., "Temperature Dependence of Rate Constants and Branching Ratios for the Reaction of Oxygen Atoms with Carbon Disulfide," J. Phys. Chem. 81, 207 (1977).

77 LEE/STI Lee, J. H., Stief, L. J., and Timmons, R. B., "Absolute Rate Parameters for the Reaction of Atomic Hydrogen with Carbonyl Sulfide and Ethylene Episulfide," J. Chem. Phys. 67, 1705 (1977).

1978

78 ALA/BIG Al-Awadi, N., Bigley, D. B., and Gabbott, R. E., "The Gas-phase Pyrolysis of Dithioacetates: a Remarkable Constancy of Substituent Effects," J. Chem. Soc. Perkin Trans. II, 1223 (1978).

78 ATK/PER1 Atkinson, R., Perry, R. A., and Pitts, J. N. Jr., "Rate Constants for the Reaction of OH radicals with COS, CS_2 and CH_3SCH_3 Over the Temperature Range 299-430 K," Chem. Phys. Lett. 54, 14 (1978).

78 ATK/PIT4 Atkinson, R., and Pitts, J. N. Jr., "Kinetics of the Reaction $O(^3P) + SO_2 + M \rightarrow SO_3 + M$ over the Temperature Range of 299°-440°K," Int. J. Chem. Kinet. 10, 1081 (1978).

78 HOR/NIS Horie, O., Nishino, J., and Amano, A., "The Reaction of Hydrogen Atoms with 1-Butanethiol and Thiolane The Role of Chemically Activated 1-Butanethiol," Int. J. Chem. Kinet. 10, 1043 (1978).

78 IWA/PRE Iwamoto, K., Presser, N., and Ross, J., "Kinetics of Aerosol Formation in Irradiated Gaseous NO_2-SO_2 Mixtures," J. Chem. Phys. 68, 663 (1978).

78 KOL Kollin, W. S., "Gas Phase Reactions of Carbon Monosulfide Studied by the Fast Flow Technique," Diss. Abst. Int. B 39, 771 (1978).

78 KUR1 Kurylo, M. J., "Flash Photolysis Resonance Fluorescence Investigation of the Reaction of OH Radicals with Dimethyl Sulfide," Chem. Phys. Lett. 58, 233 (1978).

78 KUR2 Kurylo, M. J., "Flash Photolysis Resonance Fluorescence Investigation of the Reactions of OH Radicals with OCS and CS_2," Chem. Phys. Lett. 58, 238 (1978).

78 MAR/HER Martinez, R. I., and Herron, J. T., "Stopped-Flow Study of the Gas-Phase Reaction of Ozone with Organic Sulfide: Dimethyl Sulfide," Int. J. Chem. Kinet. 10, 433 (1978).

78 MAR/REI Marvin, D. C., and Reiss, H., "Cloud Chamber Study of the Gas Phase Photooxidation of Sulfur Dioxide," J. Chem. Phys. 69, 1897 (1978).

78 PAR/HEI Partymiller, K., and Heicklen, J., "The Photolysis of Sulfur Dioxide in the Presence of Foreign Gases XII: Photolysis of SO_2 at 313.0 nm In the Presence of Both Allene and Oxygen," J. Photochem. 8, 167 (1978).

78 SLA/BAL Slagle, I. R., Balocchi, F., and Gutman, D., "Study of the Reactions of Oxygen Atoms with Hydrogen Sulfide, Methanethiol, Ethanethiol, and Methyl Sulfide," J. Phys. Chem. 82, 1333 (1978).

78 SU/CAL Su, F., and Calvert, J. G., "The Mechanism of the Photochemical Reactions of SO_2 with Isobutane Excited," Int. J. Chem. Kinet. 10, 557 (1978).

78 VAN/OBI Van Roodselaar, A., Obi, K., and Strausz, O. P., "The Reaction of $S(^3P)$ Atoms with Nitric Oxide," Int. J. Chem. Kinet. 10, 31 (1978).

78 VAN/SAF Van Roodselaar, A., Safarik, I., Strausz, O. P., and Gunning, H. E., "The Reactions of Sulfur Atoms. 15. Absolute Rate Parameters for the $S(^3P_{2,1,0})$ + Alkyne Reactions," J. Am. Chem. Soc. 100, 4068 (1978).

78 WHY/TIM Whytock, D. A., and Timmons, R. B., "Absolute Rate of the Reaction of $O(^3P)$ with Hydrogen Sulphide," Nat. Bur. Stand. Sp. Pub. 526, 339 (1978).

1979

79 ADD/LEI Addison, M. C., Leitch, A. J., Fotakis, C., and Donovan, R. J., "Reactions of $CN(X^2\Sigma^+)$ with OCS and Formation of SCN," J. Photochem. 10, 273 (1979).

79 ALA/BIG Al-Awadi, N., and Bigley, D. B., "Carbonate Pyrolysis. Part 5. The Gas-phase Pyrolysis of Some Unsymmetrical Monothioicarbonates and a Rationalisation of the Rates of Some Related Reactions," J. Chem. Soc. Perkin Trans. II, 497, (1979).

79 AST/GLA Astholz, D. C., Glanzer, K., and Troe, J., "The Spin-forbidden Dissociation-Recombination Reaction $SO_3 \rightleftarrows SO_2 + O$," J. Chem. Phys. 70, 2409 (1979).

79 BUR/CLI Burrows, J. P., Cliff, D. I., Harris, G. W., Thrush, B. A., and Wilkinson, J. P. T., "Atmospheric Reactions of the HO_2 Radical Studied by Laser Magnetic Resonance Spectroscopy," Proceedings Royal Soc. (London) A 368, 463 (1979).

79 CLY/WHI Clyne, M. A., and Whitefield, P. D., "Atomic Resonance Fluorescence for Rate Constants of Rapid Bimolecular Reactions," J. Chem. Soc., Faraday Trans. II 75, 1327 (1979).

79 DAV/RAV Davis, D. D., Ravishankara, A. R., and Fischer, S., "SO_2 Oxidation via the Hydroxyl Radical: Atmospheric Fate of HSO_x Radicals," Geophys. Res. Lett. 6, 113 (1979).

79 GRA/WIN Graham, R. A., Winer, A. M., Atkinson, R., and Pitts, J. N. Jr., "Rate Constants for the Reaction of HO_2 with HO_2, SO_2, CO, N_2O, trans-2-Butene, and 2,3-Dimethyl-2-butene at 300 K," J. Phys. Chem. 83, 1563 (1979).

79 GRI/REE Grillo, A., Reed, E., and Slack, M. W., "Infrared Measurements of Sulfur Dioxide Thermal Decomposition Rate in Shock Waves," J. Chem. Phys. 70, 1634 (1979).

79 JOU/LEB Jourdain, J. L., Le Bras, G., and Combourieu, J., "Kinetic Study of Some Elementary Reactions of Sulfur Compounds Including Reactions of S and SO with OH Radicals," Int. J. Chem. Kinet. 11, 569 (1979).

79 KAN/MCQ Kan, C. S., McQuigg, R. D., Whitbeck, M. R., and Calvert, J. G., "Kinetic Flash Spectroscopic Study of the CH_3O_2-CH_3O_2 and CH_3O_2-SO_2 Reactions," Int. J. Chem. Kinet. 11, 921 (1979).

79 MER/LEV Merryman, E. L., and Levy, A., "Enhanced SO_3 Emissions from Staged Combustion," Symp. Combust. 17, (Combustion Institute Pittsburgh, Pa., 1979) 727.

79 SNA/SIM Sanhueza, E., Simonaitis, R., and Heicklen, J., "The Reaction of CH_3O_2 with SO_2," Int. J. Chem. Kinet. 11, 907 (1979).

79 SIM/HEI Simonaitis, R., and Heicklen, J., "The Mechanism of SO_2 Oxidation by CH_3O_2 Radicals. Rate Coefficients for the Reactions of CH_3O_2 with SO_2 and NO," Chem. Phys. Lett. 65, 361 (1979).

79 SIN/IRW Singleton, D. L., Irwin, R. S., Nip, W. S., and Cvetanovic, R. J., "Kinetics and Mechanism of the Reaction of Oxygen Atoms with Hydrogen Sulfide," J. phys. Chem. 83, 2195 (1979).

79 YOK/STR Yokota, T., and Strausz, O. P., "Reaction of Hydrogen Atoms with Dimethyl Sulfide," J. Phys. Chem. 83, 3196 (1979).

APPENDIX: CONVERSION TABLES

EQUIVALENT SECOND ORDER RATE CONSTANTS

A \ B	$cm^3 mol^{-1} s^{-1}$	$dm^3 mol^{-1} s^{-1}$	$m^3 mol^{-1} s^{-1}$	$cm^3 molecule^{-1} s^{-1}$	$(mm\ Hg)^{-1} s^{-1}$	$atm^{-1} s^{-1}$	$ppm^{-1} min^{-1}$	$m^2 kN^{-1} s^{-1}$
1 $cm^3 mol^{-1} s^{-1}$ =	1	10^{-3}	10^{-6}	1.66×10^{-24}	$1.604 \times 10^{-5} T^{-1}$	$1.219 \times 10^{-2} T^{-1}$	2.453×10^{-9}	$1.203 \times 10^{-4} T^{-1}$
1 $dm^3 mol^{-1} s^{-1}$ =	10^3	1	10^{-3}	1.66×10^{-21}	$1.604 \times 10^{-2} T^{-1}$	$12.19\ T^{-1}$	2.453×10^{-6}	$1.203 \times 10^{-1} T^{-1}$
1 $m^3 mol^{-1} s^{-1}$ =	10^6	10^3	1	1.66×10^{-18}	$16.04\ T^{-1}$	$1.219 \times 10^4 T^{-1}$	2.453×10^{-3}	$120.3\ T^{-1}$
1 $cm^3 molecule^{-1} s^{-1}$ =	6.023×10^{23}	6.023×10^{20}	6.023×10^{17}	1	$9.658 \times 10^{18} T^{-1}$	$7.34 \times 10^{21} T^{-1}$	1.478×10^{15}	$7.244 \times 10^{19} T^{-1}$
1 $(mm\ Hg)^{-1} s^{-1}$ =	$6.236 \times 10^4 T$	$62.36\ T$	$6.236 \times 10^{-2} T$	$1.035 \times 10^{-19} T$	1	760	4.56×10^{-2}	7.500
1 $atm^{-1} s^{-1}$ =	$82.06\ T$	$8.206 \times 10^{-2} T$	$8.206 \times 10^{-5} T$	$1.362 \times 10^{-22} T$	1.316×10^{-3}	1	6×10^{-5}	9.869×10^{-3}
1 $ppm^{-1} min^{-1}$ = at 298K, 1 atm. total pressure	4.077×10^8	4.077×10^5	407.7	6.76×10^{-16}	21.93	1.667×10^4	1	164.5
1 $m^2 kN^{-1} s^{-1}$ =	$8314\ T$	$8.314\ T$	$8.314 \times 10^{-3} T$	$1.38 \times 10^{-20} T$	0.1333	101.325	6.079×10^{-3}	1

To convert a rate constant from one set of units A to a new set B find the conversion factor for the row A under Column B, and multiply the old value by it, e.g. to convert $cm^3 molecule^{-1} s^{-1}$ to $m^3 mol^{-1} s^{-1}$ multiply by 6.023×10^{17}.

Table adapted from Evaluated Kinetic Data for High Temperature Reactions, Volume 1: Homogeneous Gas Phase Reactions of the H_2-O_2 System, Butterworths, London, 1972.

EQUIVALENT THIRD ORDER RATE CONSTANTS

A \ B	$cm^6 mol^{-2} s^{-1}$	$dm^6 mol^{-2} s^{-1}$	$m^6 mol^{-2} s^{-1}$	$cm^6 molecule^{-2} s^{-1}$	$(mm\ Hg)^{-2} s^{-1}$	$atm^{-2} s^{-1}$	$ppm^{-2} min^{-1}$	$m^4 kN^{-2} s^{-1}$
1 $cm^6 mol^{-2} s^{-1}$ =	1	10^{-6}	10^{-12}	2.76×10^{-48}	$2.57 \times 10^{-10} T^{-2}$	$1.48 \times 10^{-4} T^{-2}$	1.003×10^{-19}	$1.447 \times 10^{-8} T^{-2}$
1 $dm^6 mol^{-2} s^{-1}$ =	10^6	1	10^{-6}	2.76×10^{-42}	$2.57 \times 10^{-4} T^{-2}$	$148\ T^{-2}$	1.003×10^{-13}	$1.447 \times 10^{-2} T^{-2}$
1 $m^6 mol^{-2} s^{-1}$ =	10^{12}	10^6	1	2.76×10^{-36}	$257\ T^{-2}$	$1.48 \times 10^{8} T^{-2}$	1.003×10^{-7}	$1.447 \times 10^{4} T^{-2}$
1 $cm^6 molecule^{-2} s^{-1}$ =	3.628×10^{47}	3.628×10^{41}	3.628×10^{35}	1	$9.328 \times 10^{37} T^{-2}$	$5.388 \times 10^{43} T^{-2}$	3.64×10^{28}	$5.248 \times 10^{39} T^{-2}$
1 $(mm\ Hg)^{-2} s^{-1}$ =	$3.89 \times 10^{9} T^2$	$3.89 \times 10^{3} T^2$	$3.89 \times 10^{-3} T^2$	$1.07 \times 10^{-38} T^2$	1	5.776×10^{5}	3.46×10^{-5}	56.25
1 $atm^{-2} s^{-1}$ =	$6.733 \times 10^{3} T^2$	$6.733 \times 10^{-3} T^2$	$6.733 \times 10^{-9} T^2$	$1.86 \times 10^{-44} T^2$	1.73×10^{-6}	1	6×10^{-11}	9.74×10^{-5}
1 $ppm^{-2} min^{-1}$ = at 298K, 1 atm. total pressure	9.97×10^{18}	9.97×10^{12}	9.97×10^{6}	2.75×10^{-29}	2.89×10^{4}	1.667×10^{10}	1	1.623×10^{6}
1 $m^4 kN^{-2} s^{-1}$ =	$6.91 \times 10^{7} T^2$	$69.1\ T^2$	$6.91 \times 10^{-5} T^2$	$1.904 \times 10^{-40} T^2$	0.0178	1.027×10^{4}	6.16×10^{-7}	1

See note to Table for Second Order Rate Constants

NBS-114A (REV. 9-78)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBSIR 80-2118	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Tables of Rate Constants for Gas Phase Chemical Reactions of Sulfur Compounds (1971-1979)

5. Publication Date: July 1980

6. Performing Organization Code

7. AUTHOR(S)
Francis Westley

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, DC 20234

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)
Morgantown Energy Technology Center, Department of Energy, Morgantown, West Virginia 26505 and
Office of Standard Reference Data, National Bureau of Standards, Washington, D.C. 20234

13. Type of Report & Period Covered: Interim

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation $k = AT^B \exp(-E/RT)$. The table covers the reactions of sulfur containing molecules and free radicals - S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, CH_3SH, cy-CH_2CH_2S, $CH_3SCH_2\cdot$ and a number of thiols, thioethers and thioesters - with other compounds. The table includes 16 unimolecular, 187 bimolecular, and 11 termolecular reactions totalling 214 distinct chemical reactions. There are 348 distinct entries, distributed as follows: 26 for first order reactions, 294 for second order reactions and 28 for third order reactions. The kinetic data were compiled from 109 experimental papers and 6 critical reviews published between 1970 and 1979.

17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)
Arrhenius parameters, chemical kinetics, combustion, decomposition, free radicals, gas phase, hydrocarbons, hydrogen, nitrogen oxygen, rate of reaction, sulfur.

18. AVAILABILITY ☒ Unlimited

☐ For Official Distribution. Do Not Release to NTIS

☐ Order From Sup. of Doc., U.S. Government Printing Office, Washington, DC 20402, SD Stock No. SN003-003-

☒ Order From National Technical Information Service (NTIS), Springfield, VA. 22161

19. SECURITY CLASS (THIS REPORT)	21. NO. OF PRINTED PAGES
UNCLASSIFIED	59
20. SECURITY CLASS (THIS PAGE)	**22. Price**
UNCLASSIFIED	$7.00

USCOMM-DC