1970

NSRDS–NBS 31

Bond Dissociation Energies In Simple Molecules

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

NATIONAL STANDARD REFERENCE DATA SYSTEM
NSRDS

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards [1] was established by an act of Congress March 3, 1901. Today, in addition to serving as the Nation's central measurement laboratory, the Bureau is a principal focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To this end the Bureau conducts research and provides central national services in four broad program areas. These are: (1) basic measurements and standards, (2) materials measurements and standards, (3) technological measurements and standards, and (4) transfer of technology.

The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Radiation Research, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Measurement Services and the following technical divisions:

> Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic and Molecular Physics—Radio Physics [2]—Radio Engineering [2]—Time and Frequency [2]—Astrophysics [2]—Cryogenics.[2]

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; develops, produces, and distributes standard reference materials; relates the physical and chemical properties of materials to their behavior and their interaction with their environments; and provides advisory and research services to other Government agencies. The Institute consists of an Office of Standard Reference Materials and the following divisions:

> Analytical Chemistry—Polymers—Metallurgy—Inorganic Materials—Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations in the development of technological standards, and test methodologies; and provides advisory and research services for Federal, state, and local government agencies. The Institute consists of the following technical divisions and offices:

> Engineering Standards—Weights and Measures — Invention and Innovation — Vehicle Systems Research—Product Evaluation—Building Research—Instrument Shops—Measurement Engineering—Electronic Technology—Technical Analysis.

THE CENTER FOR RADIATION RESEARCH engages in research, measurement, and application of radiation to the solution of Bureau mission problems and the problems of other agencies and institutions. The Center consists of the following divisions:

> Reactor Radiation—Linac Radiation—Nuclear Radiation—Applied Radiation.

THE CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in the selection, acquisition, and effective use of automatic data processing equipment; and serves as the principal focus for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Center consists of the following offices and divisions:

> Information Processing Standards—Computer Information — Computer Services — Systems Development—Information Processing Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System, and provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

> Office of Standard Reference Data—Clearinghouse for Federal Scientific and Technical Information [3]—Office of Technical Information and Publications—Library—Office of Public Information—Office of International Relations.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.

[2] Located at Boulder, Colorado 80302

[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

UNITED STATES DEPARTMENT OF COMMERCE
Maurice H. Stans, *Secretary*
NATIONAL BUREAU OF STANDARDS • Lewis M. Branscomb, *Director*

Bond Dissociation Energies in Simple Molecules

B. deB. Darwent

Department of Chemistry
The Catholic University of America
Washington, D.C. 20017

NSRDS-NBS 31

Nat. Stand. Ref. Data Ser., Nat. Bur. Stand. (U.S.), 31, 52 pages (Jan. 1970)
CODEN: NSRDA

Issued January 1970

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 (Order by SD Catalog No. C 13.48:31), Price, 55 cents

Library of Congress Catalog Card Number: 70-602101

Foreword

The National Standard Reference Data System provides effective access to the quantitative data of physical science, critically evaluated and compiled for convenience, and readily accessible through a variety of distribution channels. The System was established in 1963 by action of the President's Office of Science and Technology and the Federal Council for Science and Technology, with responsibility to administer it assigned to the National Bureau of Standards.

The System now comprises a complex of data centers and other activities, carried on in academic institutions and other laboratories both in and out of government. The independent operational status of existing critical data projects is maintained and encouraged. Data centers that are components of the NSRDS produce compilations of critically evaluated data, critical reviews of the state of quantitative knowledge in specialized areas, and computations of useful functions derived from standard reference data. In addition, the centers and projects establish criteria for evaluation and compilation of data and make recommendations on needed improvements in experimental techniques. They are normally closely associated with active research in the relevant field.

The technical scope of the NSRDS is indicated by the principal categories of data compilation projects now active or being planned: nuclear properties, atomic and molecular properties, solid state properties, thermodynamic and transport properties, chemical kinetics, and colloid and surface properties.

The NSRDS receives advice and planning assistance from the National Research Council of the National Academy of Sciences-National Academy of Engineering. An overall Review Committee considers the program as a whole and makes recommendations on policy, long-term planning, and international collaboration. Advisory Panels, each concerned with a single technical area, meet regularly to examine major portions of the program, assign relative priorities, and identify specific key problems in need of further attention. For selected specific topics, the Advisory Panels sponsor subpanels which make detailed studies of users' needs, the present state of knowledge, and existing data resources as a basis for recommending one or more data compilation activities. This assembly of advisory services contributes greatly to the guidance of NSRDS activities.

The NSRDS–NBS series of publications is intended primarily to include evaluated reference data and critical reviews of long-term interest to the scientific and technical community.

LEWIS M. BRANSCOMB, *Director*

Contents

Bond Dissociation Energies in Simple Molecules

B. deB. Darwent

Bond dissociation energy values (kcal/mol) and (kJ/mol) of simple compounds are tabulated from a literature review covering the years 1962–1966 inclusively. Some selected values which appeared in the years 1956–1962 are also included. Organic compounds are excluded except those containing one carbon atom. The groups > CO and —CN are not considered to be organic.

The values are quoted usually at 0 K or 298 K and refer to the gaseous state. They represent the energy required to break a bond at the specified temperature with all substances in the zero vibrational state of the ground electronic state. The experimental method for the energy value listed is given and referenced in the table. A value recommended by the author is listed as the final value for each reaction.

Key words: Bond dissociation energy; gaseous state; inorganic simple compounds; recommended value; zero vibrational state of the ground electronic state.

Introduction

This review of bond dissociation energies of simple compounds includes values published, generally, between 1956 and 1966 inclusive. The period from 1956 to 1962 was covered less thoroughly than that of 1962 to 1966. Cottrell's book [3][1] appeared in 1958 and is assumed to have covered the literature up to and including 1955; the compilation of Vedeneyev et al. [6] covered the field to 1962, but they did not attempt a complete coverage of the literature. In the present review all values appearing between 1962 and 1966, and selected values appearing between 1956 and 1962 have been given in the table, even if some of them may now be considered to be inaccurate or completely untrustworthy. This approach is of some value, especially for bonds on which only a few measurements have been made, since opinions of relative merit often change with time. The efficiency of retrieval of information, within the stated period, is estimated to be approximately 80 percent.

Organic compounds have been excluded, in view of Kerr's excellent review [8] of 1966, although compounds containing one carbon atom have been included; the groups > CO and − CN are not regarded as being organic.

Very recent data on thermochemical properties have been published by the National Bureau of Standards as Technical Note 270–3 [9]; many bond dissociation energies have been recalculated from those data. It should be pointed out that the data in Ref. [9] often include input from spectroscopic and other types of measurements. Thus a dissociation energy labeled "Thermochemical; based on [9]" in this tabulation is not necessarily derived solely from conventional thermochemical measurements.

The bonds are listed alphabetically under the more electropositive elements except for bonds between H and other elements, which are given under the other element. Thus data on O–H, H–Cl, etc., are found under O, Cl, etc.

The bond dissociation energy $D°$ for a bond A–B which is broken through the reaction

$$AB \rightarrow A + B$$

is defined here as the standard-state enthalpy change for the reaction at a specified temperature. That is,

$$D° = \Delta Hf_0^\circ(A) + \Delta Hf_0^\circ(B) - \Delta Hf_0^\circ(AB)$$

where ΔHf_0° is the standard-state heat of formation. All values of $D°$ refer to the gaseous state, and are given at either 0 K or 298 K, and in some cases at both temperatures. The few exceptions are noted under "Remarks". The value of $D°$ at 0 K is equal to the energy required to break the A–B bond under the stipulated conditions that the reactant and product molecules are in their electronic and vibrational ground states. Thus it has a clearer physical interpretation than the dissociation energy at other temperatures. In the simplest case where the bond of a diatomic molecule is broken, $D°$ at 298 K is greater then $D°$ at 0 K by an amount which lies between RT and $(3/2)\ RT$ (i.e., 0.6 to 0.9 kcal/mol). In polyatomic molecules this difference may be somewhat greater.

The values of $D°$ are listed in both kcal/mol and kJ/mol. The conversion factor is 1 kcal/mol = 4.184 kJ/mol.

No attempt will be made here to describe or discuss the many methods used to measure bond dissociation energies since that has already been done [1 to 8]. It is well known that individual methods are useful and reliable only for limited types of molecules and over limited ranges of conditions. Thus the classic static manometric

---

[1] Figures in brackets indicate the literature references on page 2.

method gives excellent results for I_2, N_2O_4, etc. but not for dibenzyl; the spectroscopic method gives values of the highest precision for simple molecules, especially when the dissociation products are unequivocal and a clear convergence can be obtained, but it is much less useful for more complex molecules.

Many determinations of bond dissociation energies have recently appeared using high temperatures chemistry techniques, e.g., effusion from a Knudsen cell and the use of mass spectrometry to identify and measure the concentrations of the effusing materials. Most of the measurements on the oxides of the Group IIA elements have been made by that technique and by flame photometry. In theory both methods are capable of giving values of at least modest precision for the bond dissociation energies. Although in some cases the data so obtained are often consistent and fairly precise, in other instances, e.g. CaO, there is considerable disagreement, not only between the two methods but also between values obtained by the same method.

There has been much controversy on the relative merits of these two techniques. The high temperature mass-spectrometry results are suspect [55] because of the possibility of fragmentation of the molecule under electron impact. In another review [190] it is claimed that Drowart and Goldfinger [10] had already refuted that suggestion. Actually, Drowart and Goldfinger did not really disprove the claim but rather stated that interaction with the alumina container is likely to be a more important source of uncertainty. On the other hand, there does appear to be doubt concerning both the nature of the emitter and the possibility of interference by other substances in the flame photometric work. At this stage the only safe conclusion is that much more research is required.

The estimated uncertainties of individual measurements are those given by the original authors or reviewers. Recommended values are listed in bold type with estimated uncertainties. Those estimates are based on the extent of agreement between different measurements, more weight being given to the results from the more reliable method, when the datum results from a direct measurement. For thermochemically calculated values consideration is given to the precision of each of the thermochemical quantities involved in the calculation. No attempt has been made at a statistical evaluation of uncertainties. They are to some extent the result of my own prejudice, though often tempered by the advice of experts.

The author is grateful to the Catholic University of America for leave of absence and sabbatical leave and to the National Bureau of Standards for space and technical and financial assistance. The space was provided by the Physical Chemistry Division and the financial assistance by the Office of Standard Reference Data, National Bureau of Standards. It is indeed a pleasure to acknowledge the help and advice given by Dr. D. Garvin of the Elementary Processes Section and Dr. S. A. Rossmassler of the Office of Standard Reference Data. The author is greatly indebted to Dr. W. H. Evans for many discussions and advice about thermochemical measurements and to Dr. H. M. Rosenstock for information on many matters, mostly scientific.

References

[1] Gaydon, A., Dissociation Energies and Spectra of Diatomic Molecules, 2nd ed., (Chapman and Hall, London, 1953).

[2] Szwarc, M., The determination of bond dissociation energies by pyrolytic methods, Chem. Rev., **47**, 75 (1950).

[3] Cottrell, T. L., The Strengths of Chemical Bonds, (Butterworths Scientific Publications, London, 1st ed., 1954, 2nd ed., 1958).

[4] Herzberg, G., Molecular Spectra and Molecular Structure. I. Spectra of Diatomic Molecules, 2nd ed. (D. Van Nostrand Co., Inc., Toronto-New York-London, 1950).

[5] Sehon, A. H., and Szwarc, M., Bond energies, Ann. Rev. Phys. Chem., **8**, 439 (1957).

[6] Vedeneyev, V. I., Gurvich, L. V., Kondrat'yev, V. N., Medvedev, V. A., and Frankevich, Ye. L., Bond Energies, Ionization Potentials and Electron Affinities (St. Martin's Press, New York, 1962).

[7] Wilkinson, P. G., Diatomic molecules of astrophysical interest: ionization potentials and dissociation energies, Astrophys. J., **138**, 778 (1963).

[8] Kerr, J. A., Bond dissociation energies by kinetic methods, Chem. Rev., **66**, 465 (1966).

[9] Wagman, D. D., Evans, W. H., Parker, V. B., Halow, I., Bailey, S. M., and Schumm, R. H., Selected values of chemical thermodynamic properties. Part 3. Tables for the first thirty-four elements in the standard order of arrangement, Nat. Bur. Stand. (U.S.), Tech. Note 270–3 (1967) and Part 4. Tables for Elements 35 through 53 in the standard order of arrangement, Nat. Bur. Stand. (U.S.), Tech. Note 270–4 (1969).

[10] Drowart, J., and Goldfinger, P., High temperature chemistry, Ann. Rev. Phys. Chem., **13**, 459 (1962).

[11] Gurvich, L. V., and Ryabova, V. G., Dissociation energy of the BaCl molecule, Teplofizika Vysokikh Temperatur, **2**, 215 (1964).

[12] Drummond, G., and Barrow, R. F., Thermochemical dissociation energies of gaseous calcium, strontium and barium oxides, Trans. Faraday Soc., **47**, 1275 (1951).

[13] Inghram, M. G., Chupka, W. A., and Porter, R. F., Mass spectrometric study of barium oxide vapor, J. Chem. Phys., **23**, 2159 (1955).

[14] Stafford, F. E., and Berkowitz, J., Mass-spectrometric study of the reaction of water vapor with solid barium oxide, J. Chem. Phys., **40**, 2963 (1964).

[15] Coomber, J. W., and Whittle, E., Bond dissociation energies from equilibrium studies. Part 1. D(CF_3-Br), D(C_2F-Br) and D(N-C_3F_7-Br), Trans. Faraday Soc., **63**, 608 (1967).

[16] Van der Kelen, G. P., and De Bièvre, P. J., Studies on halogenated aliphatic compounds. VI. The critical potentials of the principal ions in the mass spectra of the halogenated acetonitriles, Bull. Soc. Chim. Belges, **69**, 379 (1960).

[17] Gordon, R. D., and King, G. W., The emission spectrum of the CCl radical, Can. J. Phys., **39**, 252 (1961).

[18] Reed, R. I., and Snedden, W., Electron impact methods. II. Latent heat of sublimation of carbon, Trans. Faraday Soc. **54**, 301 (1958).

[19] Fox, R. E., and Curran, R. K., Ionization processes in CCl_4 and SF_6 by electron beams, J. Chem. Phys., **34**, 1595 (1961).

[20] Lagerqvist, A., Westerlund, H., Wright, C. V., and Barrow, R. F., Rotational analysis of the ultraviolet band system of CS, Arkiv Fysik, **14**, 387 (1959).

[21] Ryabova, V. G., and Gurvich, L. V., Determination of dissociation energy of metal halides from equilibria in flames. 2. Dissociation energies of CaF, CaF_2, SrF and SrF_2, Teplofizika Vysokikh Temperatur, **2**, 834 (1964).

[22] Ryabova, V. G., and Gurvich, L. V., Investigation of the energy of the metal-hydroxyl bond in the CaOH, SrOH and BaOH molecules, Teplofizika Vysokikh Temperatur, **3**, 318 (1965).

[23] Ryabova, V. G., and Gurvich, L. V., Determination of the dissociation energies of metal halides by investigating the equilibrium of reactions in flames. III. Dissociation energies of CaCl,$CaCl_2$, SrCl, $SrCl_2$ and $BaCl_2$, Teplofizika Vysokikh Temperatur, **3**, 604 (652) (1965).

[24] Kopp, I., and Wirhed, R., On the B-X band system of BaD, Arkiv Fysik, **32**, 307 (1966).

[25] Kopp, I., Kronekvist, M., and Guntsch, A., Rotational analysis of the A-X band system of BaH and BaD, Arkiv Fysik, **32**, 371 (1966).

[26] Kopp, I., Aslund, N., Edvinsson, G., and Lindgren, B., Rotational analysis of the perturbed C and D states of BaH and BaD, Arkiv Fysik, **30**, 321 (1965).

[27] Fisher, I. P., Mass spectrometry study of intermediates in thermal decomposition of perchloric acid and chlorine dioxide, Trans. Faraday Soc., **63**, 684 (1967).

[28] Johns, J. W. C., and Barrow, R. F., The Ultra-Violet Spectra of HF and DF, Proc. Roy. Soc. (London), **A251**, 504 (1959).

[29] Drowart, J., and Honig, R. E., Mass spectrometric study of gallium and indium, Bull. Soc. Chim. Belges, **66**, 411 (1957).

[30] Drowart, J., and Honig, R. E., A mass spectrometric method for the determination of dissociation energies of diatomic molecules, J. Phys. Chem., **61**, 980 (1957).

[31] Herzberg, G., and Monfils, A., The dissociation energies of the H_2, HD, and D_2 Molecules, J. Mol. Spect., **5**, 482 (1960).

[32] Wieland, K., Bandensysteme $B(^2\Sigma^+) \rightarrow X(^2\Sigma^+)$ und Dissoziationswerte der Radikale HgJ und HgBr, Z. Elektrochim., **64**, 761 (1960).

[33] Durie, R. A., and Ramsay, D. A., Absorption spectra of the halogen monoxides, Can. J. Phys., **36**, 35 (1958).

[34] Bulewicz, E. M., Phillips, L. E., and Sugden, T. M., Determination of dissociation constants and heats of formation of simple molecules by flame photometry. Part 8. Stabilities of the gaseous diatomic halides of certain metals, Trans. Faraday Soc., **57**, 921 (1961).

[35] Berkowitz, J., Meschi, D. J., and Chupka, W. A., Heterogenous reactions studied by mass spectrometry. II. Reaction of Li_2O(s) with H_2O(g), J. Chem. Phys., **33**, 533 (1960).

[36] Altman, R. L., Vaporization of magnesium oxide and its reaction with alumina, J. Phys. Chem., **67**, 366 (1963).

[37] Alexander, C. A., Ogden, J. S., and Levy, A., Transpiration study of magnesium oxide, J. Chem. Phys., **39**, 3057 (1963).

[38] Milton, E. R. V., Dunford, H. B., and Douglas, A. E., Spectrum of NBr excited in active nitrogen, J. Chem. Phys., **35**, 1202 (1961).

[39] Brown, L. M., and Darwent, B. deB., Spectrophotometric determination of the rate of dissociation of tertrafluorohydrazine behind a shock wave, J. Chem. Phys., **42**, 2158 (1965).

[40] Herman, L., Felenbock, P., and Herman, R., Spectre d'emission des radicaux OH et OD, J. Phys. Radium, **22**, 83 (1961).

[41] Purmal, A. P., and Frost, A. V., Energiia dissotsitsii ON, Vestnik Moscov. Univ. Ser. II Khim. No. 1, 25 (1961).

[42] Forst, W., Second-order unimolecular kinetics in the thermal decomposition of hydrogen peroxide vapor, Can. J. Chem., **36**, 1308 (1958).

[43] Levy, J. B., and Copeland, B. K. W., The kinetics of the hydrogen-fluorine reaction. II. The oxygen-inhibited reaction, J. Phys. Chem., **69**, 408 (1965).

[44] Blanchard, L., and LeGoff, P., Mass spectrometric study of the Species CS, SO, and CCl_2 produced in primary heterogeneous reactions, Can. J. Chem., **35**, 89 (1957).

[45] McGrath, W. D., and McGarvey, J. F., Absorption spectrum and dissociation energy of the SO radical, J. Chem. Phys., **37**, 1574 (1962).

[46] Gurvich, L. V., and Shenyavskaya, Ye. A., The electronic spectrum of scandium monofluoride, Optics and Spect. (U.S.S.R.) **14**, 161 (1963).

[47] Douglas, A. E., The spectrum of silicon hydride, Can. J. Phys., **35**, 71 (1957).

[48] Gurvich, L. V., and Ryabova, V. G., Investigation of the dissociation energies of BaO and BaOH, Opt. i Spektroskopiya, **18**, (1965).

[49] Seal, K. E., and Gaydon, A. G., Shock-tube measurement of the dissociation energy of NH using absolute band intensities, Proc. Phys. Soc. (London), **89**, 459 (1966).

[50] Mal'tsev, A. A., Kataev, D. I., and Takevskii, V. M., Study of the electronic spectra and isotope effect of oxygen compounds of boron. III. Gamma bands of the BO molecules, Opt. i Spektroskopiya, **9**, 713 (1960).

[51] Berkowitz, J., Correlation scheme for diatomic oxides, J. Chem. Phys., **30**, 858 (1959).

[52] Veits, I. V., and Gurvich, L. V., Bond energy of the molecules of CaOH and SrOH, Opt. i Spektroskopiya, **2**, 274 (1957).

[53] Hurley, A. C., Electronic structure of the first row hydrides. III. Predissociation by rotation in the $A^1\pi$ state and the dissociation energy of BH, Proc. Roy. Soc. (London), **A261**, 237 (1961).

[54] McKinney, C. N., and Innes, K. K., Emission spectra of the AlS molecule, J. Mol. Spect., **3**, 235 (1959).

[55] Medvedev, V. A., Dissociation energies and heats of sublimation of the oxides of alkaline earth metals, Zh. Fiz. Khim., **35**, 1481 (1961).

[56] Kant, A., and Strauss, B., Dissociation energies of diatomic molecules of the transition elements. II. Titanium, chromium, manganese and cobalt, J. Chem. Phys., **41**, 3806 (1964).

[57] Armstrong, G. T., and Marantz, S., Heats of formation of two isomers of difluorodiazine, J. Chem. Phys., **38**, 169 (1963).

[58] Verhaegen, G., and Drowart, J., Mass spectrometric determination of the heat of sublimation of boron and of the dissociation energy of B_2, J. Chem. Phys., **37**, 1367 (1962).

[59] Curran, R. K., and Fox, R. E., Mass spectrometer investigation of ionization of N_2O by electron impact, J. Chem. Phys., **34**, 1590 (1961).

[60] Dibeler, V. H., Reese, R. M., and Mann, D. E., Ionization and dissociation of perchlorylfluoride by electron impact, J. Chem. Phys., **27**, 176 (1957).

[61] Porter, R. F., and Spencer, C. W., Stabilities of the gaseous molecules, BiSe, BiTe and SbTe, J. Chem. Phys., **32**, 943 (1960).

[62] Ackerman, M., Stafford, F. E., and Verhaegen, G., Studies of the vapors of the system Au-Cr and Au-Pd by mass spectrometry, J. Chem. Phys., **36**, 1560 (1962).

[63] Ackerman, M., Drowart, J., Stafford, F. E., and Verhaegen, G., Mass spectrometric study of the gaseous molecules above AgSn, AuSn, and CuSn Alloys, J. Chem. Phys., **36**, 1557 (1962).

[64] Guttman, A., and Penner, S. S., Experimental determination of the heat of dissociation of $N_2O_4 = 2NO_2$ from the temperature dependence of absolute infrared intensities, J. Chem. Phys., **36**, 98 (1962).

[65] Flowers, M. C., and Benson, S. W., Kinetics of the gasphase reaction of CH_3I with HI, J. Chem. Phys., **38**, 882 (1963).

[66] Burns, R. P., DeMaria, G., Drowart, J., and Inghram, M. G., Mass spectrometric investigation of the vaporization of In_2O_3, J. Chem. Phys., **38**, 1035 (1963).

[67] Prophet, H., Heat of formation of methylene, J. Chem. Phys., **38**, 2345 (1963).

[68] Ehlert, T. C., Blue, G. D., Green, J. W., and Margrave, J. L., Mass spectrometric studies at high temperatures. III. Dissociation energies of the alkaline earth monofluorides, J. Chem. Phys., **41**, 2250 (1964).

[69] Hildenbrand, D. L., and Murad, E., Dissociation energy of boron monofluoride from mass-spectrometric studies, J. Chem. Phys., **43**, 1400 (1965).

[70] Benson, S. W., Thermochemistry of the bromination of chloroform and the heat of formation of the CCl_3 radical, J. Chem. Phys., **43**, 2044 (1965).

[71] Kalff, P. J., Hollander, T. J., and Alkemade, C. Th. J.,

Flame-photometric determination of the dissociation energies of the alkaline-earth oxides, J. Chem. Phys., **43**, 2299 (1965).

[72] Brebrick, R. F., Partial pressures in equilibrium with group IV tellurides. III. Germanium telluride, J. Chem. Phys., **41**, 1140 (1964).

[73] Hildenbrand, D. L., and Theard, L. P., Effusion studies, mass spectra, and thermodynamices of beryllium fluoride vapor, J. Chem. Phys., **42**, 3230 (1965).

[74] Jacobs, T. A., Giedt, R. R., and Cohen, N., Kinetics of decomposition of HF in shock waves, J. Chem. Phys., **43**, 3688 (1965).

[75] Singh, A. N., and Rai, D. K., On the dissociation energy of S_2 and SO molecules, J. Chem. Phys., **43**, 2151 (1965).

[76] Kant, A., Dissociation energies of diatomic molecules of the transition elements. I. Nickel, J. Chem. Phys., **41**, 1872 (1964).

[77] Warneck, P., Marmo, F. F., and Sullivan, J. O., Ultraviolet absorption of SO_2: Dissociation energies of SO_2 and SO, J. Chem. Phys., **40**, 1132 (1964).

[78] Carlson, K. D., and Nesbet, R. K., Wavefunctions and binding energies of the titanium monoxide molecule, J. Chem. Phys., **41**, 1051 (1964).

[79] Brewer, R. G., and Kester, F. L., Dissociation energy of the CH radical, J. Chem. Phys., **40**, 812 (1964).

[80] Marquart, J. R., and Berkowitz, J., Dissociation energies of some metal sulfides, J. Chem. Phys., **39**, 283 (1963).

[81] Berkowitz, J., and Marquart, J. R., Equilibrium composition of sulfur vapor, J. Chem. Phys., **39**, 275 (1963).

[82] DeMaria, G., Drowart, J., and Inghram, M. G., Thermodynamic study of InSb with a mass spectrometer, J. Chem. Phys., **31**, 1076 (1959).

[83] DeMaria, G., Drowart, J., and Inghram, M. G., Mass spectrometric study of Al_2O_3, J. Chem. Phys., **30**, 318 (1959).

[84] Colin, R., and Drowart, J., Thermodynamic study of tin sulfide and lead sulfide using a mass spectrometer, J. Chem. Phys., **37**, 1120 (1962).

[85] Grimley, R. T., Burns, R. P., and Inghram, M. G., Thermodynamics of the vaporization of Cr_2O_3: Dissociation energies of CrO, CrO_2, and CrO_3, J. Chem. Phys., **34**, 664 (1961).

[86] Yoshimine, M., Computed potential curve and spectroscopic constants for beryllium oxide ground state in molecular orbital approximation, J. Chem. Phys., **40**, 2970 (1964).

[87] Giguere, P. A., Revised values of the O—O and the O—H bond dissociation energies, J. Chem. Phys., **30**, 322 (1959).

[88] Lindeman, L. P., and Guffy, J. C., Recalculation of D(HO—OH) Based on New Value of D(O—H), J. Chem. Phys., **30**, 322 (1959).

[89] Margrave, J. L., Use of mass spectrometric appearance potentials in thermochemical calculations. I. Consistency relationships for methane and substituted methanes, and the heat of formation of CH_3F, J. Chem. Phys., **24**, 475 (1956).

[90] Inghram, M. G., Porter, R. F., and Chupka, W. A., Mass spectrometric study of gaseous species in the B—B_2O_3 system, J. Chem. Phys., **25**, 498 (1956).

[91] Ackerman, M., Stafford, F. E., and Drowart, J., Mass spectrometric determination of the dissociation energies of the molecules AgAu, AgCu, and AuCu, J. Chem. Phys., **33**, 1784 (1960).

[92] Panish, M. B., and Reif, L., Thermodynamics of the vaporization of Hf and HfO_2: Dissociation energy of HfO, J. Chem. Phys., **38**, 253 (1963).

[93] Verhaegen, G., Smoes, S., and Drowart, J., Mass-spectrometric determination of the dissociation energy of the molecules Sc_2, Y_2, La_2, and YLa, J. Chem. Phys., **37**, 239 (1963).

[94] Rees, A. L. G., Electronic spectrum and dissociation energy of fluorine, J. Chem. Phys., **26**, 1567 (1957).

[95] Schissel, P., Dissociation energies of Cu_2, Ag_2, Au_2, J. Chem. Phys., **26**, 1276 (1957).

[96] Goldstein, H. W., Walsh, P. N., and White, D., Rare earths. I. Vaporization of La_2O_3 and Nd_2O_3: Dissociation energies of gaseous LaO and NdO, J. Phys. Chem., **65**, 1400 (1961).

[97] Kiser, R. W., and Hobrock, B. G., The ionization potential of hydrogen disulfide (H_2S_2), J. Phys. Chem., **66**, 1214 (1962).

[98] Tschuikow-Roux, E., Thermodynamic properties of nitryl fluoride, J. Phys. Chem., **66**, 1636 (1962).

[99] Berkowitz, J., Chupka, W. A., Blue, G. D., and Margrave, J. L., Mass spectrometric study of the sublimation of lithium oxide, J. Phys. Chem., **63**, 644 (1959).

[100] Porter, R. F., and Schoonmaker, R. C., A mass spectrometric study of the vaporization of ferrous bromide, J. Phys. Chem., **63**, 626 (1959).

[101] Blackburn, P. E., Hoch, M., and Johnston, H. L., The vaporization of molybdenum and tungsten oxides, J. Phys. Chem., **62**, 769 (1958).

[102] Gunn, S. R., Green, L. G., and Von Egidy, A. I., The heat of chlorination of diboron tetrachloride, J. Phys. Chem., **63**, 1787 (1959).

[103] Sullivan, J. H., The thermal reactions of hydrogen iodide with alkyl iodides, J. Phys. Chem. **65**, 722 (1961).

[104] Drowart, J., DeMaria, G., Burns, R. P., and Inghram, M. G., Thermodynamic study of Al_2O_3 using a mass spectrometer, J. Chem. Phys., **32**, 1366 (1960).

[105] Foner, S. N., and Hudson, R. L., Mass spectrometric detection of triazine and tetrazene and studies of the free radicals NH_2 and N_2H_3, J. Chem. Phys., **29**, 442 (1958).

[106] Dibeler, V. H., Reese, R. M., and Franklin, J. L., Ionization and dissociation of oxygen difluoride by electron impact, J. Chem. Phys., **27**, 1296 (1957).

[107] Herron, J. T., and Dibeler, V. H., Mass spectrometric study of the thermal dissociation of N_2F_4, J. Chem. Phys., **35**, 747 (1961).

[108] Drowart, J., and Honig, R. F., Mass spectrometric study of copper, silver, and gold, J. Chem. Phys., **25**, 581 (1956).

[109] Kiser, R. W., Estimation of the ionization potential and dissociation energy of molecular astatine, J. Chem. Phys., **33**, 1265 (1960).

[110] Loughran, E. D., and Mader, C., Appearance potential study of tetrafluorohydrazine, J. Chem. Phys., **32**, 1578 (1960).

[111] Foner, S. N., and Hudson, R. L., Ionization potential of the OH free radical by mass spectrometry, J. Chem. Phys., **25**, 602 (1956).

[112] Brewer, L., Dissociation energy of S_2, J. Chem. Phys., **31**, 1143 (1959).

[113] Marsden, D. G. H., Dissociation energies of SO and S_2, J. Chem. Phys., **31**, 1144 (1959).

[114] Wiedemeier, H., and Gilles, P. W., Mass-spectrometric study of the sublimation of MnS(s) and the dissociation energy of MnS(g), J. Chem. Phys., **42**, 2765 (1956).

[115] Inghram, M. G., Chupka, W. A., and Berkowitz, J., Thermodynamics of the Ta-O system: The dissociation energies of TaO and TaO_2, J. Chem. Phys., **27**, 569 (1957).

[116] Berkowitz, J., Chupka, W. A., and Inghram, M. G., Thermodynamics of the V-O system: Dissociation energies of VO and VO_2, J. Chem. Phys., **27**, 87 (1957).

[117] Reese, R. M., Dibeler, V. H., and Franklin, J. L., Electron impact studies of sulfur dioxide and sulfuryl fluoride, J. Chem. Phys., **29**, 880 (1958).

[118] Schoonmaker, R. C., and Porter, R. F., Mass spectrometric study of ferrous chloride vapor, J. Chem. Phys., **29**, 116 (1958).

[119] Foner, S. N., and Hudson, R. L., Ionization and dissociation of hydrogen peroxide by electron impact, J. Chem. Phys., **36**, 2676 (1962).

[120] Knight, H. T., and Rink, J. P., Dissociation energy of cyanogen and related quantities by X-ray densitometry of Shock Waves, J. Chem. Phys., **35**, 199 (1961).

[121] Chupka, W. A., Berkowitz, J., and Inghram, M. G., Thermodynamics of the Zr-ZrO_2 system: The dissociation energies of ZrO and ZrO_2, J. Chem. Phys., **26**, 1207 (1957).

[122] Dibeler, V. H., Krauss, M., Reese, R. M., and Harllee, F. N., Mass-spectrometric study of photoionization. III. Methane and methane-d_4, J. Chem. Phys., **42**, 3791 (1965).

[123] Drowart, J., DeMaria, G., Boerboom, A. J. H., and Inghram, M. G., Mass spectrometric study of inter-group IVB molecules, J. Chem. Phys., **30**, 308 (1959).

[124] Farmer, J. B., Henderson, I. H. S., Lossing, F. P., and Marsden, D. G. H., Free radicals by mass spectrometry. IX. Ionization potentials of CF_3 and CCl_3 radicals and

bond dissociation energies in some derivatives, J. Chem. Phys., **24**. 348 (1956).

[125] Pottie, R. F., and Lossing, F. P., Free radicals by mass spectrometry. XXV. Ionization potentials of cyanoalkyl radicals, J. Am. Chem. Soc., **83**, 4737 (1961).

[126] Johnson, F. A., and Colburn, C. B., The tetrafluorohydrazine-difluoroamino radical equilibrium, J. Am. Chem. Soc. **83**, 3043 (1961).

[127] Dibeler, V. H., Reese, R. M., and Franklin, J. L., Mass spectrometric study of cyanogen and cyanoacetylenes, J. Am. Chem. Soc., **83**, 1813 (1961).

[128] Dibeler, V. H., Franklin, J. L., and Reese, R. M., Electron impact studies of hydrazine and the methyl-substituted hydrazines, J. Am. Chem. Soc., **81**, 68 (1959).

[129] Milne, T. A., and Gilles, P. W., The dissociation energy of fluorine and the magnetic deflection of its molecular beams, J. Am. Chem. Soc., **81**, 6115 (1959).

[130] Franklin, J. L., Dibeler, V. H., Reese, R. M., and Krauss, M., Ionization and dissociation of hydrazoic acid and methyl azide by electron impact, J. Am. Chem. Soc., **80**, 298 (1958).

[131] Calvert, J. G., and Gruver, J. T., A kinetic study of the thermodynamic properties of the acetyl free radical, J. Am. Chem. Soc., **80**, 1313 (1958).

[132] Gray, P., Chemistry of free radicals containing oxygen. Part I. Thermochemistry of the alkoxy radicals RO and dissociation energies of oxygen bonds, Trans. Faraday Soc., **52**, 344 (1956).

[133] Barrow, R. F., Johns, J. W. C., and Smith, F. J., Spectroscopic and thermodynamic properties of gaseous aluminum monofluoride, Trans. Faraday Soc., **52**, 913 (1956).

[134] Pedley, J. B., Heats of formation and bond angles of molecules and radicals. II. Hydrocarbon radicals, Trans. Faraday Soc., **58**, 23 (1962).

[135] Mackle, H., and McClean, R. T. B., Studies in the thermochemistry of organic sulphides. Part IV. Heat of formation of the mercaptyl radical, Trans. Faraday Soc., **58**, 895 (1962).

[136] Bulewicz, E. M., and Sugden, T. M., Determination of the dissociation constants and heats of formation of molecules by flame photometry. Part II. Heat of formation of gaseous cuprous hydride, Trans. Faraday Soc., **52**, 1475 (1956).

[137] Mackle, H., and Mayrick, R. G., Studies in the thermochemistry of organic sulphides. Part I. The gas-phase heats of formation of phenyl methyl, phenyl ethyl, benzyl methyl and benzyl ethyl sulphides, Trans. Faraday Soc., **58**, 33 (1962).

[138] Pritchard, G. O., Pritchard, H. O., Schiff, H. I., and Trotman-Dickenson, A. F., The reactions of triluoromethyl radicals, Trans. Faraday Soc., **52**, 849 (1956).

[139] Buckley, E., and Whittle, E., Photobromination of methanol. Part III. Kinetics in the presence of added carbon dioxide, Trans. Faraday Soc., **58**, 536 (1962).

[140] Barrow, R. F., Dissociation energies of the gaseous monohalides of boron, aluminum, gallium, indium and thallium, Trans, Faraday Soc., **56**, 952 (1960).

[141] Goldfinger, P., and Martens, G., Elementary rate constants in atomic chlorination reactions. Part III. Bond dissociation energies and entropies of the activated state, Trans. Faraday Soc., **57**, 2220 (1961).

[142] Busfield, W. K., Ivin, K. J., Mackle, H., and O'Hare, P. A., Studies in the thermochemistry of sulphones. Part IV Gaseous heats of formation of six sulphones and the radical CH_3SO_2, carbon-sulphur dissociation energies in sulphones and alkane sulphonyl radicals, Trans. Faraday Soc., **57**, 1064 (1961).

[143] Phillips, L. F., and Sugden, T. M., Determination of dissociation constants and heats of formation of molecules by flame photometry. Part VII. Flame photometric study of the IO Radical, Trans. Faraday Soc., **57**, 914 (1961).

[144] Chandrasekharaiah, M. S., Dissociation of energies of alkaline earth oxides, J. Phys. Chem., **68**, 2020 (1964).

[145] Cater, E. D., Lee, T. E., Johnson, E. W., Rauh, E. G., and Eick, H. A., Vaporization, thermodynamics, and dissociation energy of lanthanum monosulfide, J. Phys. Chem., **69**, 2684 (1965).

[146] Singh, R. B., and Rai, D. K., Potential curves and bond strength of PO, J. Phys. Chem., **69**, 3461 (1965).

[147] Dillard, J. G., and Kiser, R. W., Ionization and dissociation of ruthenium and osmium tetroxides, J. Phys. Chem., **69**, 3893 (1965).

[148] Cubicciotti, D., and Withers, G. L., The enthalpv of formation and the dissociation energy of thallium monofluoride, J. Phys. Chem., **69**, 4030 (1965).

[149] Malone, T. J., and McGee, H. A., Jr., Mass spectrometric investigations of the synthesis, stability, and energetics of the low-temperature oxygen fluorides. I. Dioxygen difluoride, J. Phys. Chem., **69**, 4338 (1965).

[150] Amphlett, J. C., Coomber, J. W., and Whittle, E., The C—H bond dissociation energy in fluoroform, J. Phys. Chem., **70**, 593 (1966).

[151] Kent, R. A., McDonald, J. D., and Margrave, J. L., Mass spectrometric studies at high temperatures. IX. The sublimation pressure of copper (II) fluoride, J. Phys. Chem., **70**, 874 (1966).

[152] Malone, T. J., and McGee, H. A., Jr., ionization potentials of the dioxygen fluoride free radical and the dioxygen difluoride molecule, J. Phys. Chem., **70**, 316 (1966).

[153] Saalfeld, F. E., and Svec, H. J., Mass spectra of volatile hydrides. IV. Silylgermane, J. Phys. Chem., **70**, 1753 (1966).

[154] Carter, H. V., Chappell, E. I., and Warhurst, E., The pyrolysis of organomercury compounds, J. Chem. Soc. (London) 106, 1956).

[155] Fettis, G. C., and Trotman-Dickenson, A. F., The reactions of methyl and ethyl radicals with hydrogen bromide and the strength of C—H Bonds, J. Chem. Soc. (London) 1961, 3037.

[156] Kerr, J. A., Sekhar, R. C., and Trotman-Dickenson, A. F., The pyrolyses of hydrazines and benzylamines. C—C and N—N bond dissociation energies, J. Chem. Soc. (London) 3217, (1963).

[157] Grzechowiak, J., Kerr, J. A., and Trotman-Dickenson, A. F., Reactions of difluoroamino-radicals. Part I. Hydrogen abstraction from acetone and the strength of the C—H Bond in acetone, J. Chem. Soc. (London) 5080, (1965).

[158] Somayajulu, G. R., Dissociation energies of diatomic molecules, J. Chem. Phys., **34**, 1449 (1961).

[159] Porter, R. F., Stabilities of gaseous molecules in the Pb-Se and Pb-Te systems, J. Chem. Phys., **34**, 583 (1961).

[160] Curran, R. K. Low-energy process for F^- formation in SF_6, J. Chem. Phys., **34**, 1069 (1961).

[161] Kennedy, A., and Colburn, C. B., Strength of the N—F bonds in NF_3 and of N—F and N—N bonds in N_2F_4, J. Chem. Phys., **35**, 1892 (1961).

[162] Berkowitz, J., Heat of formation of the CN radical, J. Chem. Phys., **36**, 2533 (1962).

[163] Scheer, M. D., and Fine, J., Entropies, heats of sublimation, and dissociation energies of the cesium halides, J. Chem. Phys., **36**, 1647 (1962).

[164] Tsang, W., Bauer, S. H., and Cowperthwaite, M., Dissociation energy and rate of decomposition of C_2N_2, J. Chem. Phys., **36**, 1768 (1962).

[165] Gingerich, K. A., Mass-spectrometric study of the equilibrium between diatomic and monoatomic phosphorus and dissociation energy of P_2, J. Chem. Phys., **44**, 1717 (1966).

[166] Hildenbrand, D. L., and Murad, E., Mass-spectrometric determination of the dissociation energy of beryllium monofluoride, J. Chem. Phys., **44**, 1524 (1966).

[167] Yates, R. E., Blauer, J. A., Greenbaum, M. A., and Farber, M., Dissociation energy of F_2(g) obtained from the study of gas flow of intermediate pressures through an orifice, J. Chem. Phys., **44**, 498 (1966).

[168] Cater, E. D., Rauh, E. G., and Thorn, R. J., Uranium monosulfide. III. Thermochemistry, partial pressures, and dissociation energies of US and US_2, J. Chem. Phys., **44**, 3106 (1966).

[169] DeMaria, G., Ginerich, K. A., Malaspina, L., and Piacente, V., Dissociation energy of the gaseous AlP molecule, J. Chem. Phys., **44**, 2531 (1966).

[170] Murad, E., Hildenbrand, D. L., and Main, R. R., Dissociation energies of group IIIA monofluorides—The possibility of potential maxima in their excited Π states, J. Chem. Phys., **45**, 263 (1966).

[171] Zmbov, K. F., and Margrave, J. L., Mass-spectrometric studies at high temperatures. XI. The sublimation pressure of NdF_3 and the stabilities of gaseous NdF_2 and NdF, J. Chem. Phys., **45**, 3167 (1966).

[172] Sandoval, A. A., Moser, H. C., and Kiser, R. W., Ionization and dissociation processes in phosphorus trichloride and diphosphorus tetrachloride, J. Phys. Chem., **67**, 124 (1963).

[173] Ackermann, R. J., Rauh, E. G., Thorn, R. J., and Cannon, M. C., A thermodynamic study of the thorium-oxygen system at high temperatures, J. Phys. Chem., **67**, 762 (1963).

[174] Blue, G. D., Green, J. W., Bautista, R. G., and Margrave, J. L., The sublimation pressure of calcium(II) fluoride and the dissociation energy of calcium(I) fluoride, J. Phys. Chem., **67**, 877 (1963).

[175] Pritchard, G. O., and Thommarson, R. L., The C—H bond dissociation energies in CF_3H, C_2F_5H, and C_3F_7H, J. Phys. Chem., **68**, 568 (1964).

[176] Padley, P. J., and Sugden, T. M., Determination of the dissociation constants and heats of formation of molecules by flame photometry, Trans. Faraday Soc., **55**, 2054 (1959).

[177] Bulewicz, E. M., and Sugden, T. M., Determination of the dissociation constants and heats of formation of molecules by flame photometry. Part 5.—The stabilities of MgO and MgOH, Trans. Faraday Soc., **55**, 720 (1959).

[178] Witt, W. P., and Barrow, R. F., The heat of sublimation of aluminum trifluoride and the heat of formation of aluminum monofluoride, Trans. Faraday Soc., **55**, 730 (1959).

[179] Reed, R. I., and Snedden, W., Studies in electron impact methods. Part 6.—The formation of the methine and carbon ions, Trans. Faraday Soc., **55**, 876 (1959).

[180] Drowart, J., Colin, R., and Exsteen, G., Mass-spectrometric study of the vaporization of lead monoxide, Trans. Faraday Soc., **61**, 1376 (1965).

[181] Colin, R., Drowart, J., and Verhaegen, G., Mass-spectrometric study of the vaporization of tin oxides dissociation energy of SnO, Trans. Faraday Soc., **61**, 1364 (1965).

[182] Johnston, H. S., and Bertin, H. J., Jr., Heat of formation of nitrosyl fluoride, J. Am. Chem. Soc., **81**, 6402 (1959).

[183] Cotton, F. A., and Monchamp, R. R., The heat of sublimation and the metal-metal bond energy in $Mn_2(CO)_{10}$, J. Chem. Soc. (London) 533 (1960).

[184] DeMaria, G., Goldfinger, P., Malaspina, L., and Piacente, V., Mass-spectrometric study of gaseous molecules ZnS, ZnSe and ZnTe, Trans. Faraday Soc., **61**, 2146 (1965).

[185] Corbett, P., Tarr, A. M., and Whittle, E., Vapour-phase bromination of fluoroform and methane, Trans. Faraday Soc., **59**, 1609 (1963).

[186] Bautista, R. G., and Margrave, J. L., The heat of sublimation of calcium chloride, J. Phys. Chem., **67**, 2411 (1963).

[187] Bidinosti, D. R., and McIntyre, N. S., The metal-metal bond dissociation energy in cobalt octacarbonyl, Chem. Comm. 1, (1967).

[188] Ferreira, R., Principle of Electronegativity Equalization. Part 2.—Bond-dissociation energies, Trans. Faraday Soc., **59**, 1075 (1963).

[189] Colin, R., Goldfinger, P., and Jeunehomme, M., Mass-spectrometric studies of the vaporization of the sulphides of calcium, strontium, and barium. The dissociation energy of S_2 and SO, Trans. Faraday Soc., **60**, 306 (1964).

[190] Drowart, J., Exsteen, G., and Verhaegen, G., Mass-spectrometric determination of the dissociation energy of the molecules MgO, CaO, SrO, and Sr_2O, Trans. Faraday Soc., **60**, 1920 (1964).

[191] Sugden, T. M., and Schofield, K., Heats of dissociation of gaseous alkali earth dihydroxides, Trans. Faraday Soc., **62**, 566 (1966).

[192] Jensen, D. E., and Padley, P. J., Dissociation energies of the alkali metal hydroxides, Trans. Faraday Soc., **62**, 2132 (1966).

[193] Coomber, J. W., and Whittle, E., Bromination of fluoroalkanes. Part 3.—Methane, Fluoroform and Fluoro-Ethanes, Trans. Faraday Soc., **62**, 1553 (1966).

[194] McEwan, M. J., and Phillips, L. F., Dissociation Energy of NaO_2, Trans. Faraday Soc., **62**, 1717 (1966).

[195] Hunter, G., Adiabatic dissociation energies for the ground states of the H_2, HD, and D_2 molecules, J. Chem. Phys., **45**, 3022 (1966).

[196] Bulewicz, E. M., and Sugden, T. M., Determination of the dissociation constants and heats of formation of molecules by flame photometry. Part 4.—The Stability of GaOH, InOH and TlH, Trans. Faraday Soc., **54**, 830 (1958).

[197] Chupka, W. A., Inghram, M. G., and Porter, R. F., Dissociation energy of gaseous LaO, J. Chem. Phys., **24**, 792 (1956).

[198] Lindeman, L. P., and Guffy, J. C., Determination of the O—O bond energy in hydrogen peroxide by electron impact, J. Chem. Phys., **29**, 247 (1958).

[199] DeMaria, G., Burns, R. P., Drowart, J., and Inghram, M. G., Mass-spectrometric study of gaseous molybdenum, tungsten and uranium oxides, J. Chem. Phys., **32**, 1373 (1960).

[200] Reed, R. I., and Snedden, W., The ionization potential of NH, J. Chem. Soc. (London), 4132 (1959).

[201] Brewer, L., Somayajulu, G. R., and Brackett, E., Thermodynamic properties of gaseous metal dihalides, Chem. Rev., **63**, 111 (1963).

[202] Domalski, E. S., and Armstrong, G. T., The heats of combustion of polytetrafluoroethylene (Teflon) and graphite in elemental fluorine, J. Res. Nat. Bur. Stand. (US), **71A**, (Phys. and Chem.) No. 2, 105 (1967).

[203] Brewer, L., Hicks, W. T., and Krikorian, O. H., Heat of sublimation and dissociation energy of gaseous C_2, J. Chem. Phys., **36**, 182 (1962).

Table of Bond Dissociation Energies

Table of Bond Dissociation Energies

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ag–Ag	$Ag_2 \rightarrow 2Ag$	*171.5*	41.0			Effusion; M.S.	1957	95
		157.3	37.6			Effusion; M.S.	1956	198
		157.3	37.6			Effusion; M.S.	1960	91
		163	39			Analysis of data	1956	3
		157.3 ±9.2	37.6 ±2.2			Analysis of data	1962	6
		171 ±8	41 ±2			Analysis of data	1963	7
		156.9	37.5			Thermochemical;		
		159 ±8	**38 ±2**			based on 9	1967	
Ag–Au	AgAu → Ag + Au	*199.2 ±9.2*	47.6 ±2.2			Effusion; M.S.	1960	91
Ag–Br	AgBr → Ag + Br	*289*	69			Thermochemical	1956	3
		251.0	60			Thermochemical	1950	4
		289 ±42	69 ±10			Thermochemical	1962	6
		289 ±42	**69 ±10**					
Ag–Cl	AgCl → Ag + Cl	*301*	72			Thermochemical	1956	3
		299.2	71.5			Thermochemical	1950	4
		318 ±21	76 ±5			Thermochemical	1962	6
		314 ±21	**75 ±5**					
Ag–Cu	AgCu → Ag + Cu	*170.3*	40.7			Effusion; M.S.	1960	91
		170.3 ±9.2	40.7 ±2.2	*174.1*	41.6	Effusion; M.S.		
		170.3	40.7			Thermochemical;	1967	
		172 ±8	**41 ±2**			based on 9		
Ag–H	AgH → Ag + H	*243*	58			Analysis of data	1956	3
		241.0	57.6			Thermochemical	1950	4
		222 ±8	53 ±2			Extrapolation of $X^1\Sigma$	1962	6
		230 ±13	**55 ±3**			levels		
Ag–I	AgI → Ag + I	*287.4*	68.7			Convergence in B state	1950	4
Ag–O	AgO → Ag + O	*238 ±42*	57 ±10			L.B.S. for ground state	1962	6
		134 ±38	32 ±9			L.B.S. for $B^2\Sigma$ state	1953	1
Ag–Sn	AgSn → Ag + Sn	*132.2 ±21*	31.6 ±5			Effusion; M.S.	1960	63
Al–Al	$Al_2 \rightarrow 2Al$	*188 ±42*	45 ±10			M.S.	1962	6
		163	39	*167*	40	Thermochemical:	1967	
						based on 9		

---

*Throughout the table in the Methods, remarks column, the following abbreviations have been used: M.S.—Mass Spectrometer; L.B.S.—Linear Birge-Sponer Extrapolation; E.I.—Electron Impact; A.P.—Appearance Potential.

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Al–Br	$AlBr \rightarrow Al + Br$	*439*	105			Analysis of data	1960	140
		439	105	*443*	106	Thermochemical;	1967	
			105±2			based on 9		
Al–Cl	$AlCl \rightarrow Al + Cl$	*490*	117			Analysis of data	1960	140
		492.0	117.6	*495.8*	118.5	Thermochemical;	1967	
		490±13	**117±3**	***494±13***	**118±3**	based on 9		
	$AlCl_2 \rightarrow AlCl + Cl$	*391.2±21*	93.5±5	*393.3*	94.0	Thermochemical	1962	6
				406	97			
		400±8	**95.5±2**	***402±8***	**96±2**			
	$AlCl_3 \rightarrow AlCl_2 + Cl$	*397±21*	95±5	*400*	95.5	Thermochemical	1962	6
				372	89	Thermochemical;	1967	
		372±8	**89±2**	***372±8***	**89±2**	based on 9		
	$OAlCl \rightarrow AlO + Cl$			*552*	132	Thermochemical;	1967	
						based on 9		
				515±84	123±20	Thermochemical	1962	6
Al–F	$AlF \rightarrow Al + F$	*653*	156			Analysis of data	1960	140
		653.1±7.5	156.1±1.8			Equilibrium pressure;	1959	178
						$AlF_3(C) + 2Al = 3AlF(S)$		
		661	158			Thermochemical	1956	133
		649	155			Thermochemical	1957	95
		665±13	159±3			Effusion; M.S.	1966	170
		661±8	158±2			Effusion; M.S.	1963	174
		654.8±8	156.5±2			$AlF_3 + 2Al = 3AlF$	1962	6
		659.0	157.5	*663.3*	158.6	Thermochemical;	1967	
		659.0±6.2	**157.5±1.5**	***663.6±6.2***	**158.6±1.5**	based on 9		
	$AlF_2 \rightarrow AlF + F$	*546.0±42*	130.5±10			Thermochemical	1962	6
	$AlF_3 \rightarrow AlF_2 + F$	*544±46*	130±11			Thermochemical	1962	6
	$OAlF \rightarrow AlO + F$			*674±84*	161±20	Thermochemical	1962	6
				761	182	Thermochemical;	1967	
				761±42	**182±10**	based on 9		
Al–H	$AlH \rightarrow Al + H$	*< 295*	< 70.5			Predissociation	1950	4
		280.7±5.0	67.1±1.2			Spectroscopic; predissociation	1961	53
		280±21	67±5			Thermochemical	1962	6
		280	67	*284.9*	68.1	Thermochemical;	1967	
		280.3±6.3	**67.0±1.5**	***284.9±6.3***	**68.1±1.5**	based on 9		

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Al–I	$AlI \rightarrow Al + I$	*364.0*	87.0			Analysis of fluctuation bands	1960	140
		364 ± 13	87 ± 3			Analysis of data	1962	6
		364	87	*367.7*	87.9	Thermochemical; based on 9	1967	
		364 ± 4	**87 ± 1**	***368 ± 4***	**88 ± 1**			
Al–O	$AlO \rightarrow Al + O$	*481 ± 21*	115 ± 5			Effusion; M.S.	1960	104
		569	136			Flame photometry	1958	16
		481 ± 21	115 ± 5			Thermochemical	1962	6
		479.5	114.6	*484.5*	115.8	Thermochemical; based on 9	1967	
		481 ± 8	**115 ± 2**	***485 ± 8***	**116 ± 2**			
	$OAlF \rightarrow AlF + O$			*582*	139	Thermochemical; based on 9	1967	
	$OAlCl \rightarrow AlCl + O$			*540*	129	Thermochemical; based on 9	1967	
				540 ± 41	**129 ± 10**			
Al–P	$AlP \rightarrow Al + P$	*212.6 ± 13*	50.8 ± 3			Effusion; M.S.	1966	169
Al–S	$AlS \rightarrow Al + S$	*339 ± 67*	81 ± 16			Spectroscopic; L.B.S.	1959	54
		326 ± 21	78 ± 5			Spectroscopic; predissociation	1962	6
		402	96	*406*	97	Thermochemical; based on 9	1967	
As–As	$As_2 \rightarrow 2As$	*379.9 ± 21*	90.8 ± 5			Spectroscopic; predissociation	1962	6
		379.9	90.8	*382.8*	91.5	Thermochemical; based on 9	1967	
		380 ± 21	**91 ± 5**	***382.8 ± 21***	**91.5 ± 5**			
As–Cl	$AsCl_3 \rightarrow AsCl_2 + Cl$	*444*	106	*448*	107	Thermochemical; based on 9	1967	
As–N	$AsN \rightarrow As + N$	*628 ± 126*	150 ± 30			L.B.S.	1962	6
		577	138	*582*	139	Thermochemical; based on 9	1967	
As–O	$AsO \rightarrow As + O$	*473 ± 8*	113 ± 2	*477*	114	Spectroscopic; predissociation	1960	6
		477.4	114.1	*481.6*	115.1	Thermochemical; based on 9	1967	
		477 ± 8	**114 ± 2**	***481***	**115 ± 2**			
At–At	$At_2 \rightarrow 2At$	*115.9*	27.7			Theoretical	1960	109

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Au–Au	$Au_2 \rightarrow 2Au$	*210.5*	50.3			Thermochemical; M.S.	1956	108
		221.8	53.0			Effusion; M.S.	1957	95
		215.5	51.5			Effusion; M.S.	1960	91
		215.1	51.4	*217*	51.9	Thermochemical;	1967	
		215.5±6.3	**51.5±1.5**	***218±6***	**52±1.5**	based on 9		
Au–Cl	$AuCl \rightarrow Au + Cl$	*293±59*	70±14			Spectroscopic; L.B.S.	1962	6
		289	69	*293*	70	Thermochemical;	1967	
		289±63	**69±15**	***293±63***	**70±15**	based on 9		
Au–Cr	$AuCr \rightarrow Au + Cr$	*210.9±14.6*	50.4±3.5			M.S.	1962	62
		213	51			Thermochemical;	1967	
		211.3±6.3	**50.5±1.5**			based on 9		
Au–Cu	$AuCu \rightarrow Au + Cu$	*228.0±9.2*	54.5±2.2			Effusion; M.S.	1960	91
Au–H	$AuH \rightarrow Au + H$	*297±10*	71±2.5			Spectroscopic	1962	6
		285.3	68.2	*289.1*	69.1	Thermochemical;	1967	
		285±13	**68±3**	***289±13***	**69±3**	based on 9		
Au–Pd	$AuPd \rightarrow Au + Pd$	*139.3±21*	33.3±5			M.S.	1962	62
Au–Sn	$AuSn \rightarrow Au + Sn$	*240.6±17*	57.5±4			Effusion; M.S.	1962	63
B–B	$B_2 \rightarrow 2B$	*274.1*	65.5			M.S.	1962	58
		260.7	62.3			M.S.	1962	6
		293	70	*297*	71	Thermochemical;	1967	
		293±21	**70±5**	***297±21***	**71±5**	based on 9		
	$B_2Cl_4 \rightarrow 2BCl_2$	*331*	79			Calorimetry	1959	102
		246.0	58.8			Thermochemical	1962	6
	$B_2F_4 \rightarrow 2BF_2$			*151*	36	Thermochemical	1962	6
	$B_2O_2 \rightarrow 2BO$	*>416.7*	>99.6			Effusion; M.S.	1956	90
		498±84	119±20	*502*	120	Thermochemical	1962	6
		502	120	*506*	121	Thermochemical;	1967	
		502±84	**120±20**	***506±84***	**121±20**	based on 9		
B–Br	$BBr \rightarrow B + Br$	*431*	103			Analysis of data	1960	140
		433.0±8	103.5±2	*436.8*	104.4	Analysis of data	1962	6
		433.0	103.5	*436.4*	104.3	Thermochemical;	1967	
		433.0±21	**103.5±5**	***435±21***	**104±5**	based on 9		

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
B–C	$BC \rightarrow B + C$	*444*	106			Thermochemical; based on 9	1967	
B–Cl	$BCl \rightarrow B + Cl$	*531*	127			Analysis of data	1960	140
		494±42	118±10	*498*	119	Spectroscopic; extrapolation	1962	6
		531	127	*536*	128	Thermochemical; based on 9	1967	
		531±29	**127±7**	***536±29***	**128±7**			
	$OBCl \rightarrow BO + Cl$			*515±75*	123±18	Thermochemical	1962	6
				460	110	Thermochemical; based on 9	1967	
				460±42	**110±10**			
B–F	$BF \rightarrow B + F$	*774*	185			Analysis of data	1960	140
		774±63	185±15	*778*	186	Spectroscopic	1962	6
		753±13	180±3			Effusion; M.S.	1966	170
		757±17	181±4			M.S.; $B(c) + CaF_2(c) = BF(g) + CaF(g)$	1965	69
		759.8	181.6	*764.0*	182.6	Thermochemical; based on 9	1967	
		759.4±10.5	**181.5±2.5**	***766±13***	**183±3**			
	$BF_2 \rightarrow BF + F$	*565±105*	135±25	*569*	136	Thermochemical	1962	6
		515	123			M.S.; $B(c) + CaF_2(c) = BF(g) + CaF(g)$	1965	69
		523±63	**125±15**					
	$BF_3 \rightarrow BF_2 ; F$	*557±84*	133±20	*561*	134	Thermochemical	1962	6
		665	159			M.S.; $B(c) + CaF_2(c) = BF(g) + CaF(g)$	1965	69
	$FBO \rightarrow Bo + F$	*820±113*	196±27	*824*	197	Thermochemical	1962	6
				711	170	Thermochemical; based on 9	1967	
				711±42	**170±10**			
B–H	$BH \rightarrow B + H$	*289±38*	69±9			Spectroscopic	1953	1
		327.2	78.2±1			Predissociation	1962	6
		327.2	78.2	*331.0*	79.1	Thermochemical; based on 9	1967	
		326±4	**78±1**					
B–N	$BN \rightarrow B + N$	*385±50*	92±12			L.B.S. for ground and $^3\Pi$ states	1962	6
		385	92	*389*	93	Thermochemical; based on 9	1967	
		385±21	**92±5**	***389±21***	**93±5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
B–O	BO → B + O	*715*	171			L.B.S. for $X^2\Sigma$, $A^2\Pi$, $B^2\Sigma$, $C^2\Pi$.	1960	50
		770±46	184±11	*774*	185		1959	51
		782	187	*787*	188	Thermochemical; based on 9	1967	
		782±42	**187±10**	***787±42***	**188±10**			
	ClBO → BCl + O			*791±75*	189±18	Thermochemical	1962	6
				711	170	Thermochemical; based on 9	1967	
					171±10			
	FBO → BF + O	*816±117*	195±28	*820*	196	Thermochemical	1962	6
				732	175	Thermochemical; based on 9	1967	
				732±42	**175±10**			
B–S	BS → B + S	*577±117*	138±28	*582*	139	Spectroscopic	1962	6
		494	118	*498*	119	Thermochemical; based on 9	1967	
		494±42	**118±10**	***498±42***	**119±10**			
B–Si	BSi → B + Si	*285*	68			Thermochemical; based on 9	1967	
Ba–Br	BaBr → Ba + Br	*269.9±54*	64.5±13	*274.1*	65.5	Spectroscopic; L.B.S. for ground state	1962	4; 6
		This value is probably too low (see 11)						
	$BaBr_2$ → BaBr + Br			*598±54*	143±13	Thermochemical	1962	6
		If D_1 is too low (see above); this value is too high						
Ba–Cl	BaCl → Ba + Cl	*259±50*	62±12	*264*	63	Spectroscopic; L.B.S. for ground state	1962	4; 6
		494±21	118±5			Flame photometry; $H_2 + O_2 + N_2$	1964	11
		477±25	114±6			Flame photometry; $H_2 + O_2 + N_2$	1965	23
		494	**118±10**					
	$BaCl_2$ → BaCl + Cl			*728±50*	174±12	Thermochemical	1962	6
		201 gives $D_1 + D_2 = 236$ Kcal mol^{-1}; D_2 is probably about 236 − 118 ± 10 = 118 ± 10 Kcal mol^{-1}.						
		431±42	103±10			Flame photometry; $H_2 + O_2 + N_2$	1965	23
		456±42	**109±10**					

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ba–F	$BaF \rightarrow Ba + F$	*364±71*	87±17	*368*	88	Spectroscopic; L.B.S. for ground state.	1962	4; 6
		561±8	134±2			Effusion; M.S.; $2BaF = Ba + BaF_2$	1964	68
		552±17	132±4			Effusion; M.S.; $Ba + AlF = Al + BaF$	1964	68
		602±29	144±7			Flame photometry;	1964;	11;
		569±42	**136±10**			$H_2 + O_2 + N_2$	1965	23
	$BaF_2 \rightarrow BaF + F$			*799±71*	191±17	Thermochemical	1962	6
		584.1±25	139.6±6			Effusion; M.S.	1964	68
		201 gives $D_1 + D_2 = 279$ Kcal mol^{-1}; 68 gives 273, and 6 gives 279 Kcal mol^{-1}.						
		569±42	136±10			Flame photometry; $H_2 + O_2 + N_2$	1964	11
		586±42	**140±10**					
Ba–H	$BaH \rightarrow Ba + H$	*172±8*	41±2	*176*	42	Spectroscopic; predissociation of $C^2\Sigma$	1962	1; 6
		195.5	46.73			Spectroscopic; predissociation	1966 1965	25; 24; 26
		197.3	47.16			Spectroscopic; Rydberg extrapolation	1966 1965	25; 24; 26
Ba–O	$BaO \rightarrow Ba + O$	*482.4±9.6*	115.3±2.3			Flame photometry; CO-Air; Band & Line Intensity	1965	71
		539±14.6	128.7±3.5			Thermochemical	1951	12
		544±21	130±5			Effusion; M.S.	1955	13
		573±8	137±2	*577*	138	M.S.	1962	6
		590±42	141±10			Thermochemical	1964	144
		545.6±25	130.4±6			M.S.; $Ba + SO = BaO + S$	1964	189
		577±21	138±5			Flame photometry $H_2 + O_2$	1966	191
		567.4±21	135.6±5			Thermochemical	1964	14
		561±21	134±5			Recalculated from earlier	1965	22
		561±42	**134±10**			data		
	$BaOH \rightarrow Ba + OH$	*448*	107			Effusion; M.S.; $2BaO + HOH = BaOH + O$.	1964	14
		464±33	111±8			Flame photometry; $H_2 + O_2 + N_2$	1965	22
		477	114			Flame photometry;	1965	48
		473±42	**113±10**			$H_2 + O_2 + N_2$		
	$Ba(OH)_2 \rightarrow BaOH + OH$	*414*	99			Effusion; M.S.	1964	14
		Ref. 191 gives $D_1 + D_2 = 229 \pm 12$ Kcal mol^{-1}; 14 gives $D_1 + D_2 = 206$ Kcal mol^{+1}.						
		510±50	122±12			Based on $D_2 = 107$;		191
		460±84	**110±20**			$D_1 + D_2 = 229 \pm 12$		14

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ba–S	BaS → Ba + S	*396.2 ± 18.8*	94.7 ± 4.5			Effusion; M.S.	1964	189
Be–Cl	BeCl → Be + Cl	*460 ± 63*	110 ± 15	*464*	111	Spectroscopic; extrapolation of $X^2\Sigma$ and $A^2\Pi$.	1962	6
		385	92	*389*	93	Thermochemical; based on 9	1967	
		385 ± 63	**92 ± 15**	***389 ± 63***	**93 ± 15**			
	$BeCl_2$ → BeCl + Cl	*456 ± 63*	109 ± 15	*460*	110	Thermochemical	1962	6
				539.7	129.0	Thermochemical; based on 9	1967	
		536 ± 63	**128 ± 15**	***540 ± 63***	**129 ± 15**			
Be–F	BeF → Be + F	*669 ± 84*	160 ± 20	*674*	161	Spectroscopic; extrapolation of $X^2\Sigma$ and $A^2\Pi$.	1962	6
		< 656.1	< 156.8			M.S.; Be + BeF_2 = 2BeF	1965	73
		< 617.6	< 147.6			M.S.; Al + BeF_2 = BeF + AlF	1965	73
		564.4 ± 9.6	134.9 ± 2.3			M.S.	1966	166
		575.3	137.5	*579.1*	138.4	Thermochemical; based on 9	1967	
		573 ± 42	**137 ± 10**	***577 ± 42***	**138 ± 10**			
	BeF_2 → BeF + F	*586 ± 84*	140 ± 20	*590*	141	Thermochemical	1962	6
				698.7	167.0	Thermochemical; based on 9	1967	
		690 ± 63	**165 ± 15**	***699 ± 63***	**167 ± 15**			
Be–H	BeH → Be + H	*222 ± 29*	53 ± 7	*226*	54	Spectroscopic; extrapolation of $X^2\Sigma$ and $A^2\Pi$	1962	6
		222	53	*226*	54	Thermochemical; based on 9	1967	
		222 ± 21	**53 ± 5**	***226 ± 21***	**54 ± 5**			
Be–O	BeO → Be + O	*445.2 ± 12.6*	106.4 ± 3	*449.4*	107.4	M.S.	1962	6
		443.9 ± 9.6	106.1 ± 2.3			Spectroscopic	1964	86
				448	107	Thermochemical; based on 9	1967	
		444 ± 21	**106 ± 5**	***448 ± 21***	**107 ± 5**			
Bi–Bi	Bi_2 → 2Bi	*197 ± 4*	47 ± 1	*201*	48	Thermochemical; $\Delta H_{vap.}$	1962	6
		192.5	46.0	*194.6*	46.5	Thermochemical; based on 9	1967	
		192 ± 4	**46 ± 1**	***197 ± 4***	**47 ± 1**			
Bi–S	BiS → Bi + S			*305*	73	Thermochemcial; based on 9	1967	

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Bi–Se	$BiSe \rightarrow Bi + Se$	*231.4*	55.3			Effusion; M.S.	1960	61
				259	61.8	Thermochemical; based on 9	1967	
Bi–Te	$BiTe \rightarrow Bi + Te$	*202.5*	48.4			Effusion; M.S.	1960	61
				225	53.7	Thermochemical; based on 9	1967	
Br–Br	$Br_2 \rightarrow 2Br$	*190.08 ± .12*	45.43 ± 0.03	*192.9*	46.1	Spectroscopic; convergence of bands	1962	6
		190.18	45.455	*192.86*	46.095	Thermochemical; based on 9	1967	
		190.16 ± .04	**45.45 ± 0.01**	***192.88 ± 0.04***	**46.10 ± 0.01**			
Br–Cl	$BrCl \rightarrow Br + Cl$	*215.30 ± 0.25*	51.458 ± 0.06	*218.4*	52.2	Thermochemical	1962	6
		215.85	51.59	*218.91*	52.32	Thermochemical; based on 9	1967	
		215.9 ± 0.4	**51.6 ± 0.1**	***218.8 ± 0.4***	**52.3 ± 0.1**			
Br–F	$BrF \rightarrow Br + F$	*230.04 ± 0.25*	54.98 ± 0.06	*233.5*	55.8	Spectroscopic; convergence of bands	1962	6
		281.2	67.2	*284.9*	68.1	Thermochemical; based on 9	1967	
Br–H	$HBr \rightarrow H + Br$	*362.71 ± 0.54*	86.69 ± 0.13	*366.5*	87.6	Thermochemical	1962	6
		361.5	86.4			Theoretical	1963	178
		362.50	86.64	*366.27*	87.54	Thermochemical; based on 9	1967	
		362.3 ± 0.4	**86.6 ± 0.1**	***366.1 ± 0.4***	**87.5 ± 0.1**			
Br–O	$BrO \rightarrow Br + O$	*231.0*	55.2			Spectroscopic	1958	33
		231.4 ± 2.5	55.3 ± 0.6	*235.1*	56.2	Spectroscopic; extrapolation of $A^2\Pi$.	1962	6
		231.25	55.27	*235.27*	56.23	Thermochemical: based on 9	1967	
		231.4 ± 0.4	**55.3 ± 0.1**	*235.1*	56.2 ± 0.1			
C–Br	$CH_3Br \rightarrow CH_3 + Br$	*224.7*	53.7			E.I.; M.S.	1959	179
				280	67	(T = 1000 K) pyrolysis	1962	6
				293	70	Analysis of data	1966	8
		279.9	66.9	*285.8*	68.3	Thermochemical; based on 9	1967	
		280 ± 8	**67 ± 2**	***285 ± 8***	**68 ± 2**			
	$CH_2Br_2 \rightarrow CH_2Br + Br$			*249.8 ± 14.6*	59.7 ± 3.5	E.I.; M.S.	1959	179
				261.5	62.5 (at 950 K)	Pyrolysis	1962	6
				255 ± 13	**61 ± 3**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CHBr_3 \rightarrow CHBr_2 + Br$			*257.7 ± 17*	61.6 ± 4	E.I.; M.S.	1959	179
				232.2	55.5	Pyrolysis	1962	6
	$CBr_4 \rightarrow CBr_3 + Br$			*207.9*	49.7	E.I.; M.S.	1959	179
				205	49 (at 750 K)	Pyrolysis	1962	6
		205	49	*209*	50	Thermochemical; based on 9	1967	
		205 ± 13	49 ± 3	***209 ± 13***	**50 ± 3**			
	$CCl_3Br \rightarrow CCl_3 + Br$			*207.1 ± 12.6*	49.5 ± 3	(*T* = 400–500 K); E.I.; M.S.	1962	6
				205	49	(T = 800 K), pyrolysis	1962	
				230.5 ± 5.0	55.1 ± 1.2	Recalculation of earlier data on photobromination.	1965	70
				226 ± 8	54 ± 2	Analysis of data	1966	8
		213	51	*218*	52	Thermochemical; based on 9	1967	
		213 ± 13	**51 ± 3**	***218 ± 13***	**52 ± 3**			
	$CF_3Br \rightarrow CF_3 + Br$			*272*	65	(T = 1050 K), pyrolysis	1962	6
				290.4 ± 3.3	69.4 ± 0.8	Equilibrium $Br_2 + CF_3H = HBr + CF_3Br$	1967	15
		276	66	*276*	66	Thermochemical; based on 9	1967	
				285 ± 13	**68 ± 3**			
	$BrCN \rightarrow CN + Br$	*377*	90	*380*	91	Thermochemical; based on 9	1967	
C–C	$C_2 \rightarrow 2C$	*599.1 ± 13*	143.2 ± 3	*603.3*	144.2	M.S.	1962	6
		602 ± 21	144 ± 5			Spectroscopic	1962	203
		602 ± 21	**144 ± 5**	***607 ± 21***	**145 ± 5**			
	$CH_3CN \rightarrow CH_3 + CN$			*431*	103	(*T* = 400–500 K); E.I.	1962	6
				431	103	A.P.; M.S.	1959	179
		498	119	*506*	121	Thermochemical; based on 9	1967	
		498 ± 21	**119 ± 5**	***506 ± 21***	**121 ± 5**			
	$CH_2FCN \rightarrow CH_2F + CN$			*~460*	~110	(*T* = 400–500 K); E.I.; M.S.	1960	16
	$CHF_2CN \rightarrow CHF_2 + CN$			*485*	116	(*T* = 400–500 K); E.I.; M.S.	1960	16
	$CF_3CN \rightarrow CF_3 + CN$			*502*	120	(*T* = 400–500 K); E.I.; M.S.	1960	16

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$C_2N_2 \rightarrow 2CN$			*435*	104	A.P.; M.S.	1961	127
		607	145			Shock wave; thermochemical	1961	120
				523 ± 33	125 ± 8	(T = 1700–2500 K) Shock wave	1962	164
				607	145	Analysis of data	1966	8
		598	143	*602*	144	Thermochemical; based on 9	1967	
		598 ± 21	**143 ± 5**	***603 ± 21***	**144 ± 5**			
	$CH_2CO \rightarrow CH_2 + CO$	*337.2*	80.6	*342.7*	81.9	Thermochemical; based on 9	1967	
	$CH_3CO \rightarrow CH_3 + CO$			*44.4*	10.6	Analysis of data	1966	8
				47.3	11.3	Thermochemical; based on 9	1967	
				46 ± 4	**11 ± 1**			
C–Cl	$CCl \rightarrow C + Cl$	*322*	77			Spectroscopic; L. B. S. for ground state.	1961	17
		335 ± 42	80 ± 10	*338.1*	80.8	Analysis of data	1961	6
	$CCl_4 \rightarrow CCl_3 + Cl$			*284.1 ± 13*	67.9 ± 3	A.P.; M.S.	1956	124
				301 ± 10	72 ± 2.5	A.P.; M.S.	1958	18
		337.2	80.6			Based on rate constants; previous data.	1961	141
				318	76	A.P.; M.S.	1961	19
				311.7 ± 8	74.5 ± 2	Thermochemical analysis of earlier data on photobromination.	1965	70
				305 ± 8	73 ± 2	Analysis of data; thermochemical.	1966	8
		280	67	*285*	68	Thermochemical; based on 9	1967	
				293 ± 21	**70 ± 5**			
	$CF_3Cl \rightarrow CF_3 + Cl$			*347 ± 12*	83 ± 3	A.P.; M.S.	1956	124
				~ 335	~ 80		1962	6
		335	80	*339*	81	Thermochemical; based on 9	1967	
				339 ± 13	**81 ± 3**			
	$CH_3Cl \rightarrow CH_3 + Cl$			*328*	78.4	A.P.; M.S.	1959	179
				336.8	80.5	(T = 400–500 K); E.I.; M.S.	1962	6
		318	76			Based on rate constants; previous data	1961	141
				351 ± 8	84 ± 2	Analysis of data; thermochemical	1966	8
		335.1	80.1	*341.4*	81.6	Thermochemical; based on 9	1967	
				339 ± 21	**81 ± 5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CH_2Cl_2 \rightarrow CH_2Cl + Cl$			*307.9±11.7*	73.6±2.8	(T=400–500 K); A.P.; M.S.	1959	179
		314±75				Based on rate constants; previous data	1961	141
	$CH_2Cl \rightarrow CH_2 + Cl$			*318.4±13*	76.1±3	A.P.; M. S. (Based on D(CH—H)=119.9 Kcal mol^{-1}).	1959	179
				498	119	Recalculated; based on D(CH—H)=99.3 Kcal mol^{-1}.	1967	
	$ClCN \rightarrow CN + Cl$	*435*	104	*439*	105	Thermochemical; based on 9	1967	
	$COCl \rightarrow CO + Cl$	*26.4*	6.3			Based on rate constants; previous data	1961	141
	$COCl_2 \rightarrow COCl + Cl$	*328.4*	78.5			Based on rate contants; previous data.	1961	141
C–F	$CCl_3F \rightarrow CCl_3 + F$			*427±29*	102±7	(T=400–500 K); E.I.; M.S.	1962	6
				448±11.7	107±2.8	Recalculation of earlier data on photobromination	1965	70
				444±13	106±3	Analysis of data	1966	8
		410	98	*414*	99	Thermochemical; based on 9	1967	
				444±21	**106±5**			
	$CF_4 \rightarrow CF_3 + F$			*506±10.5*	121±2.5	E.I.; M.S.	1958	18
				506±17	121+4	E.I.; M.S.	1962	6
		523	125	*527*	126	Thermochemical; based on 9	1967	
				532.6	127.3	Thermochemical; based on 202	1967	
				523±17	**125±4**			
	$CH_3F \rightarrow CH_3 + F$			*494*	118	Analysis of data	1962	6
				452±13	108±3	Thermochemical	1966	8
				452±21	**108±5**			
C–H	$CH \rightarrow C + H$	*335±4*	80±1			Spectroscopic; predissociation	1956	3
		318.4	76.1			Theoretical	1962	134
		335±21	80±5			Spectroscopic; $^2\Pi$ emission	1964	79
		334.7	80.0	*338.9*	81.0	Thermochemical; based on 9	1967	
				339±2.1	**81±0.5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CH_2 \rightarrow CH + H$			*502*	120	A.P.; M.S.	1959	179
		436.4	104.3			Theoretical	1962	134
				536±25	128±6	Analysis of data	1962	6
				< *405.0±9.6*	< 96.8±2.3	Recalculation of earlier M.S. data	1963	67
				452±25	108±6	Analysis of data	1966	8
		415.5	99.3	*421.7*	100.8	Thermochemical; based on 9 and 122.	1967	
	$CH_3 \rightarrow CH_2 + H$	*485*	116			Theoretical	1962	134
				356±29	85±7	Analysis of data	1962	6
		< *540*	< 129			Recalculation of earlier M.S.data	1963	67
		469.86	112.30			Photoionization	1965	122
				435±25	104±6	Analysis of data	1966	8
		466.5	111.5	*471.1*	112.6	Thermochemical; based on 9	1967	
		469.9±0.4	**112.3±0.1**	***473±4***	**113±1**			
	$CH_4 \rightarrow CH_3 + H$			*397*	95	A.P.; M.S.	1959	179
		423	101			Photobromination	1956	3
				434.7	103.9	Photohalogenation	1961	155
		425.1±8	101.6±2	*431±8*	103±2	Analysis of data	1962	6
		423	101			Theoretical	1962	134
		425.47±0.21	101.69±0.05			Photoionization	1965	122
				435±4	104±1	Analysis of data	1966	8
				434.3	103.8		1967	
		425.1	101.6	*431.8*	103.2	Thermochemical; based on 9	1967	
			101.6±2.0		**102.7±2.0**			
	$CD_4 \rightarrow CD_3 + D$	*438.99±0.2*	104.92±0.05			Photoionization	1965	123
	$CBr_3H \rightarrow CBr_3 + H$			*389±8*	93±2	(T=400 K); photobromination	1962	6
				377	90	Thermochemical	1962	6
		368±8	**88±2**	***377±8***	**90±2**			
	$CH_3Br \rightarrow CH_2Br + H$	*~414*	~99			Photobromination	1956	3
		402	96			Thermochemical	1962	6
		406±21	**97±5**					
	$CCl_3H \rightarrow CCl_3 + H$			*377±8*	90±2	Photobromination	1956	3
				389	93	Rate constant data	1961	141
				372±13	89±3	(T=400–500 K); E.I.; M.S.	1962	6
				389	93	(T=430 K); photochlorination	1962	6
				400.4±6.3	95.7±1.5	Recalculation of earlier data on photobromination	1965	70
		372	89	*380*	91	Thermochemical; based on 9	1967	
		372±13	**89±3**	***377±13***	**90±3**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CH_3CN \rightarrow CH_2CN + H$			*<331*	<79	A.P.; M.S.		
	$HCN \rightarrow H + CN$			*464±25*	111±6	Thermochemical	1956	3
				540±13	129±3	Shock wave; $Kr + C_2N_2$; $Kr + HCN$	1961	120
				540±13	129±3	Analysis of data	1966	8
		531	127	*540*	129	Thermochemical; based on 9	1967	
		531±21	**127±5**	***540±21***	**129±5**			
	$HCO \rightarrow H + CO$			*127.2±9.6*	30.4±2.3	(T=400–500 K); E.I.; M.S.	1962	6
				75	18	Analysis of data	1966	8
		119.7	28.6	*124.7*	29.8	Thermochemical; based on 9	1967	
	$H_2CO \rightarrow HCO + H$			*<326*	<78	Photolysis	1962	6
				314±8	75±2	E.I.; M.S.	1962	6
				368±8	88±2	Analysis of data	1966	8
		314	75	*318*	76	Thermochemical; based on 9	1967	
	$CF_3H \rightarrow CF_3 + H$			*431±17*	103±4	E.I.; M.S.; $\Delta H_f(CF_3) = -117 \pm 2$	1956	124
				427±8	102±2	From $CF_3 + CH_4 \rightarrow CF_3H + CH_3$	1956	138
				431±17	103±4	E.I.; M.S.	1962	6
				458.1±6.3	109.5±1.5	Photohalogenation	1963	185
				427±8	102±2	$CD_3 + CF_3H \rightarrow CD_3H + CF_3$	1964	175
				443.5	106.0	$Br + CF_3H = HBr + CF_3$; $Br + CH_4 = HBr + CH_3$	1966	193
				444.8	106.3	Equilibrium	1966	150
				444±4	106±1	Analysis of data	1966	8
				444.8	106.3	Equilibrium	1967	15
		423	101	*431*	103	Thermochemical; based on 9	1967	
		439±13	**105±3**	***444±13***	**106±3**			
	$CH_3Cl \rightarrow CH_2Cl + H$			*372.0±13*	88.9±3		1956	124
		410	98			Photochlorination	1961	141
	$CH_2Cl_2 \rightarrow CHCl_2 + H$			*333.0±21*	79.6±5	E.I.; M.S.	1959	179
				397	95	Photochlorination	1961	141
	$CH_3CN \rightarrow CH_2CN + H$			*< 331*	< 79	E.I.; M.S.	1961	125
	$CH_3OH \rightarrow CH_2OH + H$			*385*	92	$Br + CH_3OH \rightarrow HBr + CH_2OH$	1962	139

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
C–I	$CH_3I \rightarrow CH_3 + I$			*221.7*	53.0	A.P.; M.S.	1959	179
		230	55			Previous data on $HI + CH_3I = CH_4 + I_2$	1961	103
				220.1	52.6	E.I.	1962	6
				230 ± 4	55 ± 1	Equilibrium $HI + CH_3I = CH_4 + I_2$	1963	65
		227.2	54.3	*232.6*	55.6	Thermochemical; based on 9	1967	
		226 ± 13	**54 ± 3**	***232.2 ± 13***	**55.5 ± 3**			
	$CNI \rightarrow CN + I$	*335*	80	*339*	81	Thermochemical; based on 9	1967	
C–N	$CN \rightarrow C + N$			*808*	193	A.P.; M.S.	1961	127
				728 ± 13	174 ± 3	Shock wave; $Kr + C_2N_2$	1961	120
		812 ± 21	194 ± 5	*816*	195	Analysis of various data	1962	6
		723.4 ± 9.6	172.9 ± 2.3			Effusion; M.S.	1962	162
		732	175	*732*	175	Thermochemical; based on 9	1967	
		730.1 ± 21	**174.5 ± 5**	***732 ± 21***	**175 ± 5**			
	$CH_3NH_2 \rightarrow CH_3 + NH_2$			*335*	80	A.P.; M.S.	1959	128
				331	79	Analysis of data	1966	8
				335	80	Thermochemical; based on 9	1967	
				331 ± 13	**79 ± 3**			
	$CH_3NO_2 \rightarrow CH_3 + NO_2$			*243*	58	Analysis of data	1962	6
		238.9	57.1	*246.9*	59.0	Thermochemical; based on 9	1967	
				247 ± 13	**59 ± 3**			
C–O	$CO \rightarrow C + O$	*1070.23*	255.79	*1074.83*	256.89	Analysis of data	1962	6
		1071.77	256.16	*1076.38*	257.26	Thermochemical; based on 9	1967	
		1071.94 ± 0.4	**256.2 ± 0.1**	***1076.5 ± 0.4***	**257.3 ± 0.1**			
	$CO_2 \rightarrow CO + O$	*526.14*	*125.75*	*532.20*	127.20	Thermochemical	1962	6
		526.14	125.75	*532.16*	127.19	Thermochemical; based on 9	1967	
		525.9 ± 0.4	**125.7 ± 0.1**	***532.2 ± 0.4***	**127.2 ± 0.1**			
	$CH_3OH \rightarrow CH_3 + OH$	*374.5*	89.5				1956	132
				381.2	91.1	A.P.; M.S.	1959	179
				~ 377	~ 90	Photodissociation	1962	6
				381 ± 8	91 ± 2	Thermochemical	1966	8
		370.7	88.6	*378.7*	90.5	Thermochemical; based on 9	1967	
		370.3 ± 13	**88.5 ± 3**	***377 ± 13***	**90 ± 3**			
	$HCOOH \rightarrow CHO + OH$			*~ 377*	~ 90	Photodissociation	1962	6
				400.4	95.7	Thermochemical; based on 9	1967	
				402 ± 13	**96 ± 3**			

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CH_3COOH \rightarrow CH_3CO + OH$			*~377*	~90	Photodissociation	1962	6
				452.3	108.1	Thermochemical; based on 9	1967	
				452±21	**108±5**			
	$OCS \rightarrow CS + 0$	*619*	148	*628*	150	Thermochemical; based on 9	1967	
C–S	$CS \rightarrow C + S$	*757±151*	181±36			Spectroscopic; L.B.S. for $X^1\Sigma$ state	1959	20
		735.5	175.8	*740.1*	176.9	Thermochemical	1962	6
		757±21	**181±5**	***761±21***	**182±5**			
	$OCS \rightarrow CO + S$	*305.0*	72.9	*310.5*	74.2	Thermochemical; based on 9	1967	
	$CS_2 \rightarrow CS + S$	*389*	93	*397*	95	Thermochemical; based on 9	1967	
	$CH_3S \rightarrow CH_3 + S$			*289*	69		1962	137
	$CH_3SH \rightarrow CH_3 + SH$			*305±21*	73±5	Thermochemical; $\Delta H_f(SH) = 35.0$	1962	135
				293±21	70±5	($T = 400°–500°$); E.I.; M.S.	1962	6
		297	71	*305*	73	Thermochemical; based on 9	1967	
		297±13	**71±3**	***305±13***	**73±3**			
	$CH_3SO_2 \rightarrow CH_3 + SO_2$			*97.5±7.5*	23.3±1.8	Thermochemical	1961	142
Ca–Cl	$CaCl \rightarrow Ca + Cl$	*<266.1*	<63.6			Spectroscopic; predissociation.	1962	6
		335±42	80±10			Calorimetric	1963	186
		427±25	102±6			Flame photometry	1965	23
		427±42	**102±10**					
	$CaCl_2 \rightarrow CaCl + Cl$	*431±42*	103±10			Flame photometry	1965	23
		431±42	**103±10**					
Ca–F	$CaF \rightarrow Ca + F$	*<303.8*	<72.6			Spectroscopic; predissociation.	1962	6
		515±19	123±4.6			Effusion; M.S.	1963	174
		565±29	135±71					
		552±42	**132±10**					

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CaF_2 \rightarrow CaF + F$	*548 ± 42*	131 ± 10			Flame photometry; recalculated from ref. 21.	1965	23
		569	136			Flame photometry	1964	21
		548 ± 42	**131 ± 10**					
Ca–O	$CaO \rightarrow Ca + O$	*481 ± 17*	115 ± 4			Analysis of data on flames	1962	6
		347 ± 42	83 ± 10			Theoretical	1964	144
		389 ± 21	93 ± 5			Effusion; M.S.	1964	190
		353.1 ± 25	84.4 ± 6			Effusion; M.S.	1964	189
		382.0 ± 5.9	91.3 ± 1.4			Flame photometry; CO flame	1965	71
		490 ± 21	117 ± 5			Flame photometry; H_2 flame	1965	22
		531 ± 21	127 ± 5			Flame photometry; H_2 flame	1966	191
		460 ± 84	**110 ± 20**					
	$CaOH \rightarrow Ca + OH$	*≤ 397 ± 42*	≤ 95 ± 10			Flame photometry; $C_2H_2 + CO$ flames	1957	52
		418 ± 33	100 ± 8			Flame photometry; H_2 flame	1965	22
	$Ca(OH)_2 \rightarrow CaOH + OH$	*490 ± 75*	117 ± 18			Ref 191 gives $D_1 + D_2 = 217 \pm 10$ and 22 gives $D_2 = 100 \pm 8$		
Ca–S	$CaS \rightarrow Ca + S$	*289 ± 19*	69 ± 4.6			M.S.	1962	6
		332.6 ± 9.6	79.5 ± 2.3			M.S.; Effusion of $Ca + S_2 = CaS + S$	1963	80
		308.4 ± 18.8	73.7 ± 4.5			M.S.; Effusion	1964	189
		310 ± 21	**74 ± 5**					
Cd–S	$CdS \rightarrow Cd + S$	*≤ 377*	≤ 90	*381*	91	Spectroscopic; limit of continuum	1953	1
		≤ 197	≤ 47			M.S.	1963	80
Cl–Cl	$Cl_2 \rightarrow 2Cl$	*238.9 ± 0.25*	57.10 ± 0.06	*242.3*	57.9	Spectroscopic	1962	6
		239.99	57.36	*243.34*	58.16	Thermochemical; based on 9	1967	
		239.7 ± 0.4	**57.3 ± 0.1**					
Cl–F	$ClF \rightarrow Cl + F$	*246.9 ± 0.8*	59.0 ± 0.2	*250.2*	59.8	Spectroscopic; convergence of bands	1962	6
		251.5	60.1	*255.2*	61.0	Thermochemical; based on 9	1967	
		248.9 ± 2.1	**59.5 ± 0.5**					

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$O_3ClF \rightarrow O_3Cl + F$			*251*	60	A.P.; M.S.	1957	60
				255	61	Thermochemical	1962	6
Cl–H	$HCl \rightarrow H + Cl$	*427.60 ± 1.46*	102.20 ± 0.35	*431.45*	103.12	Thermochemical	1962	6
		424.7	101.5			Theoretical	1963	188
		428.15	102.33	*431.96*	103.24	Thermochemical; based on 9	1967	
		428.02 ± 0.42	**102.3 ± 0.1**					
Cl–O	$ClO \rightarrow Cl + O$	*246.9*	63.31			Spectroscopic	1958	33
		265.01 ± 0.13	63.34 ± 0.03	*269.16*	64.33	Spectroscopic; convergence of bands.	1962	6
		264.85	63.30	*269.03*	64.30	Thermochemical; based on 9	1967	
		267.8 ± 4.2	**64 ± 1**					
	$ClO_2 \rightarrow ClO + O$	*267*	66	*278.2*	66.5	Spectroscopic; predissociation	1962	6
		241.0 ± 6.3	57.6 ± 1.5	*245.6*	58.7	Thermochemical	1962	6
		230 ± 8	55 ± 2			E.I.; M.S.	1967	27
		243.9	58.3	*248.5*	59.4	Thermochemical; based on 9	1967	
		243 ± 13	**58 ± 3**					
	$ClO_3 \rightarrow ClO_2 + O$			*199.2*	47.6	Thermochemical	1962	6
				197.1	47.1	Thermochemical; based on 9	1967	
				201 ± 4	**48 ± 1**			
	$Cl_2O \rightarrow Cl + ClO$	*142.7*	34.1	*146.4*	35.0	Thermochemical	1962	6
		139.3	33.3	*143.1*	34.2	Thermochemical; based on 9	1967	
		139.3 ± 4	**33.3 ± 1**					
Co–Co	$Co_2 \rightarrow 2Co$	*163 ± 25*	39 ± 6			Effusion; M.S.	1964	56
		163	39	*167*	40	Thermochemical; based on 9	1967	
		164.0 ± 17	**39.2 ± 4**					
	$(CO)_4Co{-}Co(CO)_4 \rightarrow 2Co(CO)_4$			*48.1 ± 19.2*	11.5 ± 4.6	A.P.; M.S.	1967	187
Cr–Cr	$Cr_2 \rightarrow 2Cr$	*< 167*	< 40	*< 172*	< 41	M.S.	1962	62;6
		< 184	< 44			Effusion; M.S.	1964	56
Cr–O	$CrO \rightarrow Cr + O$	*425.5 ± 29*	101.7 ± 7			Effusion; M.S.	1961	85
		418	100			Thermochemical; based on 9	1967	
		423 ± 29	**101 ± 7**					

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$CrO_2 \rightarrow CrO + O$	*527 ± 63*	126 ± 15			Effusion; M.S.	1961	85
		527	126			Thermochemical; based on 9	1967	
		531 ± 63	**126 ± 15**					
	$CrO_3 \rightarrow CrO_2 + O$	*477 ± 84*	114 ± 20			Effusion; M.S.	1961	85
Cs–Br	$CsBr \rightarrow Cs + Br$			*381*	91	Effusion; Ionization on hot wire	1962	163
		416.3 ± 13	99.5 ± 3			M.S.	1962	6
Cs–Cl	$CsCl \rightarrow Cs + Cl$	*422.2*	100.9	*425.9*	101.8	Effusion; Ionization on hot wire	1962	163
		425.1 ± 13	101.6 ± 3	*428.9*	102.5	Thermochemical	1962	6
		448 ± 13	107 ± 3			Flame photometry	1962	6
		435 ± 21	**104 ± 5**					
Cs–F	$CsF \rightarrow Cs + F$	*481*	115	*485*	116	Effusion; Ionization on hot wire	1962	163
		481 ± 25	115 ± 6	*485*	116	Thermochemical	1962	6
		515 ± 33	123 ± 8			Flame photometry	1962	6
		487.4	116.5			Theoretical	1963	188
		502 ± 42	**120 ± 10**					
Cs–I	$CsI \rightarrow Cs + I$	*315.5*	75.4	*319.2*	76.3	Effusion; Ionization on hot wire	1962	163
		350.2 ± 17	83.7 ± 4	*354.0*	84.6	Flame photometry	1962	6
		335 ± 21	**80 ± 5**					
Cs–O	$CsOH \rightarrow Cs + OH$	*381 ± 13*	91 ± 3			Flame photometry	1966	192
Cu–Cu	$Cu_2 \rightarrow 2Cu$	*201 ± 38*	48 ± 9			Spectroscopic; L.B.S. for ground state.	1962	6
		190.4 ± 9.2	45.5 ± 2.2			M.S.	1960; 1962	108; 6
		190.4 ± 13	**45.5 ± 3**					
Cu–F	$CuF \rightarrow Cu + F$	*293 ± 96*	70 ± 23	*297*	71	Spectroscopic; L.B.S. for ground state	1953; 1962	3; 6
		364 ± 38	87 ± 9			Effusion; M.S.	1966	151
	$CuF_2 \rightarrow CuF + F$	*366.5*	87.6			Effusion; M.S.	1966	151

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Cu–H	$CuH \rightarrow Cu + H$	*276 ±8*	66±2	*280*	67	Flame photometry	1956; 1962	136; 6
				264	63	Thermochemical; based on 9	1967	
Cu–Sn	$CuSn \rightarrow Cu + Sn$	*173.2±17*	41.4±4	*177.4*	42.4	Effusion; M.S.	1962	63;6
		173.4	41.4			Thermochemical; based on 9	1967	
		173.4±17	**41.4±4**					
F–F	$F_2 \rightarrow 2F$	*153.1*	36.6			Thermochemical; M.S.	1956	89
		155.2±3.6	37.1±0.85			Spectroscopic; continuous absorption	1957	94
		172.8±2.1	41.3±0.5			Molecular beam: magnetic detection	1959	129
		154.8±4	37.0±1	*159.0*	38.0	Dissociation equilibrium	1962	6
		161.1 ±2.5	38.5±0.6	*165.3*	39.5	Thermochemical	1962	6
		170.54	40.76	*174.9±0.8*	41.8±0.2	Effusion; Knudsen cell	1966	167
		153.80	36.76	*157.99*	37.76	Thermochemical; based on 9	1967	
		154.8±4	**37.0±1.0**					
F–H	$HF \rightarrow H + F$	*565.3±1.3*	135.1±0.3	*566.1*	135.3	Spectroscopic; extrapolation of $X^1\Sigma$ levels	1959	28
		556.1	132.9			Theoretical	1963	188
		561.1	134.1			Shock tube	1965	74
		564.0	134.8	*568.2*	135.8	Thermochemical; based on 9	1967	
		565±4	**135±1**					
F–O	$FO \rightarrow F + O$	*106.3*	25.4			A.P.; M.S.	1957	106
		184±42	44±10	*189*	45.1	Assumed D_0(F–O) $= 1/2D_0(F_2O)$	1962	6
		151	36	*155*	37	Thermochemical; based on 9	1967	
		155±13	**37±3**					
	$FOO \rightarrow F + O_2$	*63*	15			Thermal decomposition of F_2O_2	1965	43
	$F_2O \rightarrow FO + F$	*270.3*	64.6			A.P.; M.S.	1957	106
		269.9	64.5	*274.5*	65.6	E.I.; M.S.	1962	66
		180±42	43±10	*186.2*	44.5	Estimated	1962	6
		268	64	*272*	65	Thermochemical; based on 9	1967	
		268±13	**64±3**					
	$F_2O_2 \rightarrow FO_2 + F$	*77.8*	18.4			A.P.; M.S.	1966	152

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Fe–Fe	$Fe_2Br_4 \rightarrow 2FeBr_2$			*145.2* ± *17*	34.7 ± 4	Effusion; M.S.	1959	100
				158.2	37.8	Equilibrium studies	1962	6
				172	41	Thermochemical; based on 9	1967	
				167 ± ***17***	**40** ± **4**			
	$Fe_2Cl_4 \rightarrow 2FeCl_2$	*134* ± *13*	32 ± 2			Effusion; M.S.	1958	118
				151.9	36.3	Equilibrium studies	1962	6
				142	34	Thermochemical; based on 9	1967	
				146 ± ***13***	**35** ± **3**			
Fe–Br	$FeBr_3 \rightarrow FeBr_2 + Br$			*222*	53	Thermochemical	1962	6
				188	45	Thermochemical; based on 9	1967	
				188 ± ***21***	**45** ± **5**			
Fe–Cl	$FeCl_3 \rightarrow FeCl_2 + Cl$			*209*	50	Thermochemical	1962	6
				227.2	54.3	Thermochemical; based on 9	1967	
				226 ± ***8***	**54** ± **2**			
Fe–I	$FeI_3 \rightarrow FeI_2 + I$			*144*	34.4	Equilibrium studies	1962	6
				96	23	Thermochemical; based on 9	1967	
Fe–S	$FeS \rightarrow Fe + S$	⩽ *315.9*	⩽ 75.5			M.S.; $Fe + S_2 = FeS + S$	1963	80
Ga–Br	$GaBr \rightarrow Ga + Br$	*415.5* ± *0.4*	99.3 ± 0.1	*419.7*	100.3	Spectroscopic	1960	140
		429.3 ± *17*	102.6 ± 4			Flame photometry	1962	6
		435	104	*439*	105	Thermochemical; based on 9	1967	
		435 ± ***17***	**104** ± **4**	***444*** ± ***17***	**106** ± **4**			
Ga–Cl	$GaCl \rightarrow Ga + Cl$	*474.9* ± *4*	113.5 ± 1	*478.2*	114.3	Spectroscopic	1960	140
		480.7 ± *17*	114.9 ± 4			Flame photometry	1962	6
		477	114	*477*	114	Thermochemical; based on 9	1967	
		477 ± ***13***	**114** ± **3**					
Ga–F	$GaF \rightarrow Ga + F$	*602.1* ± *21*	143.9 ± 5	*605.8*	144.8	Spectroscopic	1960	140
		577 ± *15*	138 ± 3.5			Effusion; M.S.	1966	170
		602	144	*607*	145	Thermochemical; based on 9	1967	
		602 ± ***13***	**144** ± **3**					

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ga–Ga	Ga_2 → 2Ga	*≤ 146*	≤ 35	*151*	36	M.S.	1957	30; 29
		113	27	*117*	28	Thermochemical; based on 9	1967	
		113 ± 17	**27 ± 4**	***117 ± 17***	**28 ± 4**			
Ga–H	GaH → Ga + H	*272*	65	*276*	66	Thermochemical; based on 9	1967	
Ga–I	GaI → Ga + I	*335*	80			Spectroscopic	1960	140
		381 ± 29	91 ± 7			Flame photometry	1962	6
		351	84	*356*	85	Thermochemical; based on 9	1967	
		351 ± 21	**84 ± 5**	***356 ± 21***	**85 ± 5**			
Ga–O	GaO → Ga + O	*343 ± 50*	58 ± 12			Spectroscopic; L.B.S. for ground state	1953	3
		293 ± 42	70 ± 10	*297*	71	Spectroscopic	1962	6
		347	83	*351*	84	Estimate	1962	6
		243	58	*247*	59	Thermochemical; based on 9	1967	
		247 ± 42	**59 ± 10**					
	GaOH → Ga + OH	*427 ± 21*	102 ± 5			Flame photometry	1958	196
		427	102	*431*	103	Thermochemical; based on 9	1967	
		431 ± 21	**103 ± 5**					
Ge–Br	GeBr → Ge + Br	*251 ± 29*	60 ± 7	*255*	61	Spectroscopic; extrapolation of $^2\Pi$ state	1953 1962	3; 6
		251	60	*251*	60	Thermochemical; based on 9	1967	
		251 ± 29	**60 ± 7**					
	$GeBr_2$ → GeBr + Br			*410*	98	Thermochemical; based on 9	1967	
Ge–C	GeC → Ge + C	*456 ± 21*	109 ± 5			M.S.	1959	123
		456	109	*460*	110	Thermochemical; based on 9	1967	
Ge–Cl	GeCl → Ge + Cl	*339 ± 21*	81 ± 5	*343*	82	Spectroscopic; extrapolation of $^2\Delta$ levels	1953 1962	3; 6
		339	81	*343*	82	Thermochemical; based on 9	1967	
		339 ± 21	**81 ± 5**	***343 ± 21***				

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ge–F	$GeF \rightarrow Ge + F$	*477 ± 84*	114 ± 20	*481*	115	Spectroscopic; L.B.S. for $X^2\Pi$	1962	6
		485	116	*490*	117	Thermochemical; based on 9	1967	
		484 ± 42	**115 ± 10**					
	$GeF_2 \rightarrow GeF + F$	*548*	131			Thermochemical; based on 9	1967	
Ge–Ge	$Ge_2 \rightarrow 2Ge$	*268 ± 21*	64 ± 5			Effusion; M.S.	1959	123
		276	66	*280*	67	Thermochemical; based on 9	1967	
		272 ± 21	**65 ± 5**	***280 ± 21***	**67 ± 5**			
	$Ge_2H_6 \rightarrow 2GeH_3$			*142*	34	Pyrolysis	1962	6
		315.9	75.5			A.P.; M.S.	1966	153
Ge–H	$GeH \rightarrow Ge + H$	*318*	76	*322*	77	Thermochemical	1962	6
	$GeH_4 \rightarrow GeH_3 + H$	*365*	87.2			A.P.; M.S.	1966	153
Ge–O	$GeO \rightarrow Ge + O$	*657 ± 17*	157 ± 4			L.B.S. for $X^1\Sigma$	1962	6
		665 ± 17	159 ± 4	*669*	160	Thermochemical	1962	6
		665	159	*674*	161	Thermochemical; based on 9	1967	
		669 ± 21	**160 ± 5**	***674 ± 21***	**161 ± 5**			
Ge–S	$GeS \rightarrow Ge + S$	*544 ± 13*	130 ± 3	*548*	131	Spectroscopic; extrapolation of *E* state levels.	1962	6
		556	133	*565*	135	Thermochemical; based on 9	1967	
		556 ± 17	**133 ± 4**	***561 ± 17***	**134 ± 4**			
Ge–Se	$GeSe \rightarrow Ge + Se$	*479.1 ± 25*	114.5 ± 6	*482.8*	115.4	Spectroscopic; extrapolation of *E* state levels.	1962	6
		502	120	*506*	121	Thermochemical; based on 9	1967	
		502 ± 25	**120 ± 6**	***506 ± 25***	**121 ± 6**			
Ge–Si	$GeSi \rightarrow Ge + Si$	*297 ± 21*	71 ± 5			Effusion; M.S.	1959	123
		297	71	*301*	72	Thermochemical; based on 9	1967	
		297 ± 17	**71 ± 4**	***301 ± 17***	**72 ± 4**			
	$H_3GeSiH_3 \rightarrow GeH_3 + SiH_3$	*418.0*	99.9			M.S.	1966	153

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Ge–Te	GeTe → Ge + Te	*393±42*	94±10	*397*	95	Spectroscopic; extrapolation of *E* state	1962	6
		398±17	95±4			Spectroscopic; thermochemical	1964	72
		393	94	*397*	95	Thermochemical; based on 9	1967	
		393±21	**94±5**	***397±21***	**95±5**			
	$GeTe_2$ → GeTe + Te			*188*	45	Thermochemical; based on 9	1967	
H–H	H_2 → 2H	*432.027 ±0.004*	103.257 ±0.001	*436.0*	104.2	Spectroscopic	1960	31
		432.195	103.297			Theoretical	1966	195
		432.00	103.25	*435.93*	104.19	Thermochemical; based on 9	1967	
		432.00 ±0.04	**103.25 ±0.01**					
	HD → H + D	*435.458*	104.077			Spectroscopic	1960	31
		435.642	104.121			Theoretical	1966	195
		435.43	104.07	*439.32*	105.00	Thermochemical; based on 9	1967	
		435.43 ±0.04	**104.07 ±0.01**					
	D_2 → 2D	*439.567*	105.059			Spectroscopic	1960	31
		439.747	105.102			Theoretical	1966	195
		439.53	105.05	*443.34*	105.96	Thermochemical; based on 9	1967	
		439.53 ±0.04	**105.05 ±0.01**					
Hf–O	HfO → Hf + O	*764.0*	182.6±6			Effusion; M.S.	1963	92
		772	184.6			Thermochemical; based on 9	1967	
		774±21	**185±5**					
Hg–Br	HgBr → Hg + Br			*71*	17	Toluene carrier pyrolysis	1956	154
		68.6	16.4	*72.8*	17.4	Spectroscopic; extrapolation of ground state	1960	32
		68.6±4	**16.4±1**	***72.6±4***	**17.4±1**			
Hg–Cl	HgCl → Hg + Cl			*96*	23	Toluene carrier pyrolysis	1956	154
		96±8	23±2	*100*	24	Spectroscopic; L.B.S. for ground state	1950	4
		96±8	**23±2**	***100±8***	**24±2**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Hg–S	HgS → Hg + S	*268 ± 21*	64 ± 5	*272*	65	Spectroscopic; limit of continuum	1953	1
		≤ *208.8*	≤ 49.9			M.S.	1963	80
I–Br	IBr → I + Br	*175.381 ± 0.063*	41.917 ± 0.015	*177.8*	42.5	Spectroscopic	1962	6
		175.39	41.92	*177.90*	42.52	Thermochemical; based on 9	1967	
		175.3 ± 0.4	**41.9 ± 0.1**	***177.8 ± 0.4***	**42.5 ± 0.1**			
I–Cl	ICl → I + Cl	*208.28 ± 0.4*	49.78 ± 0.1	*211.3*	50.5	Spectroscopic; convergence of bands	1962	6
		207.82	49.67	*210.75*	50.37	Thermochemical; based on 9	1967	
		207.9 ± 0.4	**49.7 ± 0.1**	***211.3 ± 0.4***	**50.5 ± 0.1**			
I–F	IF → I + F	*277.0 ± 5.0*	66.2 ± 1.2	280	67	Spectroscopic; graphical extrapolation of $B_3\Pi$	1962	6
		277.86	66.41	*281.50*	67.78	Thermochemical; based on 9	1967	
		277.8 ± 4	**66.4 ± 1**	***280 ± 4***	**67 ± 1**			
I–H	HI → H + I	*294.60 ± 0.42*	70.41 ± 0.1	*298.3*	71.3	Thermochemical	1962	6
		290.4	69.4			Theoretical	1963	188
		294.60	70.41	*298.32*	71.30	Thermochemical; based on 9	1967	
		294.6 ± 0.4	**70.4 ± 0.1**	***298.3 ± 0.4***	**71.3 ± 0.1**			
I–I	$I_2 \rightarrow 2I$	*148.808 ± 0.13*	35.566 ± 0.03	*151.0*	36.1	Spectroscopic; band convergence	1962	6
		148.963	35.603	*151.239*	36.147	Thermochemical; based on 9	1967	
		148.95 ± 0.04	**35.60 ± 0.01**					
I–O	IO → I + O	*176 ± 21*	42 ± 5			Spectroscopic; B.S. extrapolation	1958	33
		239 ± 25	57 ± 6			Flame photometry	1961	143
		184 ± 21	44 ± 5	*188*	45	Spectroscopy; L.B.S. for $X^2\Pi$ and $A^2\Pi$	1962	6
		177.0	42.3	*180.7*	43.2	Thermochemical; based on 9	1967	
		180 ± 21	**43 ± 5**	***184 ± 21***	**44 ± 5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
In–Br	InBr → In + Br	*385 ± 3*	92 ± 0.7			Spectroscopic; thermochemical	1960	140
		387.9 ± 13	92.7 ± 3			Flame photometry	1961	34
		409.6	97.9	*412.1*	98.5	Thermochemical; based on 9	1967	
		406 ± 21	**97 ± 5**	***414 ± 21***	**99 ± 5**			
In–Cl	InCl → In + Cl	*428.4 ± 8*	102.4 ± 2			Spectroscopic; thermochemical	1960	140
		434.7 ± 13	103.9 ± 3			Flame photometry	1961	34
				439	105	Thermochemical; based on 9	1967	
		435 ± 8	**104 ± 2**	***439 ± 8***	**105 ± 2**			
In–F	InF → In + F	*526.8 ± 8*	125.9 ± 2			Spectroscopic	1960	140
		523 ± 33	125 ± 8			Flame photometry	1961	34
		522.2	124.8	*525.5*	125.6	Thermochemical; based on 9	1967	
		523 ± 8	**125 ± 2**	***525 ± 8***	**126 ± 2**			
In–H	InH → In + H	*< 238*	< 57			Spectroscopic; predissociation	1950	4
		243	58	*247*	59	Thermochemical; based on 9	1967	
		238 ± 21	**57 ± 5**					
In–I	InI → In + I	*331 ± 4*	79 ± 1			Spectroscopic; analysis of data	1960	140
		326 ± 17	78 ± 4			Flame photometry	1961	34
		340.6	81.4	*342.7*	81.9	Thermochemical; based on 9	1967	
		339 ± 17	**81 ± 4**					
In–In	In_2 → 2In	*93.7 ± 10.5*	22.4 ± 2.5			Effusion; M.S.	1959	82
		103.8	24.8	*105.9*	25.3	Thermochemical; based on 9	1967	
		100 ± 13	**24 ± 3**	***100 ± 13***	**24 ± 3**			
In–O	InO → In + O	*96 ± 42*	23 ± 10			Spectroscopic; L.B.S. for ground state	1953	1
		314	75	*318*	76	Thermochemical; estimate	1962	6
		< 318	< 76			M.S.; Effusion; In_2O_3	1963	66
		105	25	*105*	25	Thermochemical; based on 9	1967	
	InOH → IN + OH	*360 ± 29*	86 ± 7			Flame photometry	1958	196
		360	86	*360*	86	Thermochemical; based on 9	1967	
		360 ± 21	**86 ± 5**	***360 ± 21***	**86 ± 5**			
In–S	InS → In + S			*146*	35	Thermochemical; based on 9	1967	
In–Sb	InSb → In + Sb	*148.1 ± 10.5*	35.4 ± 2.5			Effusion; M.S.	1959	82
				161.1	38.5	Thermochemical; based on 9	1967	

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
K–Br	KBr → K + Br	*379.1 ± 4*	90.6 ± 1	*382.8*	91.5	Thermochemical	1953	3
		379.5 ± 8	90.7 ± 2			Flame photometry	1961	34
		378.7 ± 8	**90.5 ± 2**	***382.8 ± 8***	**91.5 ± 2**			
K–Cl	KCl → K + Cl	*416.7 ± 8*	99.6 ± 2			Flame photometry	1961	34
		423.4 ± 1.7	101.2 ± 0.4	*425.9*	101.8	Thermochemical	1962	6
		394	94.1			Theoretical	1963	188
		423±8	**101 ± 2**	***427 ± 8***	**102 ± 2**			
K–F	KF → K + F	*490 ± 34*	117 ± 8			Flame photometry	1961	34
		492.9 ± 5.0	117.8 ± 1.2	*496.2*	118.6	Thermochemical	1962	6
		494	118			Theoretical	1963	188
		490 ± 21	**117 ± 5**	***494 ± 21***	**118 ± 5**			
K–I	KI → K + I	*336.4*	80.4			Flame photometry	1961	34
		322 ± 13	77 ± 3	*326*	78	Thermochemical	1962	6
		322	77			Theoretical	1963	188
		326 ± 13	**78 ± 3**	***331 ± 13***	**79 ± 3**			
K–O	KOH → K + OH			*369.4*	88.3	Thermochemical	1962	6
		339 ± 8	81 ± 2			Flame photometry	1966	192
La–La	La_2 → 2La	*241.0 ± 21*	57.6 ± 5			M.S.; photoionization	1963	93
La–O	LaO → La + O	*786.2 ± 35.6*	187.9 ± 8.5			Effusion; M.S.	1956	197
		779.5 ± 19.2	186.3 ± 4.6			Effusion; M.S.	1961	96
		782 ± 21	**187 ± 5**					
La–S	LaS → La + S	*573 ± 25*	137 ± 6			Effusion; M.S.	1965	145
Li–Br	LiBr → Li + Br	*420.9 ± 13*	100.6 ± 3			Flame photometry	1961	34
		418 ± 13	100 ± 3	*423*	101	Thermochemical	1962	6
		418 ± 21	**100 ± 5**	*423 ± 21*	**101 ± 5**			
Li–Cl	LiCl → Li + Cl	*462.3 ± 13*	110.5 ± 3			Flame photometry	1961	34
		470.7 ± 4.6	112.5 ± 1	*474.5*	113.4	Thermochemical	1962	6
		483.3	115.5			Theoretical	1963	188
		464 ± 13	**111 ± 3**	***469 ± 13***	**112 ± 3**			
Li–F	LiF → Li + F	*569 ± 34*	136 ± 8			Flame photometry	1961	34
		574.9 ± 5.0	137.4 ± 1.2	*578.6*	138.3	Thermochemical	1962	6
		590	141			Theoretical	1963	188
		573 ± 21	**137 ± 5**	***577 ± 21***	**138 ± 5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Li–I	$LiI \rightarrow Li + I$	*344.3 ± 13*	82.3 ± 3			Flame photometry	1961	34
		349.8 ± 13	83.6 ± 3	*354.0*	84.6	Thermochemical	1962	6
		341.0	81.5			Theoretical	1963	188
		347 ± 13	**83 ± 3**	***351 ± 13***	**84 ± 3**			
Li–O	$LiO \rightarrow Li + O$	*341.0*	81.5			Effusion; M.S.	1959	99
		326 ± 21	78 ± 5	*331*	79	M.S.; LiO, Li_2O	1962	6
		331 ± 13	**79 ± 3**	***335 ± 13***	**80 ± 3**			
	$LiOH \rightarrow Li + OH$	*434.3*	103.8	*439.3*	105.0	M.S.	1960	35
		427	102	*432*	103.2	Flame photometry	1962	6
		411.3	98.3	*416.3*	99.5	Flame photometry	1962	6
		423 ± 8	101 ± 2			Flame photometry	1966	192
		423 ± 21	**101 ± 5**	***427 ± 21***	**102 ± 5**			
Mg–F	$MgF \rightarrow Mg + F$	*502 ± 84*	120 ± 20	*506*	121	Spectroscopic; extrapolation of $X^2\Sigma$, $A^2\Pi$ and $B^2\Sigma$	1962	6
		441.4 ± 5.0	105.5 ± 1.2			M.S.; Effusion; $2MgF = Mg + MgF_2$	1964	68
		448.9 ± 6.7	107.3 ± 1.6			M.S.; Effusion; $AlF_3 + 2Mg = 2MgF + AlF$	1964	68
		460 ± 42	**110 ± 10**					
	$MgF_2 \rightarrow MgF + F$	*540 ± 84*	129 ± 20	*544*	130	Thermochemical	1962	6
		582.4 ± 25	139.2 ± 6			M.S.; Effusion; $AlF_3 + 2Mg = 2MgF + AlF$	1964	68
		565 ± 42	**135 ± 10**					
Mg–O	$MgO \rightarrow Mg + O$	*410 ± 8*	98 ± 2			Flame photometry	1959	177
		418 ± 13	100 ± 3			Flame photometry	1962	6
		335	80			Transpiration in O_2	1963	36
		389	93			Transpiration in O_2	1963	37
		42 ± 42	10 ± 10			Theoretical	1964	144
		360 ± 21	86 ± 5			M.S.; Effusion	1964	190
		377 ± 42	**90 ± 10**					
	$MgOH \rightarrow Mg + OH$	*234 ± 21*	56 ± 5			Flame photometry	1959	177
Mn–Br	$MnBr \rightarrow Mn + Br$	*280 ± 54*	67 ± 13			Spectroscopic; L.B.S. of ground state	1950	4
		310.5 ± 8	74.2 ± 2			Flame photometry	1961	34
		293 ± 21	**70 ± 5**					

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Mn–Cl	$MnCl \rightarrow Mn + Cl$	*318 ± 63*	76 ± 15			Spectroscopic; L.B.S. of ground state	1950	4
		356.9 ± 8	85.3 ± 2	*360.7*	86.2	Flame photometry	1961	34
		335 ± 42	**80 ± 10**					
Mn–I	$MnI \rightarrow Mn + I$	*279.1 ± 13*	66.7 ± 3	*283.3*	67.7	Flame photometry	1961	34
Mn–Mn	$Mn_2 \rightarrow 2Mn$	*< 88*	< 21			Effusion; M.S.	1964	56
	$Mn_2(CO)_{10} \rightarrow 2Mn(CO)_5$			*142 ± 54*	34 ± 13	(T = 375–419 K); $\Delta H_{sub.}$; V.P.	1960	183
Mn–O	$MnO \rightarrow Mn + O$	*402 ± 13*	96 ± 3	*406*	97	Flame photometry	1959	176
Mn–S	$MnS \rightarrow Mn + S$	*298.7 ± 17*	71.4 ± 4			Effusion; M.S.	1965	114
Mo–O	$MoO \rightarrow Mo + O$	*485 ± 63*	116 ± 15			M.S.	1960	199
	$MoO_2 \rightarrow MoO + O$	*749*	179			Effusion; V.P.; $D_1 + D_2 = 285$	1958	101
		611 ± 105	146 ± 25			M.S.; $D_1 + D_2 = 262 \pm 10$	1960	199
		669 ± 84	**160 ± 20**					
	$MoO_3 \rightarrow MoO_2 + O$	*527*	126			Effusion; V.P.; $D_1 + D_2 + D_3 = 410.3$	1958	101
		623 ± 130	149 ± 31			M.S.; $D_1 + D_2 + D_3 = 411.7$	1960	199
		561 ± 84	**134 ± 20**					
N–Br	$NBr \rightarrow N + Br$	*289 ± 59*	69 ± 14			Spectroscopic; L.B.S. of ground state	1950	4
		280 ± 21	67 ± 5			Spectroscopic	1961	38
		285 ± 21	**68 ± 5**					
	$ONBr \rightarrow NO + Br$			*117*	28	Calculated from equilibrium constants.	1962	6
		116.23	27.78	*119.96*	28.67	Thermochemical; based on 9	1967	
		116.3 ± 6.3	**27.8 ± 1.5**	***120.1 ± 6.3***	**28.7 ± 1.5**			
N–Cl	$NCl \rightarrow N + Cl$			*259*	62	Thermochemical	1962	6
	$NCl_2 \rightarrow NCl + Cl$			*280*	67	Thermochemical	1962	6
	$NCl_3 \rightarrow NCl_2 + Cl$			*381*	91	Thermochemical	1962	6

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$\mathrm{ONCl} \rightarrow \mathrm{NO} + \mathrm{Cl}$			*155*	37	Calculated from equilibrium constants	1962	6
		156.1	37.3	*160.2*	38.3	Thermochemical; based on 9	1967	
		155±6	**37±1.5**	***159±6***	**38±1.5**			
	$\mathrm{O_2NCl} \rightarrow \mathrm{NO_2} + \mathrm{Cl}$			*141.4*	33.8	Thermochemical	1962	6
		138.1	33.0	*142.3*	34.0	Thermochemical; based on 9	1967	
		138±4	**33.0±1**	***142.3±4***	**34.0±1**			
N–F	$\mathrm{NF} \rightarrow \mathrm{N} + \mathrm{F}$	*251±42*	60±10	*255*	61	Estimate	1962	6
		297	71			Thermochemical	1961	161
		297±42	**71±10**	***301±42***	**72±10**			
	$\mathrm{NF_2} \rightarrow \mathrm{NF} + \mathrm{F}$	*295.0±6.7*	70.5±1.6			Thermochemical; M.S.	1961	107
		297	71			Thermochemical	1961	161
		332.2±42	79.4±10	*336.8*	80.5	Thermochemical	1962	6
		314±21	**75±5**	***318±21***	**76±5**			
	$\mathrm{NF_3} \rightarrow \mathrm{NF_2} + \mathrm{F}$	*244.3±18.4*	58.4±4.4			Thermochemical; M.S.	1961	107
		238	57			Thermochemical	1961	161
		230	55			Thermochemical	1961	126
		238	57			A.P.; M.S.	1961	126
		238.1±21	56.9±5	*243.5*	58.2	Thermochemical	1962	6
		241.4	57.7	*246.9*	59.0	Thermochemical; based on 9	1967	
		238±8	**57±2**	***243±8***	**58±2**			
	$\mathrm{ONF} \rightarrow \mathrm{NO} + \mathrm{F}$	*231.8*	55.4			Calorimetric	1959	182
		231.8±8	55.4±2	*236.8*	56.6	Thermochemical	1962	6
		231.0	55.2	*235.6*	56.3	Thermochemical; based on 9	1967	
		231.0±4	**55.2±1**	***235.6±4***	**56.3±1**			
	$\mathrm{O_2NF} \rightarrow \mathrm{NO_2} + \mathrm{F}$			*187.0*	44.7	Thermochemical; $\Delta H^\circ_{f(298)}\mathrm{NO_2F} = -20\pm5$	1962	98
		197±21	47±5	*197±21*	47±5	Thermochemical; from 9 and $\Delta H^\circ_{f(298)}\mathrm{NO_2F} = -20\pm5$	1967	
		192±21	**46±5**	***188±21***	**45±5**			
N–H	$\mathrm{NH} \rightarrow \mathrm{N} + \mathrm{H}$	*347±13*	83±3			A.P.; M.S.	1958	130
		347±13	83±3	*351*	84	A.P.; M.S.	1962	6
		309.6±15	74.0±3.7			Spectroscopic; $^3\Pi - {}^3\Sigma^-$ absorption; shock tube	1966	49
		356	85	*360*	86	Thermochemical; based on 9	1967	
		356±8	**85±2**	***356±8***	**85±2**			
	$\mathrm{NH_2} \rightarrow \mathrm{NH} + \mathrm{H}$			*385*	92	E.I.; M.S.	1959	200
		377±17	90±4	*381*	91	Thermochemical	1962	6
				377	90	Thermochemical; based on 9	1967	
		372±8	**89±2**	***377±8.4***	**90±2**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$NH_3 \rightarrow NH_2 + H$			*444 ± 13*	106 ± 3	E.I.; M.S.	1958	105
		435 ± 8	104 ± 2	*441.0*	105.4	Thermochemical	1962	6
				435	104	Thermochemical; based on 9	1967	
		431 ± 8	**103 ± 2**	***435 ± 8***	**104 ± 2**			
	$N_2H_4 \rightarrow N_2H_3 + H$			*318 ± 21*	76 ± 5	E.I.; M.S.	1958	105
				318	76	E.I.; M.S.	1959	128
				318 ± 8	**76 ± 2**			
N–N	$N_2 \rightarrow 2N$	*941.69 ± 0.46*	225.07 ± 0.11	*945.42*	225.96	Analysis of spectroscopic and other data	1962	6
		941.685	225.068	*945.408*	225.958	Thermochemical; based on 9	1967	
		941.69 ± 0.04	**225.07 ± 0.01**	*945.42 ± 0.04*	225.96 ± 0.01			
	$N_2F_4 \rightarrow 2NF_2$			*115.9 ± 29*	27.7 ± 7	A.P.; M.S.	1960	110
				90.0 ± 6.7	21.5 ± 1.6	A.P.; M.S.	1961	107
				86.6	20.7	A.P.; M.S.	1961	161
				83.3	19.9	Equilibrium; $N_2F_4 = 2NF_2$; Manometer	1961	126
				90.8	21.7	Equilibrium $N_2F_4 = 2NF_2$; Spectrophotometric	1961	126
				81.2 ± 2.9	19.4 ± 0.7	Shock tube dissociation of N_2F_4	1965	39
		87.9	21.0	*93.3*	22.3	Thermochemical; based on 9	1967	
		84 ± 4	**20 ± 1**	***88 ± 4***	**21 ± 1**			
	$N_2H_4 \rightarrow 2NH_2$			*243 ± 38*	58 ± 9	E.I.; M.S.	1958	105
				251	60	A.P.; M.S.	1959	128
				259	62	Pyrolysis of N_2H_4	1962	6
				238.9	57.1	Pyrolysis; Toluene carrier	1963	156
				247	59	Thermochemical; based on 9	1967	
				247 ± 13	**59 ± 3**			
	$HN_3 \rightarrow NH + N_2$			*39.7*	9.5	A.P.; M.S.	1958	130
		29	7	*38*	9	Thermochemical; based on 9	1967	
				38 ± 4	**9 ± 1**			
	$N_2O \rightarrow NO + N$			*< 434.3 ± 9.6*	< 103.8 ± 2.3	A.P.; M.S.	1961	59
		475.7 ± 4	113.7 ± 1	*481.6*	115.1	Thermochemical	1962	6
		475.09	113.55	*480.91*	114.94	Thermochemical; based on 9	1967	
		474.9 ± 4	**113.5 ± 1**	***480.7 ± 4***	**114.9 ± 1**			
	$N_2O_3 \rightarrow NO + NO_2$	*36.4 ± 4.2*	8.7 ± 1	*41.0*	9.8	Equilibrium data	1962	6
		35.1	8.42	*39.5*	9.49	Thermochemical; based on 9	1967	
		35.1 ± 0.8	**8.4 ± 0.2**	***39.7 ± 0.8***	**9.5 ± 0.2**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$N_2O_4 \rightarrow 2NO_2$	*50.84*	12.15	*54.68*	13.07	Equilibrium $N_2O_4 = 2NO_2$	1962	64
		53.43	12.77	*57.28 ± 0.21*	13.69 ± 0.05	Recalculated equilibrium data	1962	6
		53.18	12.71	*57.20*	13.67	Thermochemical; based on 9	1967	
		53.1 ± 2.1	**12.7 ± 0.5**	***57.3 ± 2.1***	**13.7 ± 0.5**			
Na–Br	$NaBr \rightarrow Na + Br$	*366.1*	87.5	*370.3*	88.5	Thermochemical: fluorescence	1962	6
		356.9	85.3			Theoretical	1963	188
		366.1 ± 13	**87.5 ± 3**	***370.3 ± 13***	**88.5 ± 3**			
Na–Cl	$NaCl \rightarrow Na + Cl$	*410 ± 2*	98 ± 0.5	*410.0*	98.0	Thermochemical	1962	6
		423.0	101.1			Theoretical	1963	188
		410 ± 8	**98 ± 2**	***410 ± 8***	**98 ± 2**			
Na–I	$NaI \rightarrow Na + I$	*301.7 ± 8*	72.1 ± 2				1961	34
		295.4 ± 0.4	70.6 ± 0.1	*299.6*	71.6	Thermochemical; fluorescence	1962	6
		308.4	73.7			Theoretical	1963	188
		297 ± 8	**71 ± 2**	***301 ± 8***	**72 ± 2**			
Na–O	$NaOH \rightarrow Na + OH$			*381 ± 13*	91 ± 3	Thermochemical	1962	6
		322 ± 17	77 ± 4			Flame photometry	1966	192
	$NaO_2 \rightarrow NaO + O$	*272 ± 13*	65 ± 3			Flame photometry	1966	194
Nd–F	$NdF \rightarrow Nd + F$			*545.2 ± 12.6*	130.3 ± 3.0	Effusion; M.S.	1966	171
Nd–O	$NdO \rightarrow Nd + O$	*692.9 ± 28.9*	165.6 ± 6.9			Effusion; M.S.	1960	96
		690 ± 25	165 ± 6	*695*	166	M.S.	1962	6
		690 ± 42	**165 ± 10**	***695 ± 42***	**166 ± 10**			
Ni–Br	$NiBr \rightarrow Ni + Br$	*356 ± 13*	85 ± 3	*360*	86	Flame photometry	1961	34
Ni–Cl	$NiCl \rightarrow Ni + Cl$	*368 ± 21*	88 ± 5	*372*	89	Flame photometry	1961	34
		314	75			Thermochemical	1962	6
		347 ± 42	**83 ± 10**					
Ni–I	$NiI \rightarrow Ni + I$	*289 ± 21*	69 ± 5	*293*	70	Flame photometry	1961	34
Ni–Ni	$Ni_2 \rightarrow 2Ni$	*228.0 ± 2.1*	54.5 ± 0.5			Effusion: M.S.	1964	76

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
O–H	$OH \rightarrow O + H$			*431.4 ± 19.2*	103.1 ± 4.6	A.P.; M.S.;	1956	111
						Spectroscopic	1961	40
		424.09 ± 1.3	101.36 ± 0.3	*428.19*	102.34	Spectroscopic; extrapolation of $A^2\Pi$ and $B^2\Sigma$.	1962	6
		424.09	101.36	*428.19*	102.34	Thermochemical;	1967	
		423.8 ± 2.1	**101.3 ± 0.5**	***428.0 ± 2.1***	**102.3 ± 0.5**	based on 9.		
	$H_2O \rightarrow OH + H$			*485.3 ± 19.2*	116.0 ± 4.6	A.P.; M.S.	1956	111
		485.8 ± 4.2	116.1 ± 1.0	*490.8*	117.3	Spectroscopic [OH]	1961	41
		488.3	116.7			A.P.; M.S.	1958	198
		492.5	117.7			Recalculation of data from Ref. 198.	1959	88
		493.7 ± 0.1	118.0 ± 0.03	*498.7*	119.2	Thermochemical	1962	6
		493.63	117.98	*498.73*	119.20	Thermochemical;	1967	
		493.7 ± 0.8	**118.0 ± 0.2**	***498.7 ± 0.8***	**119.2 ± 0.2**	based on 9		
	$HO_2 \rightarrow H + O_2$	*197 ± 13*	47 ± 3	*201.7*	48.2	A.P.; M.S.	1956	111
		192	46	*197*	47	Thermochemical;	1967	
		192 ± 13	**46 ± 3**	***197 ± 13***	**47 ± 3**	based on 9		
	$H_2O_2 \rightarrow HO_2 + H$	*369.0*	88.2	*374.5*	89.5	A.P.; M.S.	1956	111
		365.3 ± 8	87.3 ± 2	*370.7*	88.6	Thermochemical	1962	6
		372	89	*377*	90	Thermochemical;	1967	
		370.3 ± 8.4	**88.5 ± 2.0**	***374.5 ± 8.4***	**89.5 ± 2.**	based on 9		
O–O	$O_2 \rightarrow 2O$	*493.59 ± 0.21*	117.97 ± 0.05	*498.40*	119.12	Spectroscopic; extrapolation of $B^3\Sigma\bar{\mu}$.	1962	6
		493.570	117.966	*498.340*	119.106	Thermochemical;	1967	
		493.59 ± 0.4	**117.97 ± 0.1**			based on 9		
	$HO_2 \rightarrow OH + O$	*266.1 ± 8*	63.6 ± 2	*271.5*	64.9	Thermochemical	1962	6
		259	62	*268*	64	Thermochemical;	1967	
		264.4 ± 4	**63.2 ± 1**			based on 9		
	$H_2O_2 \rightarrow 2OH$	*203.8*	48.7	*210.5*	50.3	Photochemical		6
		200.0 ± 13	47.8 ± 3			E.I.; M.S.	1958	198
		202.5	48.4			Recalculation of Ref. 198 data	1959	88
				198.74	47.50	Kinetic	1958	42
		204.2	48.8			Kinetic	1959	87
				209.2 ± 13.4	50.0 ± 3.2	A.P.; M.S.	1962	119
		207.36 ± 1.46	49.56 ± 0.35	*214.14*	51.18	Thermochemical	1962	6
		207.44	49.58	*214.22*	51.20	Thermochemical;	1967	
		207.1 ± 2.1	**49.5 ± 0.5**	***213.8 ± 2.1***	**51.1 ± 0.5**	based on 9		
	$FO_2 \rightarrow FO + O$	*463.2*	110.7			A.P.; M.S.	1966	152

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$F_2O_2 \rightarrow 2FO$			*259.8*	62.1	Thermochemical; assumptions of O–F bond energies	1959	131
				260.7 ± 84	62.3 ± 20	Thermochemical	1962	6
		434.3	103.8			A.P.; M.S. on F_2O_2	1965	149
				326	78	Thermochemical; based on 9	1967	
Os–O	$OsO_4 \rightarrow OsO_3 + O$	*452*	108			A.P.; M.S.	1965	147
				302.9	72.4	Thermochemical; based on 9	1967	
				301 ± 21	72 ± 5			
P–O	$PO \rightarrow P + O$	*592.0 ± 2.5*	141.5 ± 0.6	*595.4*	142.3	Spectroscopic; convergence of $B^2\Sigma$ levels	1962	6
		520.9	124.5			Theoretical	1965	146
		592.0 ± 4	**141.5 ± 1**	***595.4 ± 4***	**142.3 ± 1**			
P–P	$P_2 \rightarrow 2P$	*485.60 ± 0.38*	116.06 ± 0.09	*489.07*	116.89	Spectroscopic; predissociation of $B^1\Sigma$; graphical extrapolation of $X^1\Sigma$	1962	6
				472.8	113	A.P.; M.S.	1963	172
				467.8	111.8	Effusion; M.S. (3rd law)	1966	165
				511.7	122.3	Effusion; M.S. (2nd law)	1966	165
		481	115	*485*	116	Thermochemical; based on 9	1967	
		481 ± 8	**115 ± 2**	***485 ± 8***	**116 ± 2**			
	$P_2Cl_4 \rightarrow 2PCl_2$			*243*	58	A.P.; M.S.	1963	172
Pb–O	$PbO \rightarrow Pb + O$	*391.6 ± 3.3*	93.6 ± 0.8	*396.6*	94.8	Thermochemical	1962	6
		369.9 ± 5.9	88.4 ± 1.4			A.P.; M.S.	1965	180
		377 ± 13	**90 ± 3**	***381 ± 13***	**91 ± 3**			
Pb–S	$PbS \rightarrow Pb + S$	*305 ± 21*	73 ± 5	*310*	74	Thermochemical	1962	6
		331.0 ± 12	79.1 ± 2.8			Effusion; M.S.	1962	84
		318 ± 21	**76 ± 5**	***322 ± 21***	**77 ± 5**			
Pb–Se	$PbSe \rightarrow Pb + Se$	*257.3 ± 10.5*	61.5 ± 2.5			Effusion; M.S.	1961	159
		257.3 ± 10.5	61.5 ± 2.5	*261.1*	62.4	M.S.	1962	6
		257.3 ± 10.5	**61.5 ± 2.5**	***261.1 ± 10.5***	**62.4 ± 2.5**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Pb–Te	$\mathrm{PbTe \rightarrow Pb + Te}$	*215.1 ± 8.4*	51.4 ± 2.0			Effusion; M.S.	1961	159
		215.1 ± 8	51.4 ± 2	*218.8*	52.3	M.S.	1962	6
		215.1 ± 8	**51.4 ± 2**	***218.8 ± 8***	**52.3 ± 2**			
Rb–Br	$\mathrm{RbBr \rightarrow Rb + Br}$	*383.7 ± 8*	91.7 ± 2			Flame photometry	1961	34
		385 ± 25	92 ± 6			Thermochemical	1962	6
		385 ± 25	**92 ± 6**					
Rb–Cl	$\mathrm{RbCl \rightarrow Rb + Cl}$	*424.7 ± 8*	101.5 ± 2			Flame photometry	1961	34
		459.4 ± 13	109.8 ± 3	*463.2*	110.7	Thermochemical	1962	6
		444 ± 21	**106 ± 5**	***448 ± 21***	**107 ± 5**			
Rb–F	$\mathrm{RbF \rightarrow Rb + F}$	*502 ± 33*	120 ± 8			Flame photometry	1961	34
		477 ± 13	114 ± 3	*480.3*	114.8	Thermochemical	1962	6
		490 ± 21	**117 ± 5**	***494 ± 21***	**118 ± 5**			
Rb–I	$\mathrm{RbI \rightarrow Rb + I}$	*339.7 ± 8*	81.2 ± 2			Flame photometry	1961	34
		323.0 ± 13	77.2 ± 3	*326.8*	78.1	Thermochemical	1962	6
		331 ± 13	**79 ± 3**	***335 ± 13***	**80 ± 3**			
Rb–O	$\mathrm{RbOH \rightarrow Rb + OH}$	*347 ± 8*	83 ± 2			Flame photometry	1966	192
Ru–O	$\mathrm{RuO_4 \rightarrow RuO_3 + O}$	*435*	104			A.P.; M.S.	1965	147
S–F	$\mathrm{SO_2F \rightarrow SO_2 + F}$	*67.53*	16.14			A.P.; M.S.	1958	117
	$\mathrm{SO_2F_2 \rightarrow SO_2F + F}$	*656.1*	156.8			A.P.; M.S.	1958	117
	$\mathrm{SF_6 \rightarrow SF_5 + F}$	*≤ 326*	≤ 78			A.P.; M.S.	1961	160
S–H	$\mathrm{HS \rightarrow H + S}$	*340.6 ± 12.1*	81.4 ± 2.9	*344.3*	82.3	Spectroscopic; extrapolation of $A^2\Sigma$	1962	6
		351	84	*356*	85	Thermochemical; based on 9	1967	
		349.4 ± 6.3	**83.5 ± 1.5**	***353.1 ± 6.3***	**84.4 ± 1.5**			
	$\mathrm{H_2S \rightarrow HS + H}$	*379.5*	90.7	*384.9*	92.0 ± 3	Thermochemical	1962	6
		377	90	*381*	91	Thermochemical; based on 9	1967	
		377 ± 4	**90 ± 1**	***381 ± 4***	**91 ± 1**			

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
S–O	$SO \rightarrow S + O$	*497.1*	118.8			A.P.; M.S.	1958	117
		531.8	127.1			Spectroscopic; B.S. extrapolation	1962	45
		517.02 ± 0.13	123.57 ± 0.03	*521.70*	124.69	Spectroscopic; predissociation	1962	6
		516.7	123.5			Spectroscopic	1964	77
		517.1	123.6			Spectroscopic; examination of data	1965	75
		517.1	123.6	*521.7*	124.7	Thermochemical: based on 9	1967	
		517.1 ± 8	**123.6 ± 2**					
	$SO_2 \rightarrow SO + O$			*385 ± 29*	92 ± 7	A.P.; M.S.	1957	44
				548	131	Thermochemical; secondary scource	1959	113
		541.58 ± 1.3	129.44 ± 0.3	*546.51*	*130.62*	Thermochemical	1962	6
		515.9 ± 33.5	123.3 ± 8			Spectroscopic; continuum limit	1964	77
		547.3	130.8	*552.3*	*132.0*	Thermochemical: based on 9	1967	
		547.3 ± 8	**130.8 ± 2.0**					
	$SO_3 \rightarrow SO_2 + O$	*341.83 ± 0.63*	81.70 ± 0.15	*347.3*	*83.0*	Thermochemical	1962	6
		342.50	81.86	*348.07*	*83.19*	Thermochemical: based on 9	1967	
		342.7 ± 4	81.9 ± 1	*348.1 ± 4*	*83.2 ± 1*			
S–S	$S_2 \rightarrow 2S$	*414.6*	99.1			Secondary source	1959	112
		424.3	101.4			Theoretical	1961	158
		412.1 ± 2.5	98.5 ± 0.6	*417.6*	99.8	Thermochemical	1962	6
		424.7	101.5			Dissociation equilibrium; M.S.	1963	81
		407.5 ± 18.8	97.4 ± 4.5			Effusion; M.S.; CaS	1964	189
		391.2 ± 29	93.5 ± 7			Effusion; M.S.; SrS	1964	189
		395.8 ± 23.0	94.6 ± 5.5			Effusion; M.S.; BaS	1964	189
		425.1	101.6	*429.3*	102.6	Thermochemical; based on 9	1967	
		424.7 ± 6.3	**101.5 ± 1.5**	***428.9 ± 6.3***	**102.5 ± 1.5**			
	$H_2S_2 \rightarrow 2HS$	*261.9*	62.6			Theoretical	1961	158
				277.0 ± 25	66.2 ± 6	Thermochemical	1962	6
				247 ± 13	59 ± 3	A.P.; M.S.	1962	97
				274.9	65.7	Thermochemical: based on 9	1967	
				272 ± 21	**65 ± 5**			
Sb–Sb	$Sb_2 \rightarrow 2Sb$	*295.4 ± 6.3*	70.6 ± 1.5	*299.6*	71.6	Effusion; M.S.	1959	82
Sb–Te	$SbTe \rightarrow Sb + Te$	*251.0*	60.0			Effusion; M.S.	1960	61

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, *D*°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Sc–Sc	$Sc_2 \rightarrow 2Sc$	*108.4±21*	25.9±5			Effusion; M.S.	1963	93
Sc–F	$ScF \rightarrow Sc + F$			*506±71*	*121±17*	Spectroscopic; L.B.S.	1962	46
Si–H	$SiH \rightarrow Si + H$	*310±25*	74±6	*314.2*	*75.1*	Spectroscopic; extrapolation of $^2\Delta$	1957	47
	$SiH_4 \rightarrow SiH_3 + H$			*335*	*80*	Thermochemical	1962	6
		398.3	95.2			M.S.	1966	153
Sn–O	$SnO \rightarrow Sn + O$	*561±8*	134±2	*565*	*135*	Equilibrium $SnO_2 + Sn = 2SnO$	1962	6
		529.3±8.4	126.5±2.0			A.P.; M.S.	1965	181
		544±21	**130±5**	*548±21*	**131±5**			
Sn–S	$SnS \rightarrow Sn + S$	*469±13*	112±3	*473*	113	Thermochemical	1962	6
		460±13	110±3			Effusion; M.S.	1962	84
		464±21	**111±5**	***469±21***	**112±5**			
Sr–Cl	$SrCl \rightarrow Sr + Cl$	*289±59*	69±14	*293*	70	Spectroscopic; L.B.S. of ground state	1962	6
		410±25	98±6			Flame photometry	1965	23
		335±84	**80±20**	***339±84***	**81±20**			
	$SrCl_2 \rightarrow SrCl + Cl$			*611±59*	146±14	Thermochemical	1962	6
		418±25	100±6			Flame photometry	1965	23
Sr–F	$SrF \rightarrow Sr + F$	*335±67*	80±16	339	81	Spectroscopic; L.B.S. of ground state	1962	6
		525.5±13	125.6±3			Effusion; M.S. $2SrF = Sr + SrF_2$	1964	68
		552±29	132±7			Flame photometry	1965	23
		540±42	**129±10**					
	$SrF_2 \rightarrow SrF + F$			774±67	185±16	Thermochemical	1962	6
		578.2±21	138.2±5			Effusion; M.S. $2SrF = Sr + SrF_2$	1964	68
		556±42	133±10			Flame photometry	1965;	23
		565±42	**135±10**				1966	21

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, $D°$				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Sr–O	$SrO \rightarrow Sr + O$	*469 ± 8*	112 ± 2	*472 ± 4*	112.9	Flame photometry analysis of various data	1962	6
		427 ± 42	102 ± 10			Theoretical	1964	144
		385 ± 25	92 ± 6			Effusion; M.S.	1964	189
		396.6	94.8			Flame photometry; CO flame	1965	71
		515 ± 21	123 ± 5			Flame photometry; H_2 flame	1966	191
		460 ± 84	**110 ± 20**					
	$SrOH \rightarrow Sr + OH$	*≤ 377 ± 42*	≤ 90 ± 10			Flame photometry; C_2H_2 + CO flame	1957	52
		410 ± 63	98 ± 15				1965	22
	$Sr(OH)_2 \rightarrow SrOH + OH$	*490 ± 113*	117 ± 23			Ref. 191 gives $D_1 + D_2 = 215 \pm 12$ and 22 gives $D_2 = 98 \pm 15$ kcal mol^{-1}		
Sr–S	$SrS \rightarrow Sr + S$	*222 ± 21*	53 ± 5	*226*	54	Spectroscopic; long λ of continuum	1962	6
		335	80			Effusion; M.S.	1963	80
		310.0 ± 18.8	74.1 ± 4.5			Effusion; M.S.	1964	189
		314 ± 42	**75 ± 10**					
Ta–O	$TaO \rightarrow Ta + O$	*810.4 ± 50*	193.7 ± 12			Effusion; M.S.	1957	115
Te–Se	$TeSe \rightarrow Te + Se$	*241.0*	57.6			Effusion; M.S.	1960	61
Te–Te	$Te_2 \rightarrow 2Te$	*218 ± 8*	52 ± 2			Effusion; M.S.	1961	159
Th–O	$ThO \rightarrow Th + O$	*820*	196	*824*	197	M.S.	1962	6
		< 820	< 196			Effusion; M.S.	1963	173
	$ThO_2 \rightarrow ThO + O$	*< 770*	< 184			Effusion; M.S.; Ref. 173 gives $D_1 + D_2 < 375.9$ kcal mol^{-1}	1963	173
Ti–O	$TiO \rightarrow Ti + O$	*653 ± 25*	156 ± 6	*657*	157	M.S.	1962	6
		541.4	129.4			Theoretical	1964	78
Ti–Ti	$Ti_2 \rightarrow 2Ti$	*< 243*	< 58			Effusion; M.S.	1964	56

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
Tl–Br	TlBr → Tl + Br	*328.0*	78.4	331.8	79.3	Thermochemical; spectroscopic data	1960	140
		324.7	77.6			Flame photometry	1961	34
		326 ± 21	**78 ± 5**	***331 ± 21***	**79 ± 5**			
Tl–Cl	TlCl → Tl + Cl			*377*	90	Thermochemical; spectroscopic data	1960	140
		364 ± 8	87 ± 2			Flame photometry	1961	140
Tl–F	TlF → Tl + F	*460*	110			Thermochemical; spectroscopic	1960	140
		460 ± 42	110 ± 10			Flame photometry	1961	34
		452 ± 10.5	108 ± 2.5			Calorimetry	1965	148
		423 ± 14.6	101 ± 3.5			Effusion; M.S.; Tl + MgF = TlF + Mg	1966	170
		439 ± 21	**105 ± 5**					
Tl–I	TlI → Tl + I	*272 ± 13*	65 ± 3	*276*	66	Thermochemical	1960	140
		285 ± 13	68 ± 3			Flame photometry	1961	34
		280 ± 21	**67 ± 5**	***285 ± 21***	**68 ± 5**			
U–O	UO → U + O	*749 ± 29*	179 ± 7			M.S.	1960	199
	UO_2 → UO + O	*674 ± 59*	161 ± 14			M.S.	1960	199
	UO_3 → UO_2 + O	*640 ± 88*	153 ± 21			M.S.	1960	199
U–S	US → U + S	*561 ± 9.6*	134 ± 2.3			Effusion; M.S.	1966	168
V–O	VO → V + O	*617.6 ± 19.2*	147.6 ± 4.6			Effusion; M.S.	1957	116
	VO_2 → VO + O	*617.6 ± 19.2*	147.6 ± 4.6			Effusion; M.S.	1957	116
W–O	WO → W + O	*678 ± 42*	162 ± 10			M.S.; Effusion	1959	83
		644 ± 42	154 ± 10			M.S.; partial pressure	1960	199
		661 ± 42	**158 ± 10**					

Table of Bond Dissociation Energies—*Continued*

Bond	Reaction	Dissociation energy, D°				Method, remarks	Date	Ref.
		0 K		298 K				
		kJ/mol	kcal/mol	kJ/mol	kcal/mol			
	$WO_2 \rightarrow WO + O$	*661 ± 42*	158 ± 10			M.S.; Effusion	1959	83
		594 ± 71	142 ± 17			M.S.; partial pressure	1960	199
		628 ± 84	**150 ± 20**					
	$WO_3 \rightarrow WO_2 + O$	*573 ± 42*	137 ± 10			M.S.; Effusion	1959	83
		615 ± 100	147 ± 24			M.S.; partial pressure	1960	199
		594 ± 42	**142 ± 10**					
Y–La	$Yla \rightarrow Y + La$	*197*	47			Effusion; M.S.	1963	93
Y–Y	$Y_2 \rightarrow 2Y$	*156.1 ± 21*	37.3 ± 5			Effusion; M.S.	1963	93
Zn–S	$ZnS \rightarrow Zn + S$	*406 ± 29*	97 ± 7	410	98	Spectroscopic; continuum limit	1962	6
		203.8	48.7			Effusion; M.S.; $ZnS \rightarrow Zn + 1/2\,S_2$	1963	80
		201 ± 13	48 ± 3			Effusion; M.S.	1965	184
		201 ± 13	**48 ± 3**					
Zn–Se	$ZnSe \rightarrow Zn + Se$	*132.6 ± 12.6*	31.7 ± 3.0			Effusion; M.S.	1965	184
Zr–O	$ZrO \rightarrow Zr + O$	*753 ± 21*	180 ± 5			Effusion; M.S.	1957	121

U. S. GOVERNMENT PRINTING OFFICE: 1970 OL - 357-055

(cut here)

Announcement of New Publications on Standard Reference Data

Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402

Dear Sir:

Please add my name to the announcement list of new publications to be issued in the series: National Standard Reference Data Series—National Bureau of Standards.

Name ______________________________

Company ______________________________

Address ______________________________

City ______________ State ______________ Zip Code ______________

(Notification Key N337)

Publications in the National Standard Reference Data Series
National Bureau of Standards

You may use this listing as your order form by checking the proper box of the publication(s) you desire or by providing the full identification of the publication you wish to purchase. The full letter symbols with each publications number and full title of the publication and author must be given in your order, e.g. NSRDS–NBS–17, Tables of Molecular Vibrational Frequencies, Part 3, by T. Shimanouchi.

Pay for publications by check, money order, or Superintendent of Documents coupons or deposit account. Make checks and money orders payable to Superintendent of Documents. Foreign remittances should be made either by international money order or draft on an American bank. Postage stamps are not acceptable.

No charge is made for postage to destinations in the United States and possessions, Canada, Mexico, and certain Central and South American countries. To other countries, payments for documents must cover postage. Therefore, one-fourth of the price of the publication should be added for postage.

Send your order together with remittance to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

(cut here)

☐ NSRDS-NBS 1, **National Standard Reference Data System—Plan of Operation,** by E. L. Brady and M. B. Wallenstein, 1964 (15 cents).

☐ NSRDS-NBS 2, **Thermal Properties of Aqueous Uni-univalent Electrolytes,** by V. B. Parker, 1965 (45 cents).

☐ NSRDS-NBS 3, Sec. 1, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, Si II, Si III, Si IV,** by C. E. Moore, 1965 (35 cents).

☐ NSRDS-NBS 3, Sec. 2, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, Si I,** by C. E. Moore, 1967 (20 cents).

☐ NSRDS-NBS 4, **Atomic Transition Probabilities, Volume 1, Hydrogen Through Neon,** by W. L. Wiese, M. W. Smith and B. M. Glennon, 1966 ($2.50).

☐ NSRDS-NBS 5, **The Band Spectrum of Carbon Monoxide,** by P. H. Krupenie, 1966 (70 cents).

☐ NSRDS-NBS 6, **Tables of Molecular Vibrational Frequencies, Part 1,** by T. Shimanouchi, 1967 (40 cents).

☐ NSRDS-NBS 7, **High Temperature Properties and Decomposition of Inorganic Salts, Part 1, Sulfates,** by K. H. Stern and E. L. Weise, 1966 (35 cents).

☐ NSRDS-NBS 8, **Thermal Conductivity of Selected Materials,** by R. W. Powell, C. Y. Ho, and P. E. Liley, 1966 ($1.00).

☐ NSRDS-NBS 9, **Bimolecular Gas Phase Reactions (rate coefficients),** by A. F. Trotman-Dickenson and G. S. Milne, 1967 ($2).

☐ NSRDS-NBS 10, **Selected Values of Electric Dipole Moments for Molecules in the Gas Phase,** by R. D. Nelson, Jr., D. R. Lide, Jr., and A. A. Maryott, 1967 (40 cents).

☐ NSRDS-NBS 11, **Tables of Molecular Vibrational Frequencies, Part 2,** by T. Shimanouchi, 1967 (30 cents).

☐ NSRDS-NBS 12, **Tables for the Rigid Asymmetric Roto: Transformation Coefficients from Symmetric to Asymmetric Bases and Expectation Values of P_z^2, P_z^4, and P_z^6,** by R. H. Schwendeman, 1968 (60 cents).

☐ NSRDS-NBS 13, **Hydrogenation of Ethylene on Metallic Catalysts,** by J. Horiuti and K. Miyahara, 1968 ($1.00).

☐ NSRDS-NBS 14, **X-Ray Wavelengths and X-Ray Atomic Energy Levels,** by J. A. Bearden, 1967 (40 cents).

☐ NSRDS-NBS 15, **Molten Salts, Vol. 1, Electrical Conductance, Density, and Viscosity Data,** by G. Janz, F. W. Dampier, G. R. Lakshminarayanan, P. K. Lorenz, and R. P. T. Tomkins, 1968 ($3).

☐ NSRDS-NBS 16, **Thermal Conductivity of Selected Materials, Part 2,** by C. Y. Ho, R. W. Powell, and P. E. Liley, 1968 ($2).

☐ NSRDS-NBS 17, **Tables of Molecular Vibration Frequencies, Part 3,** by T. Shimanouchi, 1968 (30 cents).

☐ NSRDS-NBS 18, **Critical Analysis of the Heat-Capacity Data of the Literature and Evaluation of Thermodynamic Properties of Copper, Silver, and Gold From 0 to 300 K,** by G. T. Furukawa, W. G. Saba, and M. L. Reilly, 1968 (40 cents).

☐ NSRDS-NBS 19, **Thermodynamic Properties of Ammonia as an Ideal Gas,** by L. Haar, 1968 (20 cents).

☐ NSRDS-NBS 20, **Gas Phase Reaction Kinetics of Neutral Oxygen Species,** by H. S. Johnson, 1968 (45 cents).

☐ NSRDS-NBS 21, **Kinetic Data on Gas Phase Unimolecular Reactions,** by S. W. Benson and H. E. O'Neal, (In press).

☐ NSRDS-NBS 22, **Atomic Transition Probabilities, Vol. II, Sodium Through Calcium, A Critical Data Compilation,** by W. L. Wiese, M. W. Smith, and B. M. Miles, ($4.50).

☐ NSRDS-NBS 23, **Partial Grotrian Diagrams of Astrophysical Interest,** by C. E. Moore and P. W. Merrill, 1968 (55 cents).

☐ NSRDS-NBS 24, **Theoretical Mean Activity Coefficients of Strong Electrolytes in Aqueous Solutions from 0 to 100° C,** by Walter J. Hamer, 1968 ($4.25).

☐ NSRDS-NBS 25, **Electron Impact Excitation of Atoms,** by B. L. Moiseiwitsch and S. J. Smith, 1968 ($2).

☐ NSRDS-NBS 26, **Ionization Potentials, Appearance Potentials, and Heats of Formation of Positive Ions,** by J. L. Franklin, J. G. Dillard, H. M. Rosenstock, J. T. Herron, K. Draxl, and F. H. Field, ($4).

☐ NSRDS-NBS 27, **Thermodynamic Properties of Argon from the Triple Point to 300 K at Pressures to 1000 Atmospheres,** by A. L. Gosman, R. D. McCarty, and J. G. Hust, ($1.25).

☐ NSRDS-NBS 28, **Molten Salts: Vol. 2. 1. Electrochemistry. 2. Surface Tension Data,** by G. J. Janz, Chr. G. M. Dijkhuis, G. R. Lakshminarayanan, R. P. T. Tomkins, and J. Wong, ($2.75).

☐ NSRDS-NBS 29, **Photon Cross Sections, Attenuation Coefficients, and Energy Absorption Coefficients from 10 keV to 100 GeV,** by J. H. Hubbell, (75 cents).

☐ NSRDS-NBS 30, **High Temperature Properties and Decomposition of Inorganic Salts. Part 2. Carbonates,** K. H. Stern, (In press).

U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 357-055

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, chemistry, and engineering. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts.

Published in three sections, available separately:

- **Physics and Chemistry**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $9.50; foreign, $11.75*.

- **Mathematical Sciences**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $5.00; foreign, $6.25*.

- **Engineering and Instrumentation**

Reporting results of interest chiefly to the engineer and the applied scientist. This section includes many of the new developments in instrumentation resulting from the Bureau's work in physical measurement, data processing, and development of test methods. It will also cover some of the work in acoustics, applied mechanics, building research, and cryogenic engineering. Issued quarterly. Annual subscription: Domestic, $5.00; foreign, $6.25*.

TECHNICAL NEWS BULLETIN

The best single source of information concerning the Bureau's research, developmental, cooperative and publication activities, this monthly publication is designed for the industry-oriented individual whose daily work involves intimate contact with science and technology—*for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Annual subscription: Domestic, $3.00; foreign, $4.00*.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitive data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other agency and NBS-sponsored work) of limited or transitory interest.

Federal Information Processing Standards Publications. This series is the official publication within the Federal Government for information on standards adopted and promulgated under the Public Law 89–306, and Bureau of the Budget Circular A–86 entitled, Standardization of Data Elements and Codes in Data Systems.

CLEARINGHOUSE

The Clearinghouse for Federal Scientific and Technical Information, operated by NBS, supplies unclassified information related to Government-generated science and technology in defense, space, atomic energy, and other national programs. For further information on Clearinghouse services, write:

Clearinghouse
U.S. Department of Commerce
Springfield, Virginia 22151

---

* Difference in price is due to extra cost of foreign mailing.

Order NBS publications from:

Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20230

OFFICIAL BUSINESS