
LANGE'S HANDBOOK OF CHEMISTRY

John A. Dean

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Fifteenth Edition

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ABOUT THE EDITOR

John A. Dean assumed the editorship of *Lange's Handbook of Chemistry* in 1968 with the Eleventh Edition. He is currently Professor Emeritus of Chemistry at the University of Tennessee at Knoxville. The author of nine major chemistry reference books used throughout the world, John Dean's research interests, reflected in over 105 research papers and scholarly publications, include instrumental methods of analysis, flame emission and atomic absorption spectroscopy, chromatographic and solvent extraction methods, and polarography. He received his B.S., M.S., and Ph.D. in Chemistry from the University of Michigan at Ann Arbor. In 1974, he was given the Charles H. Stone Award by the Carolina-Piedmont Section of the American Chemical Society. In 1991, he was awarded the Distinguished Service Award by the Society for Applied Spectroscopy; by the same organization he was awarded Honorary Membership in 1997.

PREFACE TO FIFTEENTH EDITION

This new edition, the fifth under the aegis of the present editor, remains the one-volume source of factual information for chemists, both professionals and students—the first place in which to “look it up” on the spot. The aim is to provide sufficient data to satisfy all one’s general needs without recourse to other reference sources. A user will find this volume of value as a time-saver because of the many tables of numerical data which have been especially compiled.

Descriptive properties for a basic group of approximately 4300 organic compounds are compiled in Section 1, an increase of 300 entries. All entries are listed alphabetically according to the senior prefix of the name. The data for each organic compound include (where available) name, structural formula, formula weight, Beilstein reference (or if unavailable, the entry to the *Merck Index*, 12th ed.), density, refractive index, melting point, boiling point, flash point, and solubility (citing numerical values if known) in water and various common organic solvents. Structural formulas either too complex or too ambiguous to be rendered as line formulas are grouped at the bottom of each facing double page on which the entries appear. Alternative names, as well as trivial names of long-standing usage, are listed in their respective alphabetical order at the bottom of each double page in the regular alphabetical sequence. Another feature that assists the user in locating a desired entry is the empirical formula index.

Section 2 on General Information, Conversion Tables, and Mathematics has had the table on general conversion factors thoroughly reworked. Similarly the material on Statistics in Chemical Analysis has had its contents more than doubled.

Descriptive properties for a basic group of inorganic compounds are compiled in Section 3, which has undergone a small increase in the number of entries. Many entries under the column “Solubility” supply the reader with precise quantities dissolved in a stated solvent and at a given temperature.

Several portions of Section 4, Properties of Atoms, Radicals, and Bonds, have been significantly enlarged. For example, the entries under “Ionization Energy of Molecular and Radical Species” now number 740 and have an additional column with the enthalpy of formation of the ions. Likewise, the table on “Electron Affinities of the Elements, Molecules, and Radicals” now contains about 225 entries. The Table of Nuclides has material on additional radionuclides, their radiations, and the neutron capture cross sections.

Revised material for Section 5 includes the material on surface tension, viscosity, dielectric constant, and dipole moment for organic compounds. In order to include more data at several temperatures, the material has been divided into two separate tables. Material on surface tension and viscosity constitute the first table with 715 entries; included is the temperature range of the liquid phase. Material on dielectric constant and dipole

moment constitute another table of 1220 entries. The additional data at two or more temperatures permit interpolation for intermediate temperatures and also permit limited extrapolation of the data. The Properties of Combustible Mixtures in Air has been revised and expanded to include over 450 compounds. Flash points are to be found in Section 1. Completely revised are the tables on Thermal Conductivity for gases, liquids, and solids. Van der Waals' constants for gases has been brought up to date and expanded to over 500 substances.

Section 6, which includes Enthalpies and Gibbs Energies of Formation, Entropies, and Heat Capacities of Organic and Inorganic Compounds, and Heats of Melting, Vaporization, and Sublimation and Specific Heat at Various Temperatures for organic and inorganic compounds, has expanded by 11 pages, but the major additions have involved data in columns where it previously was absent. More material has also been included for critical temperature, critical pressure, and critical volume.

The section on Spectroscopy has been retained but with some revisions and expansion. The section includes ultraviolet-visible spectroscopy, fluorescence, infrared and Raman spectroscopy, and X-ray spectrometry. Detection limits are listed for the elements when using flame emission, flame atomic absorption, electrothermal atomic absorption, argon induction coupled plasma, and flame atomic fluorescence. Nuclear magnetic resonance embraces tables for the nuclear properties of the elements, proton chemical shifts and coupling constants, and similar material for carbon-13, boron-11, nitrogen-15, fluorine-19, silicon-29, and phosphorus-31.

In Section 8, the material on solubility constants has been doubled to 550 entries. Sections on proton transfer reactions, including some at various temperatures, formation constants of metal complexes with organic and inorganic ligands, buffer solutions of all types, reference electrodes, indicators, and electrode potentials are retained with some revisions. The material on conductances has been revised and expanded, particularly in the table on limiting equivalent ionic conductances.

Everything in Sections 9 and 10 on physiochemical relationships, and on polymers, rubbers, fats, oils, and waxes, respectively, has been retained.

Section 11, Practical Laboratory Information, has undergone significant changes and expansion. Entries in the table on "Molecular Elevation of the Boiling Point" have been increased. McReynolds' constants for stationary phases in gas chromatography have been reorganized and expanded. The guide to ion-exchange resins and discussion is new and embraces all types of column packings and membrane materials. Gravimetric factors have been altered to reflect the changes in atomic weights for several elements. Newly added are tables listing elements precipitated by general analytical reagents, and giving equations for the redox determination of the elements with their equivalent weights. Discussion on the topics of precipitation and complexometric titrations include primary standards and indicators for each analytical technique. A new topic of masking and demasking agents includes discussion and tables of masking agents for various elements, for anions and neutral molecules, and common demasking agents. A table has been added listing the common amino acids with their pI and pK_a values and their 3-letter and 1-letter abbreviations. Lastly a 9-page table lists the threshold limit value (TLV) for gases and vapors.

As stated in earlier prefaces, every effort has been made to select the most useful and reliable information and to record it with accuracy. However, the editor's 50 years of

involvement with textbooks and handbooks bring a realization of the opportunities for gremlins to exert their inevitable mischief. It is hoped that users of this handbook will continue to offer suggestions of material that might be included in, or even excluded from, future editions and call attention to errors. These communications should be directed to the editor. The street address will change early in 1999, as will the telephone number. However, the e-mail address should remain as “pd105@aol.com.”

Knoxville, TN

John A. Dean

PREFACE TO FOURTEENTH EDITION

Perhaps it would be simplest to begin by stating the ways in which this new edition, the fourth under the aegis of the present editor, has *not* been changed. It remains the one-volume source of factual information for chemists, both professionals and students—the first place in which to “look it up” on the spot. The aim is to provide sufficient data to satisfy all one’s general needs without recourse to other reference sources. Even the worker with the facilities of a comprehensive library will find this volume of value as a time-saver because of the many tables of numerical data which have been especially compiled.

The changes, however, are both numerous and significant. First of all, there is a change in the organization of the subject matter. For example, material formerly contained in the section entitled Analytical Chemistry is now grouped by operational categories: spectroscopy; electrolytes, electromotive force, and chemical equilibrium; and practical laboratory information. Polymers, rubbers, fats, oils, and waxes constitute a large independent section.

Descriptive properties for a basic group of approximately 4000 organic compounds are compiled in Section 1. These follow a concise introduction to organic nomenclature, including the topic of stereochemistry. Nomenclature is consistent with the 1979 rules of the Commission on Nomenclature, International Union of Pure and Applied Chemistry (IUPAC). All entries are listed alphabetically according to the senior prefix of the name. The data for each organic compound include (where available) name, structural formula, formula weight, Beilstein reference, density, refractive index, melting point, boiling point, flash point, and solubility (citing numerical values if known) in water and various common organic solvents. Structural formulas either too complex or too ambiguous to be rendered as line formulas are grouped at the bottom of the page on which the entries appear. Alternative names, as well as trivial names of long-standing usage, are listed in their respective alphabetical order at the bottom of each page in the regular alphabetical sequence. Another feature that assists the user in locating a desired entry is the empirical formula index.

Section 2 combines the former separate section on Mathematics with the material involving General Information and Conversion Tables. The fundamental physical constants reflect values recommended in 1986. Physical and chemical symbols and definitions have undergone extensive revision and expansion. Presented in 14 categories, the entries follow recommendations published in 1988 by the IUPAC. The table of abbreviations and standard letter symbols provides, in a sense, an alphabetical index to the foregoing tables. The table of conversion factors has been modified in view of recent data and inclusion of SI units; cross-entries for “archaic” or unusual entries have been curtailed.

Descriptive properties for a basic group of approximately 1400 inorganic compounds are compiled in Section 3. These follow a concise, revised introduction to inorganic nomenclature that follows the recommendations of the IUPAC published in 1990. In this section are given the exact atomic (or formula) weight of the elements accompanied, when available, by the uncertainty in the final figure given in parentheses.

In Section 4 the data on bond lengths and strengths have been vastly increased so as to include not only the atomic and effective ionic radii of elements and the covalent radii for atoms, but also the bond lengths between carbon and other elements and between elements other than carbon. All

lengths are given in picometers (SI unit). Effective ionic radii are tabulated as a function of ion charge and coordination number. Bond dissociation energies are given in kilojoules per mole with the uncertainty of the final figure(s) given in parentheses when known. New tables include bond dipole moments, group dipole moments, work functions of the elements, and relative abundances of the naturally occurring elements. The table of nuclides has been shortened and includes only the more commonly encountered nuclides; tabulations list half-life, natural abundance, cross-section to thermal neutrons, and radiation emitted upon disintegration. Entries have been updated.

Revised material in Section 5 includes an extensive tabulation of binary and ternary azeotropes comprising approximately 850 entries. Over 975 compounds have values listed for viscosity, dielectric constant, dipole moment, and surface tension. Whenever possible, data for viscosity and dielectric constant are provided at two temperatures to permit interpolation for intermediate temperatures and also to permit limited extrapolation of the data. The dipole moments are often listed for different physical states. Values for surface tension can be calculated over a range of temperatures from two constants that can be fitted into a linear equation. Also extensively revised and expanded are the properties of combustible mixtures in air. A table of triple points has been added.

The tables in Section 6 contain values of the enthalpy and Gibbs energy of formation, entropy, and heat capacity at five temperatures for approximately 2000 organic compounds and 1500 inorganic compounds, many in more than one physical state. Separate tabulations have enthalpies of melting, vaporization, transition, and sublimation for organic and inorganic compounds. All values are given in SI units (joule) and have been extracted from the latest sources such as *JANAF Thermochemical Tables*, 3d ed. (1986); *Thermochemical Data of Organic Compounds*, 2d ed. (1986); and *Enthalpies of Vaporization of Organic Compounds*, published under the auspices of the IUPAC (1985). Also updated is the material on critical properties of elements and compounds.

The section on Spectroscopy has been expanded to include ultraviolet-visible spectroscopy, fluorescence, Raman spectroscopy, and mass spectroscopy. Retained sections have been thoroughly revised: in particular, the tables on electronic emission and atomic absorption spectroscopy, nuclear magnetic resonance, and infrared spectroscopy. Detection limits are listed for the elements when using flame emission, flame atomic absorption, electrothermal atomic absorption, argon ICP, and flame atomic fluorescence. Nuclear magnetic resonance embraces tables for the nuclear properties of the elements, proton chemical shifts and coupling constants, and similar material for carbon-13, boron-11, nitrogen-15, fluorine-19, silicon-29, and phosphorus-31.

Section 8 now combines all the material on electrolytes, electromotive force, and chemical equilibrium, some of which had formerly been included in the old "Analytical Chemistry" section of earlier editions. Material on the half-wave potentials of inorganic and organic materials has been thoroughly revised. The tabulation of the potentials of the elements and their compounds reflects recent IUPAC (1985) recommendations.

An extensive new Section 10 is devoted to polymers, rubbers, fats, oils, and waxes. A discussion of polymers and rubbers is followed by the formulas and key properties of plastic materials. For each member and type of the plastic families there is a tabulation of their physical, electrical, mechanical, and thermal properties and characteristics. A similar treatment is accorded the various types of rubber materials. Chemical resistance and gas permeability constants are also given for rubbers and plastics. The section concludes with various constants of fats, oils, and waxes.

The practical laboratory information contained in Section 11 has been gathered from many of the previous sections of earlier editions. This material has been supplemented with new material under separation methods, gravimetric and volumetric analysis, and laboratory solutions. Significant new tables under separation methods include: properties of solvents for chromatography, solvents having the same refractive index and the same density, McReynolds' constants for stationary phases in gas chromatography, characteristics of selected supercritical fluids, and typical performances in HPLC for various operating conditions. Under gravimetric and volumetric analysis, gravimetric factors, equations and equivalents for volumetric analysis, and titrimetric factors have been retained

along with the formation constants of EDTA metal complexes. In this age of awareness of chemical dangers, tables have been added for some common reactive and incompatible chemicals, chemicals recommended for refrigerated storage, and chemicals which polymerize or decompose on extended storage at low temperature. Updated is the information about the U.S. Standard Sieve Series. Thermometry data have been revised to bring them into agreement with the new International Temperature Scale–1990, and data for type N thermocouples are included.

Every effort has been made to select the most useful and most reliable information and to record it with accuracy. However, the editor's many years of involvement with handbooks bring a realization of the opportunities for gremlins to exert their inevitable mischief. It is hoped that users of this handbook will offer suggestions of material that might be included in, or even excluded from, future editions and call attention to errors. These communications should be directed to the editor at his home address (or by telephone).

John A. Dean

PREFACE TO FIRST EDITION

This book is the result of a number of years' experience in the compiling and editing of data useful to chemists. In it an effort has been made to select material to meet the needs of chemists who cannot command the unlimited time available to the research specialist, or who lack the facilities of a large technical library which so often is not conveniently located at many manufacturing centers. If the information contained herein serves this purpose, the compiler will feel that he has accomplished a worthy task. Even the worker with the facilities of a comprehensive library may find this volume of value as a time-saver because of the many tables of numerical data which have been especially computed for this purpose.

Every effort has been made to select the most reliable information and to record it with accuracy. Many years of occupation with this type of work bring a realization of the opportunities for the occurrence of errors, and while every endeavor has been made to prevent them, yet it would be remarkable if the attempts towards this end had always been successful. In this connection it is desired to express appreciation to those who in the past have called attention to errors, and it will be appreciated if this be done again with the present compilation for the publishers have given their assurance that no expense will be spared in making the necessary changes in subsequent printings.

It has been aimed to produce a compilation complete within the limits set by the economy of available space. One difficulty always at hand to the compiler of such a book is that he must decide what data are to be excluded in order to keep the volume from becoming unwieldy because of its size. He can hardly be expected to have an expert's knowledge of all branches of the science nor the intuition necessary to decide in all cases which particular value to record, especially when many differing values are given in the literature for the same constant. If the expert in a particular field will judge the usefulness of this book by the data which it supplies to him from fields other than his specialty and not by the lack of highly specialized information in which only he and his co-workers are interested (and with which he is familiar and for which he would never have occasion to consult this compilation), then an estimate of its value to him will be apparent. However, if such specialists will call attention to missing data with which they are familiar and which they believe others less specialized will also need, then works of this type can be improved in succeeding editions.

Many of the gaps in this volume are caused by the lack of such information in the literature. It is hoped that to one of the most important classes of workers in chemistry, namely the teachers, the book will be of value not only as an aid in answering the most varied questions with which they are confronted by interested students, but also as an inspiration through what it suggests by the gaps and inconsistencies, challenging as they do the incentive to engage in the creative and experimental work necessary to supply the missing information.

While the principal value of the book is for the professional chemist or student of chemistry, it should also be of value to many people not especially educated as chemists. Workers in the natural sciences—physicists, mineralogists, biologists, pharmacists, engineers, patent attorneys, and librarians—are often called upon to solve problems dealing with the properties of chemical products or materials of construction. For such needs this compilation supplies helpful information and will serve not only as an economical substitute for the costly accumulation of a large library of monographs on specialized subjects, but also as a means of conserving the time required to search for

information so widely scattered throughout the literature. For this reason especial care has been taken in compiling a comprehensive index and in furnishing cross references with many of the tables.

It is hoped that this book will be of the same usefulness to the worker in science as is the dictionary to the worker in literature, and that its resting place will be on the desk rather than on the bookshelf.

Cleveland, Ohio
May 2, 1934

N. A. Lange

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3.2 PHYSICAL PROPERTIES OF PURE SUBSTANCES

TABLE 3.2 Physical Constants of Inorganic Compounds

Names follow the IUPAC Nomenclature. Solvates are listed under the entry for the anhydrous salt. Acids are entered under Hydrogen and acid salts are entered as a subentry under hydrogen.

Formula weights are based upon the International Atomic Weights of 1993 and are computed to the nearest hundredth when justified. The actual significant figures are given in the atomic weights of the individual elements.

Each element that has neither a stable isotope nor a characteristic natural isotopic composition is represented in this table by one of that element's commonly known radioisotopes identified by mass number and relative atomic mass.

Density values are given at room temperature unless otherwise indicated by the superscript figure; for example, 2.487^{15} indicates a density of 2.487 g/cm^3 for the substance at 15°C . A superscript 20 over a subscript 4 indicates a density at 20°C relative to that of water at 4°C . For gases the values are given as grams per liter (g/L).

Melting point is recorded in a certain case as 250 d and in some other cases as d 250, the distinction being made in this manner to indicate that the former is a melting point with decomposition at 250°C while in the latter decomposition only occurs at 250°C and higher temperatures. Where a value such as $-6\text{H}_2\text{O}$, 150 is given it indicates a loss of 6 moles of water per formula weight of the compound at a temperature of 150°C . For hydrates the temperature stated represents the compound melting in its water of hydration.

Boiling point is given at atmospheric pressure (760 mm of mercury or 101 325 Pa) unless otherwise indicated; thus $82^{15\text{mm}}$ indicates that the boiling point is 82°C when the pressure is 15 mm of mercury. Also, subl 550 indicates that the compound sublimates at 550°C . Occasionally decomposition products are mentioned.

Solubility is given in parts by weight (of the formula weight) per 100 parts by weight of the solvent (i.e., percent by weight) and at room temperature. Another unit frequently used is grams per 100 mL of solvent (mL per 100 mL for liquids and gases). The symbols of the common mineral acids represent aqueous solutions of these acids.

Abbreviations Used in the Table

a, acid	h, hot
abs, absolute	hex, hexagonal
abs alc, anhydrous ethanol	HOAc, acetic acid
acet, acetone	i, insoluble
alk, alkali (aq NaOH or KOH)	ign, ignites
anhyd, anhydrous	L, liter
aq, aqueous	lq, liquid
aq reg, aqua regia	MeOH, methanol
atm, atmosphere	min, mineral
BuOH, butanol	mL, milliliter
bz, benzene	org, organic
c, solid state	oxid, oxidizing
ca., approximately	PE, petroleum ether
chl, chloroform	pyr, pyridine
conc, concentrated	s, soluble
cub, cubic	satd, saturated
d, decomposes	sl, slightly
dil, dilute	soln, solution
disprop, disproportionates	solv, solvent(s)
EtOAc, ethyl acetate	subl, sublimates
eth, diethyl ether	sulf, sulfides
EtOH, 95% ethanol	tart, tartrate
expl, explodes	THF, tetrahydrofuran
fcc, face-centered cubic	v, very
fcctetr, face-centered tetragonal	vac, vacuum
FP, flash point	viol, violently
fum, fuming	volat, volatilizes
fus, fusion, fuses	<, less than
g, gas, gram	>, greater than
glyc, glycerol	

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Actinium-227	Ac	227.0278	10.07	1050(50)	ca. 3200	d aq; s acids
bromide	AcBr ₃	466.74	5.85	subl 800		s aq
Aluminum	Al	26.981539	2.70	660.323	2518	s HCl, H ₂ SO ₄ , alk
acetylacetonate	Al(C ₅ H ₇ O ₂) ₃	324.31	1.27	190–193	315	i aq; v s alc; s bz, eth
ammonium bis(sulfate)	AlNH ₄ (SO ₄) ₂ · 12H ₂ O	453.33	1.65	anhyd >280		14.3 g/100 mL aq; s glyc; i alc
12-water						
antimonide	AlSb	148.74	4.26	1060		
arsenide	AlAs	101.90	3.76	1740		
bis(acetylacetyl)ate	Al(OOCC ₆ H ₄ OCOCH ₃) ₂ OH	402.30				
borate (2/1)	2Al ₂ O ₃ · B ₂ O ₃	273.54		ca. 1050		v sl s aq, alc, eth
bromide	AlBr ₃	266.69	3.205 ¹⁸	97.5	subl 253	i aq
butoxide, <i>sec</i> -	Al(C ₄ H ₉ O) ₃	246.33	0.967		200–206 ^{30mm}	d (viol) aq; s alc, acet, bz, CS ₂
butoxide, <i>tert</i> -	Al(C ₄ H ₉ O) ₃	246.33	1.025 ²⁰		subl 180	FP 27; v s org solv
carbide (4/3)	Al ₄ C ₃	143.96	2.360	2100	d >2200 ^{400mm}	v s org solv
chlorate	Al(ClO ₃) ₃	277.35				d aq; fire hazard
chloride	AlCl ₃	133.34	2.440 ²⁵	192.6	subl 181.1	v s aq; s alc
						g/100 mL: 70 aq (viol), 100 ¹² abs
ethoxide	Al(C ₂ H ₅ O) ₃	162.16	1.142 ²⁰	140	205 ^{14mm}	alc; s CCl ₄ , eth; sl s bz
fluoride	AlF ₃	83.98	2.882 ²⁵	1090	subl 1272	s hot aq d; v sl s alc, eth
hydroxide	Al(OH) ₃	78.01	2.42	to Al ₂ O ₃ , 300		0.56 aq; i a, alk, alc, acet
iodide	AlI ₃	407.69	3.98 ¹⁷	191.0	382	i aq; s acids, alkalis
isopropoxide	Al(C ₃ H ₇ O) ₃	204.25	1.0346 ²⁰	118.5	135 ^{10mm}	d aq; s alc, eth, CS ₂
methoxide	Al(CH ₃ O) ₃	72.07		0	130	d aq; s alc, bz, chl, PE
nitrate 9-water	Al(NO ₃) ₃ · 9H ₂ O	375.13	1.72	73	d 135	g/100 mL: 64 aq, 100 alc; s acet
nitride	AlN	40.99	3.05	d 2517		d aq, acid, alkali
oxide (alpha-)	AlO ₃	101.96	3.97	2054(6)	2980	i aq; v sl s a, alk
perchlorate 6-water	Al(ClO ₄) ₃ · 6H ₂ O	433.43	2.020	120.8	anhyd 178	133 g/100 mL ²⁰ aq
phenoxide	Al(C ₆ H ₅ O) ₃	306.27	1.23	d 265		d aq; s alc, chl, eth
phosphate	AlPO ₄	121.95	2.56	>1460		i aq; sl s a
phosphide	AlP	57.96	2.85 ¹⁵	2550		d aq
phosphinate (hypophosphite)	Al(H ₂ PO ₂) ₃	221.94		d to PH ₃ , 220		i aq; s HCl, warm alkali

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Aluminum (<i>continued</i>)						
potassium bis(sulfate) 12-water	$\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	474.39	1.757 ²⁰	−9H ₂ O, 92	anhyd, 200	11.4 g/100 mL aq; v s glyc; i alc
propoxide	$\text{Al}(\text{C}_3\text{H}_7\text{O})_3$	204.25	1.0578 ²⁰	106	248 ^{14mm}	d aq; s alc
selenide	Al_2Se_3	290.84	3.437 ²⁰	947		d aq, acid
silicon oxide (1/1)	$\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$	162.05	3.247			i aq; d HF; s fused alkali
sodium bis(sulfate) 12-water	$\text{AlNa}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	458.28	1.675 ²⁰	61		110 g/100 mL ¹⁵ aq; i alc
stearate	$\text{Al}(\text{C}_{18}\text{H}_{35}\text{O}_2)_3$	877.41	1.070	117–120		i aq, alc; s bz, alk
sulfate	$\text{Al}_2(\text{SO}_4)_3$	342.15	1.61	770 d		36.4 g/100 mL ²⁰ aq; sl s alc
sulfate 18-water	$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$	666.46	1.69 ¹⁷	d 86.5		87 g/100 mL ⁰ aq; i alc
sulfide	Al_2S_3	150.16	2.20 ¹³	1097	subl 1500	hyd aq; s acid
tetrahydridoborate	$\text{Al}(\text{BH}_4)_3$	71.53		−64.5	44.5	d aq; ign air; expl in O ₂ , 20
Americium	Am	243	12	1176	2011	s a
Ammonia	NH ₃	17.03	lq; 0.6818 at bp g: 0.6175 ¹⁵ , 7.2 ^{ann}	−77.75	−33.35	g/100 mL: 34 aq; 13.2 alc; s eth,
Ammonium acetate	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$	77.08	1.17 ²⁰	114	d	organic solvents g/100 mL: 148 ⁴ aq, 7.9 ¹⁵ MeOH; s alc
amidosulfate	$\text{NH}_4\text{SO}_3\text{NH}_2$	114.13		131	d 160	v s aq; sl s alc
benzoate	$\text{NH}_4\text{C}_6\text{H}_5\text{O}_2$	139.15	1.260	198	subl 160	g/100 mL: 20 ¹⁵ aq, 2.8 alc; s glyc
bromide	NH ₄ Br	97.94	2.429	452 (subl under pressure)	d 397 vacuo	76 g/100 mL ²⁰ aq; v s acet, alc, eth
calcium arsenate 6-water	$\text{NH}_4\text{CaAsO}_4 \cdot 6\text{H}_2\text{O}$	305.13	1.905 ¹⁵	d 140		0.02 aq; s NH ₄ Cl
carbamate	$\text{NH}_4\text{COONH}_2$	78.07		subl 60		v s aq; sl s alc; i eth
carbonate 1-water	$(\text{NH}_4)_2\text{CO}_3 \cdot \text{H}_2\text{O}$	114.10		volatilizes 60		v s aq; i alc
chloride	NH ₄ Cl	53.49	1.5274 ²⁵	237.8	520	g/100 mL: 26 ¹⁵ aq, 0.6 ¹⁹ abs alc; i acet, eth
chromate(VI)	$(\text{NH}_4)_2\text{CrO}_4$	152.07	1.91 ¹²	d 185		34 g/100 mL ²⁰ aq; sl s MeOH
chromium(III) bisulfate 12-water	$\text{NH}_4\text{Cr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	478.34	1.72	94 d		7.2 g/100 mL ⁰ aq
copper(II) tetrachloride 2-water	$(\text{NH}_4)_2\text{CuCl}_4 \cdot 2\text{H}_2\text{O}$	277.46	1.993	anhyd, 110	d > 120	40.3 g/100 mL ²⁰ aq; s alc

cyanide	NH_4CN	44.06	1.10	d 36	v s aq, alc
dichromate(VI)	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	252.07	2.155	d 180 to Cr_2O_3	35.6 g/100 mL ²⁰ aq; s alc; flammable
dihydrogen arsenate	$\text{NH}_4\text{H}_2\text{AsO}_4$	158.97	2.311	d 300	v s aq
dihydrogen phosphate	$\text{NH}_4\text{H}_2\text{PO}_4$	115.03	1.803 ¹⁹	d 190	37 g/100 mL ²⁰ aq; sl s alc; i acet
disulfatocobaltate(II)	$(\text{NH}_4)_2[\text{Co}(\text{SO}_4)_2] \cdot 6\text{H}_2\text{O}$	395.23	1.902		18 g/100 mL ²⁰ aq; v sl s alc
6-water					
disulfatoferrate(II) 6-water	$(\text{NH}_4)_2[\text{Fe}(\text{SO}_4)_2] \cdot 6\text{H}_2\text{O}$	392.14	1.864	d 100	36.4 g/100 mL ²⁰ aq; i alc
disulfatoferrate(III)	$\text{NH}_4[\text{Fe}(\text{SO}_4)_2] \cdot 12\text{H}_2\text{O}$	482.19	1.71	39–41	124 g/100 mL aq
12-water					
disulfatonickelate(II)	$(\text{NH}_4)_2[\text{Ni}(\text{SO}_4)_2] \cdot 6\text{H}_2\text{O}$	395.00	1.923		8.95 g/100 mL ²⁰ aq
6-water					
dithiocarbamate	$\text{NH}_4\text{S}(\text{C}=\text{S})\text{NH}_2$	110.20	1.451 ²⁰	99 d	v s aq; s alc; sl s eth
diuranate(VI)	$(\text{NH}_4)_2\text{U}_2\text{O}_7$	624.22			v sl s aq, alk; s acids
fluoride	NH_4F	37.04	1.009 ²⁵	d to NH_3 + HF	100 g/100 mL ⁰ aq; s alc
formate	NH_4OOCH	63.06	1.27	116	143 g/100 mL ²⁰ aq; s alc, eth
heptamolybdate(VI)(6–)	$(\text{NH}_4)_7\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$	1235.86	2.498	anhyd 90	43 g/100 mL aq; s acids; i alc
4-water					
hexachloropalladate(IV)	$(\text{NH}_4)_2[\text{PdCl}_6]$	355.20	2.418	d	sl s aq
hexachloroplatinatate(IV)	$(\text{NH}_4)_2[\text{PtCl}_6]$	443.87	3.065	d 380	0.5 aq
hexadecanoate	$\text{NH}_4\text{OOC}(\text{CH}_2)_{14}\text{CH}_3$	273.45		21–22	s aq; sl s bz; i alc, acet
hexafluoroaluminate(3–)	$(\text{NH}_4)_3[\text{AlF}_6]$	195.09	1.78	d > 100	v s aq
hexafluorogallate	$(\text{NH}_4)_3\text{GaF}_6$	237.83	2.10	d 200	
hexafluorogermanate	$(\text{NH}_4)_2\text{GeF}_6$	222.68	2.564	380	s aq; i eth
hexafluorophosphate	$\text{NH}_4[\text{PF}_6]$	163.00	2.180 ¹⁸	d 68	74.8 g/100 mL ²⁰ aq; s alc, acet
hexafluorosilicate	$(\text{NH}_4)_2[\text{SiF}_6]$	178.15	2.011	d	18.6 g/100 mL ²⁰ aq; i alc, acet
hexanitratocerate(IV)	$(\text{NH}_4)_2[\text{Ce}(\text{NO}_3)_6]$	548.22			135 g/100 mL ²⁰ aq; s alc, HNO
hydrogen carbonate	NH_4HCO_3	79.06	1.586	107 (rapid heating)	g/100 mL: 17.4 ²⁰ aq, 10 glyc
hydrogen citrate	$(\text{NH}_4)_3\text{HC}_6\text{H}_5\text{O}_7$	226.19	1.48		100 g/100 mL aq; sl s alc
hydrogen difluoride	NH_4HF_2	57.04	1.51	124.6	v s aq; sl s alc
hydrogen oxalate hydrate	$\text{NH}_4\text{HC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	125.08	1.556	anhyd, 170	s aq, alc; i bz, eth
hydrogen phosphate	$(\text{NH}_4)_2\text{HPO}_4$	132.06	1.619	d 155	69 g/100 mL ²⁰ aq; i alc, acet
hydrogen sulfate	NH_4HSO_4	115.11	1.78	146.9	100 g/100 mL aq; i alc, acet
hydrogen sulfide	NH_4HS	51.11	1.17	d 25 to NH_3 + H_2S	128 g/100 mL ⁰ aq; s glyc; i alc, acet
hydrogen sulfite	NH_4HSO_3	99.11	2.03	subl 150 in N_2	267 g/100 mL ¹⁰ aq

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
<i>Ammonium acetate (continued)</i>						
hydrogen (±)tartrate	$\text{NH}_4\text{HC}_4\text{H}_4\text{O}_6$	167.12	1.68	d 200		2.2 ¹⁵ aq; i alc
hydroxide	NH_4OH	35.05		−77		49% dissolved NH_3
hypophosphite	$\text{NH}_4\text{H}_2\text{PO}_2$	83.03		d		v s aq; sl s alc; i acet
iodate	NH_4IO_3	192.94	3.309	d 150		2.6 ¹⁵ aq
iodide	NH_4I	144.94	2.514 ²⁵	subl 551	220 vacuo	167 g/100 mL ²⁰ aq; v s alc, acet
lactate	$\text{NH}_4\text{C}_3\text{H}_5\text{O}_3$	107.11	1.2 ¹⁵	92		v s aq, alc, glyc; i acet, eth
magnesium arsenate 6-water	$\text{NH}_4\text{MgAsO}_4 \cdot 6\text{H}_2\text{O}$	289.36	1.923	d		0.038 ²⁰ aq
molybdate(VI)(2−)	$(\text{NH}_4)_2\text{MoO}_4$	196.04	2.276 ²⁵	d		s acids
nitrate	NH_4NO_3	80.04	1.725 ²⁵	169.6	d 210	g/100 mL: 192 ²⁰ aq; 3.8 ²⁰ alc; 17 ²⁰ MeOH; s acet
octadecanoate	$\text{NH}_4\text{OOC}(\text{CH}_2)_{16}\text{CH}_3$	301.50		21–22		sl s aq; s alc; i acet
octanoate	$\text{NH}_4\text{OOC}(\text{CH}_2)_6\text{CH}_3$	161.24		d on standing		v s aq, alc, acet; sl s eth
oxalate hydrate	$(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$	142.11	1.50	d 70		5.1 ²⁰ aq; s alc
oxodioxalatotitanate(IV)	$(\text{NH}_4)_2\text{TiO}(\text{C}_2\text{O}_4)_2$	276.02				v s aq
perchlorate	NH_4ClO_4	117.49	1.95	d 240		g/100 mL ²⁵ : 21.9 aq, 1.49 EtOH, 0.014 BuOH, 0.029 EtOAc
permanganate	NH_4MnO_4	136.97	2.208 ¹⁰	explodes, 110		0.8 ¹⁵ aq
peroxodisulfate	$(\text{NH}_4)_2\text{S}_2\text{O}_8$	228.20	1.982	d 120	expl 180	58 g/100 mL ⁰ aq
phosphinate	$\text{NH}_4\text{PH}_2\text{O}_2$	83.04	1.634	200	d 240	g/100 mL: 100 aq, 5 alc; i acet
phosphomolybdate hydrate	$(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3 \cdot \text{H}_2\text{O}$	1894.36		d		sl s aq
picrate	$\text{NH}_4\text{C}_6\text{H}_2\text{N}_3\text{O}_7$	246.14	1.719	d	expl 423	1.1 ²⁰ aq; sl s alc
selenate(VI)	$(\text{NH}_4)_2\text{SeO}_4$	179.04	2.193 ³⁰	d		117 g/100 mL ⁷ aq; s HOAc; i alc
stearate	$\text{NH}_4\text{C}_{18}\text{H}_{35}\text{O}_2$	301.51	0.89	22		sl s aq, bz; s alc; i acet
sulfamate	$\text{NH}_4\text{NH}_2\text{SO}_3$	114.13		131	d 160	v s aq; sl s alc
sulfate	$(\text{NH}_4)_2\text{SO}_4$	132.14	1.769 ²⁰	d >280		43.5 g/100 mL ²⁰ aq; i alc, acet
sulfide	$(\text{NH}_4)_2\text{S}$	68.14		d ≈0		v s aq; s alc, alk
sulfite hydrate	$(\text{NH}_4)_2\text{SO}_3 \cdot \text{H}_2\text{O}$	134.16	1.41	d 60		75 g/100 mL ²⁰ aq; i alc, acet
(±)tartrate	$(\text{NH}_4)_2\text{C}_4\text{H}_4\text{O}_6$	184.15	1.601	d		58 g/100 mL ¹⁵ aq; sl s alc
tetraborate 4-water	$(\text{NH}_4)_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$	263.44				s aq; i alc

tetrachloroaluminate	$\text{NH}_4[\text{AlCl}_4]$	186.83	304		s aq, eth
tetrachloropalladate(II)	$(\text{NH}_4)_2[\text{PdCl}_4]$	284.29	d		v s aq; i abs alc
tetrachloroplatinatate(II)	$(\text{NH}_4)_2[\text{PtCl}_4]$	372.97	140 d		s aq; i alc
tetrachlorozincate	$(\text{NH}_4)_2[\text{ZnCl}_4]$	243.28	150 d	subl 341	v s aq
tetrafluoroborate	$\text{NH}_4[\text{BF}_4]$	104.84	subl		25 g/100 mL ¹⁶ aq
thiocyanate	NH_4SCN	76.12	149.6	d 170	128 g/100 mL ⁰ aq; v s alc; s acet
thiosulfate	$(\text{NH}_4)_2\text{S}_2\text{O}_3$	148.21	d 150		2.15 ¹⁵ aq; i alc, eth
vanadate(V)(1-)	NH_4VO_3	116.98	d 200		0.48 ²⁰ aq
Antimony	Sb	121.760(1)	630.7	1587	s hot conc H_2SO_4 , aqua regia
arsenide	SbAs	196.68	≈680		
(III) bromide	SbBr ₃	361.47	96.6	280	s acet, bz, chl
(III) chloride	SbCl ₃	228.12	73.4	220.3	10 g/100 mL ²⁰ aq; s alc, bz, chl
(V) chloride	SCl ₅	299.02	3.5	79 ^{22mm}	d aq; s HCl, chl, CCl ₄
(III) fluoride	SbF ₃	178.75	292	376	444 g/100 mL ²⁰ aq
(V) fluoride	SbF ₅	216.75	8.3	141	d viol aq; s HOAc; forms solids
hydride (stibine)	SbH ₃	124.78	-91.5	-18.4	with alc, bz, CS ₂ , eth
(III) iodide	SbI ₃	502.47	168	401	20 mL/100 mL ²⁰ aq; s CS ₂ , alc
(III) oxide (valentinite)	Sb ₂ O ₃	291.52	655	1425	g/100 g ²⁵ ; 1.16 bz, 1.24 tol, 0.16 chl
(V) oxide	Sb ₂ O ₅	323.52	-O ₂ >300		v sl s aq; s HCl, KOH
(III) selenide	Sb ₂ Se ₃	480.40	612		v sl s aq; sl s warm KOH, eth
(III) sulfate	Sb ₂ (SO ₄) ₃	531.71	d		v sl s aq; s conc HCl
(III) sulfide	Sb ₂ S ₃	339.72	546		sl s aq
(V) sulfide	Sb ₂ S ₅	403.85	75 d		0.002 ²⁰ aq (d); s H ₂ SO ₄
(III) telluride	Sb ₂ Te ₃	626.32	620		i aq; s HCl (d), NaOH
triethyl	Sb(C ₂ H ₅) ₃	209.0	-29	159.5	i aq; s HNO ₃
trimethyl	Sb(CH ₃) ₃	166.9		80.6	i aq
Argon	Ar	39.948(1)	-189.38		sl s aq
Arsenic	As	74.92159(2)	817	-185.87	3.36 mL/100 mL ²⁰ aq
(III) bromide	AsBr ₃	314.63	31.1	subl 615	i aq; s HNO ₃
(III) chloride	AsCl ₃	181.28	-16.2	220.0	hyd aq; s HCl, CS ₂ , PE
(di-) disulfide	As ₂ S ₂	213.97	320	130.2	misc chl, CCl ₄ , eth; s HCl
(III) fluoride	AsF ₃	131.92	-5.95	565	s alkali; v sl s bz
(V) fluoride	AsF ₅	169.91	-79.8	57.8	s alc, bz, eth, HF
(III) hydride (arsine)	AsH ₃	77.95	-116.9	-52.8	hyd aq; s alc, bz, eth
(III) iodide	AsI ₃	455.63	140.9	-62.5	28 mL/100 mL ²⁰ aq; s bz, chl
(III) oxide (arsenolite)	As ₂ O ₃	197.84	3.86	424	s bz, tol; sl s aq, alc, eth
			274	460	1.8 ²⁰ aq; s alc

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
<i>Arsenic (continued)</i>						
(III) oxide (claudetite)	As ₂ O ₃	197.84	3.74	313	460	sl s aq; s dil acid, alk
(V) oxide	As ₂ O ₅	229.84	4.32	315	d 800	66 g/100 mL ²⁰ aq; s alc
(III) selenide	As ₂ Se ₃	386.72	4.75	260		s alkali, HNO ₃
(III) sulfide	As ₂ S ₃	246.04	3.460	310	707	i aq; s alk, slowly s hot HCl
(V) sulfide	As ₂ S ₅	310.17		subl 500		0.0003 aq; s alkali, HNO ₃
(III) telluride	As ₂ Te ₃	532.64	6.50	621		
Astatine	At	210		302		
Barium	Ba	137.33	3.51 ²⁰	726.9	1845	d aq to Ba(OH)
acetate hydrate	Ba(C ₂ H ₃ O ₂) ₂ · H ₂ O	273.43	2.19	anhyd 110	d 150	58.8 g/100 mL ⁰ aq; 0.014 alc
benzenesulfonate	Ba(O ₃ SC ₆ H ₅) ₂	451.70				s aq; sl s alc
bromate hydrate	Ba(BrO ₃) ₂ · H ₂ O	411.14	3.99 ¹⁸	d 260		0.96 ³⁰ aq; s acet; i alc
bromide	BaBr ₂	297.14	4.781	856	1835	92 g/100 mL ⁰ aq; s MeOH, acet
carbonate	BaCO ₃	197.34	4.2865	d 1300 to BaO + CO ₂		0.0024 aq; s acids
chlorate hydrate	Ba(ClO ₃) ₂ · H ₂ O	322.24	3.179	anhyd 120	−O ₂ , 250	34 g/100 mL ²⁰ aq; sl s alc, acet
chloride	BaCl ₂	208.24	3.856 ²⁴	962	1560	36 g/100 mL ²⁰ aq; s MeOH; i acet, EtAc
chloride dihydrate	BaCl ₂ · 2H ₂ O	244.26	3.097	anhyd 113		31.7 g/100 mL ⁰ aq
chromate(VI)	BaCrO ₄	253.33	4.498 ²⁰	d		0.001 ²⁰ aq; s mineral acids
cyanide	Ba(CN) ₂	189.36				80 g/100 mL ¹⁴ aq; s alc
fluoride	BaF ₂	175.32	4.89	1368	2260	0.161 ²⁰ aq; s acids
hexafluorosilicate	Ba[SiF ₆]	279.40	4.29 ²¹	d 300		0.0235 ²⁵ aq; s NH ₄ Cl soln; i alc
hydrogen phosphate	BaHPO ₄	233.31	4.165 ¹⁵	d 410		0.01 aq; s HCl, HNO ₃
hydroxide 8-water	Ba(OH) ₂ · 8H ₂ O	315.48	2.18 ¹⁶	78		3.9 ²⁰ aq
iodate	Ba(IO ₃) ₂	487.13	5.23 ²⁰	d 476		0.033 ²⁰ aq; s HCl
iodide	BaI ₂	391.14	5.15	711	2027	169 g/100 mL ²⁰ aq; s alc, acet
manganate(VI)(2−)	BaMnO ₄	256.26	4.85			disprop to Ba(MnO ₄) ₂ + MnO ₂
molybdate	BaMoO ₄	297.27	4.975	1450		0.0058 ²⁵ aq
niobate	Ba(NbO ₃) ₂	419.14	5.44	1455		i aq
nitrate	Ba(NO ₃) ₂	261.34	3.24 ²³	592	d	5.0 aq; v sl s alc, acet
nitrite hydrate	Ba(NO ₂) ₂ · H ₂ O	247.35	3.173 ³⁰	d 115		54.8 g/100 mL ⁰ aq; i alc

oxalate	BaC ₂ O ₄	225.35	2.658	400 d	3088	i aq
oxide	BaO	153.33	5.72	1973		3.5 ²⁰ aq; s acids, EtOH
perchlorate	Ba(ClO ₄) ₂	336.23	3.20	505		g/100 mL ²⁵ : 129 aq, 78 EtOH, 42 BuOH, 81 EtOAc; i eth
perchlorate 3-water	Ba(ClO ₄) ₂ · 3H ₂ O	390.27	2.74	d 400		198 g/100 mL ²⁵ aq; s MeOH; sl s acet
permanganate	Ba(MnO ₄) ₂	375.20	3.77	d 200		v s aq
peroxide	BaO ₂	169.33	4.96	450 d	–O ₂ , 800	1.5 ⁰ aq
selenide	BaSe	216.29	5.02	1780		d aq
stearate	Ba(C ₁₈ H ₃₅ O ₂) ₂	704.28	1.145	160		i aq
sulfate	BaSO ₄	233.39	4.50 ¹⁵	1580	d > 1600	0.00285 aq
sulfide	BaS	169.39	4.25 ¹⁵	2230		7.9 ²⁰ aq; dec in acids
sulfite	BaSO ₃	217.39	4.44	d		0.02 ⁰ aq; i alc
tetracyanoplatinate(II)-4-water	Ba[Pt(CN) ₄] · 4H ₂ O	508.54	2.076			2.86 aq; i alc
thiocyanate 2-water	Ba(SCN) ₂ · 2H ₂ O	289.53	2.286 ¹⁸	d 160		170 g/100 mL ²⁰ aq; s alc, acet
thiosulfate hydrate	BaS ₂ O ₃ · H ₂ O	267.47	3.5 ¹⁸	d 220		0.21 ²⁰ aq; i alc, acet, eth, CS
titanate(IV)(2 –)	BaTiO ₃	233.19	6.02	1625		i aq
vanadate	Ba ₃ (VO ₄) ₂	641.86	5.14	707		
zirconate	BaZrO ₃	276.55	5.52	2500		i aq, alk; sl s acids
Berkelium (α form)	Bk	247	14.78	1050		
(β form)	Bk	247	13.25	986		
Beryllium	Be	9.012	1.8477 ²⁰	1287	2467	i aq; s acid, alk
bromide	BeBr ₂	168.82	3.465 ²⁵	508	521	v s aq; s alc; 18.6 pyr
carbide	Be ₂ C	30.04	1.90 ¹⁵	d > 2127		d aq; s acids, alkali giving CH ₄
chloride	BeCl ₂	79.92	1.899 ²⁵	415 (alpha)	482.3	42 g/100 mL aq; s alc, eth, pyr, CS ₂
fluoride	BeF ₂	47.01	1.986	555	subl 1036 ^{1mm}	v s aq (slowly)
hydride	BeH ₂	11.03	0.65	– H ₂ , 220		d aq (slowly), acids (rapidly)
hydroxide	Be(OH) ₂	43.03	1.909	93		s hot conc acids and alkali (viol)
iodide	BeI ₂	262.82	4.32	480	487	hyd aq violently; s alc, eth, CS ₂
nitrate 3-water	Be(NO ₃) ₂ · 3H ₂ O	187.07	1.557	60.5	d 125	166 g/100 mL ²⁰ aq
nitride	Be ₃ N ₂	55.05	2.71	2200		d hot aq, alkali
oxide	BeO	25.01	3.025	2578 (alpha)	3787	s conc H ₂ SO ₄
selenate 4-water	BeSeO ₄ · 4H ₂ O	224.03	2.03	anhyd 300	d 560	49 g/100 mL ²⁵ aq
silicate	Be ₂ SiO ₄	110.11	3.0	1560		i aq
sulfate 4-water	BeSO ₄ · 4H ₂ O	177.14	1.713	anhyd 270	d 580	39 g/100 mL ²⁰ aq; i alc
sulfide	BeS	41.08	2.36	d		i aq; s HNO ₃

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Bismuth	Bi	208.9804	9.78	271.5	1564	i aq; s hot H ₂ SO ₄
(III) bromide	BiBr ₃	448.69	5.72	218	453	d aq; s dil acids, acet
bromide oxide	BiBrO	304.88	8.082 ¹⁵	d		i aq; s acids
(III) chloride	BiCl ₃	315.34	4.75	233.5	447	d aq; s HCl, alc, eth, acet
chloride oxide	BiClO	260.43	7.72 ¹⁵	d		i aq; s HCl
(III) fluoride	BiF ₃	265.98	8.32	727	900	i aq; s HF
(V) fluoride	BiF ₅	303.97	5.55 ²⁵	154.4	subl 550	d (viol) aq giving O ₃ + BiF ₃
hydride	BiH ₃	212.00	9.303 g/L	-67	16.8	very unstable liquid
(III) hydroxide	Bi(OH) ₃	260.00	4.962 ¹⁵	- water, 100		d aq; s HCl
(III) iodide	BiI ₃	589.69	5.778 ²⁰	408.6	subl 439	i aq; s HCl, alc
iodide oxide	BiIO	351.88	7.922	d red heat		i aq; s HCl
(III) nitrate 5-water	Bi(NO ₃) ₃ · 5H ₂ O	485.07	2.83	anhyd 80		d aq; s HNO ₃ , acet, glyc
(III) oxide	Bi ₂ O ₃	465.96	8.76	817	1890	i aq; s HCl, HNO ₃
(V) oxide	Bi ₂ O ₅	497.96	5.10	d 150		i aq; s KOH
(III) phosphate	BiPO ₄	303.95	6.323 ¹⁵	d		s conc HCl, HNO ₃
(III) selenide	Bi ₂ Se ₃	654.84	7.70 ²⁰	710 d	d	i aq; d aq reg
(III) sulfate	Bi ₂ (SO ₄) ₃	706.14	5.08	d 405		d aq, alc; s HCl
(III) sulfide	Bi ₂ S ₃	514.16	6.78	850		i aq, EtAc; s HNO ₃ , HCl
(III) telluride	Bi ₂ Te ₃	800.76	7.74	588.5		i aq; s alc
Boranes						
diborane(6)	B ₂ H ₆	27.67	1.214 g/L	-165.5	-92.5	FP -68; s NH ₄ OH, conc H ₂ SO ₄
tetraborane(10)	B ₄ H ₁₀	53.32	2.340 g/L	-120	18	sl s aq; s bz
pentaborane(9)	B ₅ H ₉	63.13	0.60	-46.81	60.0	hyd aq
pentaborane(11)	B ₅ H ₁₁	65.14	0.745	-123	63	d aq
hexaborane(10)	B ₆ H ₁₀	74.95	0.67	-62.3	108 d	d hot aq
decaborane(14)	B ₁₀ H ₁₄	122.22	0.948	99.5	213	sl s aq; s bz, CS ₂ , eth
Borazine	B ₃ H ₆ N ₃	80.50	lq; 0.81 ^{bp}	-58	55	sl s aq (d)
Boric acids, <i>see under</i> Hydrogen						
Boron	B	10.811	2.34	2076	3864	i aq
carbide	B ₄ C	55.25	2.510 ²⁵	2350	>3500	s fused alkalis
tribromide	BBr ₃	250.52	2.6	-46.0	91.3	d aq, alc

trichloride	BCl_3	117.17	5.141 g/L	-107	12.7	d aq, alc
trifluoride	BF_3	67.81	3.077 g/L ^{STP}	-127.1	-100.4	332 g/100 mL ⁰ aq; s bz, chl, CCl_4
trifluoride 1-diethyl ether	$\text{BF}_3 \cdot \text{O}(\text{C}_2\text{H}_5)_2$	141.94	1.125	-60.4	125.7	d aq
trifluoride 1-methanol	$\text{BF}_3 \cdot \text{HOCH}_3$	131.89	1.203		59 ^{4mm}	
nitride	BN	24.82	2.18	2967		sl s hot acids
oxide	B_2O_3	69.62	2.55	450.0	2065	3.3 aq (slowly); s alc, glyc
Bromine	Br_2	159.808	3.1023 ²⁵	-7.25	58.8	3.4 g/100 mL ²⁰ aq; v s alc, chl, eth
pentafluoride	BF_5	174.90	2.460	-60.5	40.76	explodes with water; s HF
trifluoride	BF_3	136.90	2.803 ²⁵	8.77	125.74	d viol aq; d alk; smokes in air
Cadmium	Cd	112.411	8.65 ²⁵	321	765	i aq, alk; s HNO_3 , hot HCl
acetate	$\text{Cd}(\text{C}_2\text{H}_3\text{O}_2)_2$	230.50	2.341	255	d	v s aq; s alc
bromide	CdBr_2	272.22	5.192	566	963	99 g/100 mL ²⁰ aq; s acet; sl s eth
carbonate	CdCO_3	172.42	4.258 ⁴	d 500		s acids, NH_4OH
chloride	CdCl_2	183.32	4.05 ²⁵	568	960	120 g/100 mL ²⁵ aq
cyanide	$\text{Cd}(\text{CN})_2$	164.44	2.226	d 200		1.71 g/100 mL ¹⁵ aq; sl s alc
fluoride	CdF_2	150.41	6.33	1110	1748	4.3 g/100 mL ²⁵ aq
hydroxide	$\text{Cd}(\text{OH})_2$	146.43	4.79	- H_2O , 130	CaO , 200	0.00026 ²⁰ aq; s acids
iodide	CdI_2	366.22	5.670	388	742	84.7 g/100 mL ²⁰ aq; s alc, acet, eth
nitrate 4-water	$\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$	308.48	2.455	59.4		167 g/100 mL ²⁵ aq; s alc, acet
oxide	CdO	128.41	8.15 cubic	1540		i aq; s acids
phosphide	Cd_3P_2	399.18	5.96	700		s dil acid
selenide	CdSe	191.37	5.81 ¹⁵	1350		i aq; d acids
sulfate-water (3/8)	$3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$	769.56	3.08	monohydrate, 80		94.4 g/100 mL ²⁵ aq; i alc, EtAc
sulfide	CdS	144.48	4.83	1750		0.13 ¹⁸ aq; s acids
telluride	CdTe	240.01	6.20 ⁴⁵	1041		i aq; d HNO_3
tungstate(VI)	CdWO_4	360.25	8.0			i aq, dil acids; s alkali CN's
Calcium	Ca	40.078(4)	1.55	842	1484	d aq; s acids
acetate	$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$	158.17	1.50	d >160		37.4 g/100 mL ⁰ aq; i alc, bz, acet
arsenate	$\text{Ca}_3(\text{AsO}_4)_2$	398.07	3.620			0.013 ²⁵ aq
bromide	CaBr_2	199.89	3.38	742	1815	143 g/100 mL ²⁰ aq; v s alc, acet
carbide	CaC_2	64.10	2.222	2300		reacts with aq giving C_2H_2
carbonate (aragonite)	CaCO_3	100.09	2.83	d 825 to CaO		s dil acids
carbonate (calcite)	CaCO_3	100.09	2.711	d 825 to CaO		0.0013 g/100 mL ²⁰ ; s acids
chlorate 2-water	$\text{Ca}(\text{ClO}_3)_2 \cdot 2\text{H}_2\text{O}$	243.01	2.711	anhyd 100		167 g/100 mL ²⁰ aq; s alc
chloride	CaCl_2	110.98	2.16 ²⁵	775	ca. 1940	42 g/100 mL ²⁰ aq; s alc, acet
chloride 6-water	$\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$	219.07	1.71	anhyd 200		74.5 g/100 mL ²⁰ aq; v s alc
chlorite	$\text{Ca}(\text{ClO}_2)_2$	174.99	2.71 ²⁵	100		167 g/100 mL aq; s alc

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Calcium (<i>continued</i>)						
chromate(VI) 2-water	$\text{CaCrO}_4 \cdot 2\text{H}_2\text{O}$	192.10	2.50	anhyd 200		sl s aq; s dil acids
citrate 4-water	$\text{CaC}_6\text{H}_6\text{O}_7 \cdot 4\text{H}_2\text{O}$	570.51		anhyd 120		0.10 aq; i alc
cyanamide	CaCN_2	80.10	2.29	ca. 1340	subl	no known solv without dec
cyanide	$\text{Ca}(\text{CN})_2$	92.11		s > 350		s aq
dichromate(VI)	CaCr_2O_7	256.10	2.370 ³⁰	d > 100		v s aq; i eth; d alc
dihydrogen phosphate hydrate	$\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$	252.07	2.220 ¹⁸	anhyd 100	d 200	1.8 ³⁰ aq
diphosphate (pyrophosphate)	$\text{Ca}_2\text{P}_2\text{O}_7$	254.10	3.09	1353		i aq; s HCl, HNO_3
fluoride	CaF_2	78.08	3.180	1418	2533	0.0015 ²⁰ aq; s conc mineral acids
formate	$\text{Ca}(\text{CHO}_2)_2$	130.11	2.015	300 d		16.6 g/100 mL ²⁰ aq; i alc
(+)-gluconate	$\text{Ca}[\text{OOC}(\text{CHOH})_2\text{CH}_2\text{OH}]_2$	430.38				3.72 ²⁰ aq
glycerophosphate	$\text{Ca}[\text{C}_3\text{H}_5(\text{OH})_3]\text{PO}_4$	210.16		d > 170		1.66 ²⁰ aq; i alc
hexafluorosilicate	$\text{Ca}[\text{SiF}_6]$	182.17	2.662			i aq, acet
hydride	CaH_2	42.09	1.70	1000		d aq, alc
hydroxide	$\text{Ca}(\text{OH})_2$	74.09	2.343	−H ₂ O, 580		0.17 ¹⁰ aq; s acids
hypochlorite	$\text{Ca}(\text{OCl})_2$	142.99	2.35	100 d		d aq evolving Cl ₂ ; i alc
iodate	$\text{Ca}(\text{IO}_3)_2$	389.88	4.519 ¹⁵	d > 540		0.10 ⁰ aq; i alc
iodide	CaI_2	293.89	3.956	783	1755	68 g/100 mL ²⁰ aq; v s alc, acet; i eth
lactate 5-water	$\text{Ca}(\text{C}_3\text{H}_5\text{O}_3)_2 \cdot 5\text{H}_2\text{O}$	308.30		−3H ₂ O, 100	anhyd 120	5.4 ¹⁵ aq; v sl s alc
magnesium carbonate	$\text{Ca}[\text{Mg}(\text{CO}_3)_2]$	184.41	2.872	d 730		0.032 ¹⁸ aq; s HCl
molybdate(VI)(2-)	CaMoO_4	200.02	4.35			s conc mineral acids
nitrate	$\text{Ca}(\text{NO}_3)_2$	164.09	2.504	561		152 g/100 mL ³⁰ aq
nitride	Ca_3N_2	148.25	2.67	1195		d aq; s dilute acids (d)
nitrite 4-water	$\text{Ca}(\text{NO}_2)_2 \cdot 4\text{H}_2\text{O}$	204.15	1.674	d		84.5 g/100 mL ¹⁸ aq; sl s alc
oleate	$\text{Ca}(\text{C}_{18}\text{H}_{33}\text{O}_2)_2$	603.01		83–84	d > 400	0.04 aq; s chl, bz; v sl s alc, eth
oxalate hydrate	$\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$	146.11	2.2	anhyd 200		0.0006 aq; s acids
oxide	CaO	56.08	3.34	2900	3500	0.13 ²⁵ aq; s acids
palmitate	$\text{Ca}(\text{C}_{16}\text{H}_{31}\text{O}_2)_2$	550.93		d > 155		0.003 aq; sl s bz, chl, HOAc
(+)-panthothenate (vitamin B ₃)	$\text{Ca}[\text{O}_2\text{CH}_2\text{CH}_2\text{NHO}-\text{CH}(\text{OH})\text{C}(\text{CH}_3)_2\text{CH}_2\text{OH}]_2$	476.55		d 195–196		36 g/100 mL aq; sl s alc, acet

perchlorate	$\text{Ca}(\text{ClO}_4)_2$	238.98	2.65	d 270	g/100 mL ²⁵ ; 112 aq, 89.5 EtOH, 68 BuOH, 57 EtOAc, 43 acet
permanganate 5-water	$\text{Ca}(\text{MnO}_4)_2 \cdot 5\text{H}_2\text{O}$	368.03	2.4	d	338 g/100 mL aq
peroxide	CaO_2	72.08	2.92	explodes 275	sl s aq; s acids
phenoxide	$\text{Ca}(\text{OC}_6\text{H}_5)_2$	226.28	d in air		sl s aq, alc
phosphate	$\text{Ca}_3(\text{PO}_4)_2$	310.18	3.14	1670	0.03 ²⁵ aq; s HCl, HNO ₃ ; i alc
phosphide	Ca_3P_2	182.18	2.51	ca. 1600	d aq; s acids; i alc, eth
phosphinate	$\text{Ca}(\text{PH}_2\text{O}_2)_2$	170.06		d > 300	15.4 g/100 mL aq; sl s glyc
propanoate	$\text{Ca}(\text{OOC}_3\text{H}_5)_2$	186.22			s aq; sl s alc; i acet, bz
salicylate 2-water	$\text{Ca}(\text{C}_7\text{H}_5\text{O}_3)_2 \cdot 2\text{H}_2\text{O}$	350.34		anhyd 200	2.8 ¹⁵ aq; 0.015 ¹⁶ EtOH
selenate 2-water	$\text{CaSeO}_4 \cdot 2\text{H}_2\text{O}$	219.07	2.75	anhyd 200	9.2 g/100 mL ²⁵ aq
selenide	CaSe	119.04	3.82		
silicate	Ca_2SiO_4	172.24	3.27	2130	i aq
stearate	$\text{Ca}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	607.04		179–180	0.004 ¹⁵ aq; s hot pyr; i acet, chl
succinate 3-water	$\text{CaC}_4\text{H}_6\text{O}_4 \cdot 3\text{H}_2\text{O}$	212.22			1.28 ²⁰ aq; s acids; i alc
sulfate	CaSO_4	136.14	2.960	1460	0.20 aq; s acids
sulfate hemihydrate	$\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$	145.15		anhyd 163	0.3 ²⁰ aq; s acids, glyc
sulfate 2-water	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	172.17	2.32	– 1.5 H ₂ O, 128	0.26 ²⁰ aq; s acid, glyc
sulfide	CaS	72.14	2.59	2525	0.02 (d) aq; d acids
sulfite 2-water	$\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$	156.17		anhyd 100	0.004 aq; s acids d; sl s alc
(±)tartrate 4-water	$\text{CaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	260.21		anhyd 200	0.0045 ²⁵ aq; s acids; sl s alc
telluride	CaTe	167.68	4.873		
tetraborate	CaB_4O_7	195.36			s dil acids
tetrahydridoaluminate	$\text{Ca}[\text{AlH}_4]_2$	102.10		ign moist air	d viol aq, alc; i bz, eth
thiocyanate 3-water	$\text{Ca}(\text{SCN})_2 \cdot 3\text{H}_2\text{O}$	210.29		d > 160	150 g/100 mL aq; v s alc
thioglycollate 3-water	$\text{Ca}(-\text{OOCCH}_2\text{S}-) \cdot 3\text{H}_2\text{O}$	184.24		– H ₂ O, > 95	s aq; v sl s alc, chl; i bz, eth
thiosulfate 6-water	$\text{CaS}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$	260.30	1.872	d > 45	92 g/100 mL ²⁵ aq; i alc
titanate	CaTiO_3	135.84	3.98	1980	
tungstate(VI)(2–)	CaWO_4	287.93	6.062 ²⁰		0.0032 aq; d hot acids
Californium-252	Cf	252.1		900	
chloride	CfCl_3	358.5	5.88		
Carbon (diamond)	C	12.011	3.513	3500 ^{(63,5)atm}	i aq, alc
(graphite)	C		2.267	subl 3915–4020	
dioxide	CO_2	44.01	c: 1.56 ^{–79} g: 1.975 g/L ⁰	– 78.44 subl	88 mL/100 mL ²⁰ aq
diselenide	CSe_2	169.93	2.6626 ²⁵		i aq; s acet, eth; misc CCl ₄ ; d alc
disulfide	CS_2	76.14	1.2555	– 45.5 – 111.6	FP – 30; 0.29 ²⁰ aq; s alc, eth

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Carbon (<i>continued</i>)						
hydride (methane)	CH ₄	16.04	0.415 ⁻¹⁶⁴	-182.48	-161.49	s bz
monoxide	CO	28.01	lq: 0.814 ⁻¹⁹⁵ g: 1.250 g/L ⁰	-205.05	-191.49	2.3 mL/100 mL ²⁰ aq; 16 mL/100 ml alc; s HOAc, EtAc
suboxide	C ₃ O ₂	68.03	1.114 ⁰ 2.985 g/L	-111.3	6.8	d aq to malonic acid; sl s CS ₂
tetrabromide	CBr ₄	331.65	3.42	90.1	190	i aq; s alc, chl, eth
tetrachloride	CCl ₄	153.82	1.589 ²³	-22.9	76.7	0.05 mL/100 mL aq; s alc, chl, eth
tetrafluoride	CF ₄	88.00	1.96 ⁻¹⁸⁴	-183.6	-127.8	sl s aq
tetraiodide	CI ₄	519.63	4.34 ²⁰	171	subl 130	slowly hyd aq; s bz, chl, eth
Carbonyl bromide	COBr ₂	187.82	2.5	64.5	64.5	hyd aq
chloride	COCl ₂	98.92	4.340 g/L	-127.9	8.2	hyd aq; s bz, HOAc
fluoride	COF ₂	66.01	lq: 1.139 g: 2.896 g/L	-114.0	-83.1	hyd aq
sulfide	COS	60.07	2.636 g/L	-138.81	-50.23	54 mL/100 mL ²⁰ aq; s alc, CS ₂
Cerium	Ce	140.11	6.773	795	3440	i aq; s acids
(III) bromide	CeBr ₃	379.83	5.18	733	1460	s aq, alc
(III) chloride	CeCl ₃	246.47	3.97 ²⁵	817	1730	s aq, alc
(III) fluoride	CeF ₃	197.11	6.157	1430	2327	i but slowly hyd aq; s H ₂ SO ₄
(IV) fluoride	CeF ₄	216.11	4.77	d > 550	i aq	
(III) iodide	CeI ₃	520.83		766	1400	s aq
(III) nitrate 3-water	Ce(NO ₃) ₃ 3H ₂ O	380.17		anhyd 150	d 200	234 g/100 mL ²⁰ aq
(IV) oxide	CeO ₂	172.11	7.65	2400		i aq; s acids
(III) sulfate	Ce ₂ (SO ₄) ₃	568.42	3.912	d 1000		9.72 g/100 mL ²¹ aq
(IV) sulfate	Ce(SO ₄) ₂	332.24	3.91	d 195		hyd aq; s dil H ₂ SO ₄
Cesium	Cs	132.9054	1.8785 ¹⁵	28.44	668.2	d aq; s acids
bromide	CsBr	212.81	4.44	636	≈ 1300	107 g/100 mL ¹⁸ aq; s alc; i acet
carbonate	Cs ₂ CO ₃	325.82	4.24	792		v s aq; 11 g/100 mL ²⁰ alc; s eth
chloride	CsCl	168.36	3.99	646	1300	g/100 mL: 187 ²⁰ aq; 34 ²⁵ MeOH; v s alc
fluoride	CsF	151.90	4.115	703	1231	322 g/100 mL ¹⁸ aq
hydroxide	CsOH	149.91	3.68	272	990	386 g/100 mL ¹⁵ aq; s alc

iodate	CsIO ₃	307.81	4.934 ²⁰	565	2.6 ²⁵ aq
iodide	CsI	259.81	4.510	621	76.5 g/100 mL ²⁰ aq; s EtOH; i acet
nitrate	CsNO ₃	194.91	3.66	414	23 g/100 mL ²⁰ aq; s acet; v sl s alc
oxide	Cs ₂ O	281.81	4.65	490	v s aq
perchlorate	CsClO ₄	232.36	3.327	250	g/100 mL ²⁵ : 1.96, 0.0086 EtOH, 0.118 acet, 0.0048 BuOH; i EtOAc, eth
selenate	Cs ₂ SeO ₄	408.77	4.453		244 g/100 mL ¹² aq
sulfate	Cs ₂ SO ₄	361.87	4.243	1005	179 g/100 mL ²⁰ aq; i alc, acet, pyr
Chlorine	Cl ₂	70.905	g: 2.98 ²⁰ g/L lq: 1.5649 ⁻³⁵	- 101.5	199 mL/100 mL ²⁵ aq
dioxide	ClO ₂	67.45	2.960 g/L	- 59.6	11.2 g/100 mL ¹⁰ aq
fluoride	ClF	54.45	4.057 g/L	- 155.6	d viol aq; organics burst into flame
heptoxide	Cl ₂ O ₇	182.90	1.805 ²⁵	- 91.5	hyd aq slowly; explodes on concus- sion or on contact with flame or I ₂
monoxide	Cl ₂ O	86.90	3.813 g/L	- 120.6	v s aq (forms HClO); s CCl ₄
pentafluoride	ClF ₅	130.44	5.724 g/L	- 103	hyd viol aq; organic matter and glass wool burst into flame
trifluoride	ClF ₃	92.45	g: 4.057 g/L lq: 1.825 ⁸⁸	- 76.3	reacts with aq
trioxide (dimer)	(ClO ₃) ₂	166.90	1.92 ²⁰	3.5	s dil HCl
Chromium	Cr	51.996	7.15	1907	sl s aq, alc; s a; i eth
(II) acetate	Cr(C ₂ H ₃ O ₂) ₂	170.09	1.79		s aq
(III) acetate	Cr(C ₂ H ₃ O ₂) ₃	229.13			s aq, alc
(II) bromide	CrBr ₂	211.80	4.236	842	s hot aq; v s alc
(III) bromide	CrBr ₃	291.71	4.68		v s aq
(II) chloride	CrCl ₂	122.90	2.88 ²⁵	814	s aq, alc (slow); i acet
(III) chloride	CrCl ₃	158.35	2.87	1152	sl s aq; s hot HCl
(II) fluoride	CrF ₂	89.99	3.79	894	aq, alc; s HF, HCl
(III) fluoride	CrF ₃	108.99	3.8	1400	s aq
(III) formate 6-water	Cr(CHO ₂) ₃ · 6H ₂ O	295.15		d > 300	i aq, alc; s eth, chl
hexacarbonyl	Cr(CO) ₆	220.06	1.77	d 130	i aq; s acids
(III) hydroxide	Cr(OH) ₃	101.02		d	208 g/100 mL ¹⁵ aq; s alc
(III) nitrate 9-water	Cr(NO ₃) ₃ · 9H ₂ O	400.15	1.80	d > 100	i aq, alc; sl s acids, alkalis
(III) oxide	Cr ₂ O ₃	151.99	5.21	2330	i aq; s HNO ₃
(IV) oxide	CrO ₂	84.00	4.89	197	61.7 g/100 mL aq; may ign organics
(VI) oxide	CrO ₃	99.99	2.70 ²⁵	198	

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Chromium (<i>continued</i>)						
(III) phosphate	CrPO ₄	146.97	4.6	>1800		i aq, acids, aq reg
potassium bisulfate 12-water	CrK(SO ₄) ₂ · 12H ₂ O	499.41	1.826 ²⁵	89	anhyd 400	22 g/100 mL ²⁵ aq; i alc
(II) sulfate 7-water	CrSO ₄ · 7H ₂ O	274.17				22.9 g/100 mL ⁰ aq; sl s alc
(III) sulfate 18-water	Cr ₂ (SO ₄) ₃ · 18H ₂ O	716.45	1.7	d 100		220 g/100 mL ²⁰ aq
Chromyl chloride	CrO ₂ Cl ₂	154.90	1.9145 ²⁴	−96.5	117	d aq; s bz, chl, eth, CCl ₄
fluoride	CrO ₂ F ₂	121.99		31.6 ^{85mm}	subl 29.6	
Cobalt	Co	58.9332	8.90	1494	2927	i aq; s dil HNO ₃
(II) acetate 4-water	Co(C ₂ H ₃ O ₂) ₂ · 4H ₂ O	249.08	1.705 ¹⁹	anhyd 140		s aq; 2.1 g/100 mL ¹⁵ MeOH
(III) acetate	Co(C ₂ H ₃ O ₂) ₃	236.07		d > 100		s aq, HOAc, alc
(II) bromide	CoBr ₂	218.74	4.909 ²⁵	678 (in N ₂)		112 g/100 mL ²⁰ aq; s alc, acet
(II) carbonate	CoCO ₃	118.94	4.13	d		0.18 ¹⁵ aq; s hot acids
(II) chloride	CoCl ₂	129.84	3.367 ²⁵	735	1049	53 g/100 mL ²⁰ aq; s alc, acet, eth, glyc, pyr
(II) chloride 6-water	CoCl ₂ · 6H ₂ O	237.93	1.924	anhyd 110		97 g/100 mL ²⁰ aq
(II) chromate	CoCrO ₄	174.93	≈4.0	d		i aq; s acids
(II) cyanide	Co(CN) ₂	110.97	1.872 ²⁵	d 300		0.0042 ¹⁸ aq; s KCN
(II) fluoride	CoF ₃	96.93	4.46	1127	≈1400	1.36 ²⁰ aq; s warm mineral acids
(III) fluoride	CoF ₃	115.93	3.88	926		d aq
(II) formate 2-water	Co(CHO ₂) ₂ · 2H ₂ O	185.00	2.129 ²²	anhyd 140	d 175	5.03 g/100 mL ³⁰ aq; i alc
(II) hydroxide	Co(OH) ₂	92.95	3.37	168 (vacuo)		0.00018 aq; v s acids
(III) hydroxide	Co(OH) ₃	109.96	4.46	−H ₂ O, 100	d	0.00032 aq; s acids
(II) iodide (alpha, black)	CoI ₂	312.74	5.584 ²⁵	515 (vacuo)	570 (vacuo)	203 aq
(II) nitrate 6-water	Co(NO ₃) ₃ · 6H ₂ O	291.03	1.88	55	d > 74	155 g/100 mL ³⁰ aq; v s alc
(II) oxalate	CoC ₂ O ₄	146.95	3.021	d 250		0.002 ¹⁸ aq
(II) oxide	CoO	74.93	6.44	−s1935		i aq; s acids, alkalis
(II,III) oxide	Co ₃ O ₄	240.80	6.07	d > 900		i aq; s acids, alkalis
(II) phosphate 8-water	Co ₃ (PO ₄) ₂ · 8H ₂ O	510.87	2.769	anhyd 200		v sl s aq; s mineral acids
(II) sulfate 7-water	CoSO ₄ · 7H ₂ O	281.10	2.03	anhyd 420	d 1140	65 g/100 mL ²⁰ aq; sl s alc
(II) sulfide	CoS	91.00	5.45 ¹⁸	1180		i aq; s acids
(II) thiocyanate 3-water	Co(SCN) ₂ · 3H ₂ O	229.14		anhyd 105		7.8 ¹⁸ aq; s alc, eth

Copper	Cu	63.546	8.96 ²⁰	1084.62	2561.5	i; s HNO ₃ , hot H ₂ SO ₄
(II) acetate 1-water	Cu(C ₂ H ₃ O ₂) · H ₂ O	199.65	1.882	115	d 240	8 g/100 mL aq; 0.48 MeOH; sl s eth
acetate <i>meta</i> -arsenate (1/3)	Cu(C ₂ H ₃ O ₂) ₂ · 3Cu(AsO ₂) ₂	1013.80				unstable in acids, bases; s NH ₄ OH
(II) borate(1 –)	Cu(BO ₂) ₂	149.17	3.859	497	1345	s a; i aq
(I) bromide	CuBr	143.45	4.98	498	900	v sl s aq; s HCl, HBr, NH ₄ OH
(II) bromide	CuBr ₂	223.35	4.71			126 g/100 mL aq; s alc, acet, pyr; i bz
(II) carbonate hydroxide (1/1) (malachite)	CuCO ₃ · Cu(OH) ₂	221.12	4.0	d 200		i aq; s acids
(II) chlorate 6-water	Cu(ClO ₃) ₂ · 6H ₂ O	338.54		65	d 100	242 g/100 mL ¹⁸ aq; v s alc; s acet
(I) chloride	CuCl	99.00	4.14	430	≈1400	0.024 aq; s conc HCl, conc NH ₄ OH
(II) chloride	CuCl ₂	134.45	3.386	300 d		73 g/100 mL ²⁰ aq; s alc, acet
(II) chloride 2-water	CuCl ₂ · 2H ₂ O	170.48	2.51	anhyd 200	d >300	76.4 g/100 mL ²⁵ aq; v s alc; s acet
(I) chromium(III) oxide (1/1)	Cr ₂ O ₃ · Cu ₂ O	295.07	5.24 ²⁰	d >900		i aq; s HNO ₃
(II) citrate 2.5-water	Cu ₂ C ₆ H ₄ O ₇ · 2.5H ₂ O	360.22		anhyd 100		0.17 aq; s acids
(I) cyanide	CuCN	89.56	2.92	473 (in N ₂)	d	i aq; s NH ₄ OH, KCN; d hot dil HCl
(II) fluoride	CuF ₂	101.54	4.23	836	1676	4.75 g/100 mL ²⁰ aq; s acids
(II) formate	Cu(CHO ₂) ₂	153.58	1.831			12.5 aq
(II) hexafluorosilicate 4-water	Cu[SiF ₆] · 4H ₂ O	277.60	2.56	d		124 g/100 mL ²⁰ aq
(II) hydroxide	Cu(OH) ₂	97.56	3.368	d 160		i aq; s acids
(I) iodide	CuI	190.45	5.67	606	≈1290	i aq; s KCN, NH ₄ OH, KI
(II) nitrate 3-water	Cu(NO ₃) ₂ · 3H ₂ O	241.60	2.32	114.5	170 d	138 g/100 mL ⁹ aq; v s alc
(II) oleate	Cu(OOCC ₁₇ H ₃₃) ₂	626.46				i aq; sl s alc; s eth
(II) oxalate hemihydrate	CuC ₂ O ₄ · 0.5H ₂ O	160.57		anhydr >200	d 310	0.002 aq; s NH ₄ OH
(I) oxide	Cu ₂ O	143.09	6.0 ²⁵	1235	–O ₂ , 1800	i aq; s HCl
(II) oxide	CuO	79.54	6.315 ¹⁴	1450		i aq, alc; s acids, KCN
(II) perchlorate	Cu(ClO ₄) ₂	262.45	2.225 ²³	d >130		146 g/100 mL ³⁰ aq; s eth, EtAc; i bz
(II) phosphate 3-water	Cu ₃ (PO ₄) ₂ · 3H ₂ O	434.63		d		i aq; s acids
(II) salicylate 4-water	Cu(C ₇ H ₅ O ₃) ₂ · 4H ₂ O	409.83		dehyd in air		v s aq; s alc
(II) selenate 5-water	CuSeO ₄ · 5H ₂ O	296.58	2.559	anhyd 265	d ca. 480	25 g/100 mL ²⁰ aq; v sl s acet
(I) selenide	Cu ₂ Se	206.05	6.84 ²¹	1113		d HCl
(II) selenide	CuSe	142.51	6.0	d 550		s acids
(II) stearate	Cu(OOCC ₁₇ H ₃₅) ₂	630.50		≈250		i aq, alc, eth; s hot bz, pyr
(II) sulfate	CuSO ₄	159.61	3.603	d >560		14.3 g/100 mL ⁰ aq; i alc
(II) sulfate 5-water	CuSO ₄ · 5H ₂ O	249.69	2.284 ¹⁶	anhyd 200		32 g/100 mL ²⁰ aq; s MeOH, glyc

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
<i>Copper (continued)</i>						
(I) sulfide	Cu ₂ S	159.16	5.6 ₄ ²⁰	1130		i aq; d HNO ₃ , s KCN
(II) sulfide	CuS	95.61	4.76			i aq; s hot HNO ₃ , KCN
(I) sulfite hydrate	Cu ₂ SO ₃ · H ₂ O	225.16	3.83 ¹⁵	d		sl s aq; s HCl
(II) tartrate 3-water	CuC ₄ H ₄ O ₆ · 3H ₂ O	265.66				0.4220 aq; s acids, alkalis
(I) thiocyanate	CuSCN	121.62	2.85	1084		0.00044 aq; s NH ₄ OH, eth, alkali SCN
(II) tungstate(VI)(2-)	CuWO ₄ · 2H ₂ O	347.41				0.1 ¹⁵ aq; d acids; s NH ₄ OH
Curium-244	Cm	244.063	13.51	1340	≈3110	s acids
Cyanogen azide	NC—CN NC—N ₃	52.03 68.04	2.335 g/L	−27.84	−21.15	mL/100 mL: 450 ²⁰ aq, 230 alc; s acetonitrile; pure azide detonates upon shock. Handle only in sol- vents.
bromide	NCBr	105.92	2.005	52	61.5	v s aq, alc, eth
chloride	NCCl	61.47	2.697 g/L	−6.5	13.8	s aq, alc, eth
fluoride	NCF	45.02	1.975 g/L	−82	−46	
Deuterium oxide	D ₂ or ² H ₂ D ₂ O	4.03 20.03	0.169 ^{mp} lq 1.1056 ²⁰	−252.89 3.82	−249.49 101.43	sl s aq misc aq
Dysprosium	Dy	162.50	8.540 ²⁵	1412	2567	s acids
bromide	DyBr ₃	402.21	4.78	880	1480	s aq
chloride	DyCl ₃	268.86	3.67	680	1530	s aq
fluoride	DyF ₃	219.50	7.465	1154	2230	i aq
oxide	Dy ₂ O ₃	373.00	7.81 ²⁷	2408		s aq
Einsteinium	Es	252.083	8.84	860		
Erbium	Er	167.26	9.066	1529	2868	s acid
chloride	ErCl ₃	273.62	4.1	776	1500	s aq; sl s alc
oxide	Er ₂ O ₃	382.52	8.640	2418		0.0005 ²⁵ aq; s acids
sulfate 8-water	Er ₂ (SO ₄) ₃ · 8H ₂ O	766.83	3.205	anhyd 110	d 630	16.0 g/100 mL ²⁰ aq
Europium	Eu	151.965	5.244	822	1527	s acids
(III) chloride	EuCl ₃	258.32	4.89	623 d		s aq
(III) oxide	Eu ₂ O ₃	351.93	7.42	2350		i aq; s acids
(III) sulfate 8-water	Eu ₂ (SO ₄) ₃ · 8H ₂ O	736.24	−8H ₂ O, 375			2.56 ²⁰ aq

Fermium-257	Fm	257.0951	1527	–188.13	d aq viol; ignites organics and silicates
Fluorine	F ₂	38.00	–219.61	–45.9	hyd aq; s acet; ignites alc, eth; liquid explodes on slight concussion
nitrate	FONO ₂	81.00	–175	–15.9	explodes on slightest provocation
perchlorate	FOClO ₃	118.45	–167.3		
Francium-223	Fr	223.02			
Gadolinium	Gd	157.25	1312	3273	s acids
chloride	GdCl ₃	263.61	~609	1580	s aq
fluoride	GdF ₃	214.25	1231	2277	i aq
nitrate 6-water	Gd(NO ₃) ₃ · 6H ₂ O	451.36	91		s aq, alc
oxide	Gd ₂ O ₃	362.50	2340		s acids
sulfate 8-water	Gd ₂ (SO ₄) ₂ · 8H ₂ O	746.81	anhyd 400	d 500	4.08 aq
Gallium	Ga	69.723	29.7646	2203	s conc HCl, halogens, alkalis
antimonide	GaSb	191.48	712		s HCl
arsenide	GaAs	144.65	1238		s HCl
chloride	GaCl ₃	176.08	77.9	201.2	d aq; s bz, CCl ₄ , CS ₂
fluoride	GaF ₃	126.72	>1000	subl 950	0.004 ²⁵ aq; s HF
nitrate	Ga(NO ₃) ₃	255.74	d 110	→ Ga ₂ O ₃ , 200	v s aq
phosphide	GaP	100.70	1465		
selenide	GaSe	148.68	960	d	
triethyl	Ga(C ₂ H ₅) ₃	146.90	–82.3	142.8	
trimethyl	Ga(CH ₃) ₃	114.84	–15.7	55.8	
Germanium	Ge	72.61	937.3	2830	i aq; s hot H ₂ SO ₄
(IV) bromide	GeBr ₄	392.23	26.1	186.4	hyd aq; s bz, eth
(IV) chloride	GeCl ₄	214.42	–49.5	86.5	hyd aq; s bz, eth; sl s dil HCl
(IV) fluoride	GeF ₄	148.60	–15	d > 1000	hyd aq; s dil HCl
hydride (germane)	GeH ₄	76.64	–164.8	–88.1	sl s hot HCl
(IV) oxide	GeO ₂	104.61	1115	1200	0.43 ²⁰ aq; s acids, alkalis
sulfide	GeS ₂	136.74	530		
Gold	Au	196.967	1064.18	2856	s aq reg, KCN, hot H ₂ SO ₄
(I) chloride	AuCl	232.42	289		s HCl, HBr, KCN
(III) chloride	AuCl ₃	303.33	d > 160	subl 180	68 g/100 mL ²⁰ aq; s EtOH
(I) cyanide	AuCN	222.99	d		s aq reg, KCN, NH ₄ OH
(III) cyanide 3-water	Au(CN) ₃ · 3H ₂ O	329.07	d 50		v s aq; sl s alc

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Gold (<i>continued</i>)						
dianthimonide	AuSb ₂	440.47		460		
(III) fluoride	AuF ₃	253.96	6.75	subl 300	d 500	
(III) oxide	Au ₂ O ₃	441.93		d 150		s HCl, KCN
(I) sodium thiosulfate 2-water	AuNa ₃ (S ₂ O ₃) ₂ · 2H ₂ O	526.24	3.09	anhyd 160		50 g/100 mL aq; i alc
stannide	AuSn	315.66		418		
(III) sulfide	Au ₂ S ₃	490.13	8.754	d 197		i aq; s Na ₂ S
Hafnium	Hf	178.49	13.31	2227	4450	s HF
chloride	HfCl ₄	320.30		432	subl 317	hyd aq; s acet, MeOH
oxide	HfO ₂	210.49	9.68 ²⁰	2774		i aq
Helium	He	4.00260	0.176 g/L	−272.15 ²⁵ atm	−268.935	0.861 mL/100 mL ²⁰ aq
Holmium	Ho	164.9304	0.1249 (lq)	1474	2720	s acids; oxidizes in moist air
bromide	HoBr ₃	404.64	4.86	914	1470	s aq
chloride	HoCl ₃	271.29	3.7	718	1510	s aq
Hydrazine	H ₂ N—NH ₂	32.05	1.0036 ¹⁵	2.0	113.5	FP 52; misc aq, alc
hydrate	H ₂ N—NH ₂ · H ₂ O	50.06	1.030	−51.7 & −65	118–119	misc aq, alc; i chl, eth
Hydrazinium(1+) chloride	H ₂ N—NH ₃ Cl	68.51	1.5	89	d 240	v s aq; i org solv
(2+) chloride	ClH ₃ N—NH ₃ Cl	104.97	1.423	198	d 200	v s aq; sl s alc
(1+) iodide	H ₂ N—NH ₃ I	159.96		125		s aq
(+1) perchlorate	H ₂ N—NH ₃ ClO ₄	132.51	1.939 ¹⁵	137	d 145	d aq; s alc
(2+) sulfate	(H ₃ NNH ₃)SO ₄	130.13	1.378	254	d	3.4 ²⁰ aq; i alc
(1+) tartrate	(H ₂ N—NH ₃) ₂ C ₄ H ₄ O ₆	182.13		183		6.0 g/100 mL ⁰ aq
Hydrogen	H ₂	2.0159	0.088 g/L	−259.35	−252.88	1.9 mL aq
		0.07099 ^{bp}				
		(lq)				
amidosulfate (sulfamate)	H ₂ NSO ₃ H	97.09	2.126	205	d	14.7 g/100 mL aq; sl s alc, acet
azide	HN ₃	43.03	1.126 ⁰	−80	37	v s aq; (very explosive)
borate(1−) (cubic)	HBO ₂	43.83	2.486	236		v sl s aq
borate(3−) (ortho)	H ₃ BO ₃	61.83	1.435 ¹⁵	171.0	d 357	5.56 g/100 mL ³⁰ aq
bromide	HBr	80.91	3.388 g/L ²⁰	−86.87	−66.71	193 g/100 mL ²⁵ aq; misc alc

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Hydrogen (<i>continued</i>)						
phosphate(V)(3-)- d_3	$^2\text{H}_3\text{PO}_4$	101.03	1.908 ²⁵	46.0		v s aq
phosphide, <i>see</i> Phosphine						
phosphinate	HPH_2O_2	66.0	1.493 ¹⁹	26.5	d 50	s aq
phosphonate (phosphorous acid)	H_2PHO_3	82.00	1.651 ²⁵	≈73	d > 180	v s aq, alc
selenate	H_2SeO_4	144.98	2.9508 ¹⁵	58	260	vs aq (viol)
selenide	H_2Se	80.98	2.12 ₄ ^{bp}	-65.73	-41.4	9.5 mL/100 mL ²⁰ aq; s CS_2
sulfate	H_2SO_4	98.08	1.8318 ²⁰	10.38	335.5	misc aq
sulfate- d_2	$^2\text{H}_2\text{SO}_4$ or D_2SO_4	100.09	1.8620	14.35		misc aq
sulfide	H_2S	34.08	1.5392 g/L ⁰	-85.49	-60.33	0.334 mL ²⁵ aq
tellurate(IV)	H_2TeO_3	177.63	3.0	d to TeO_2		0.0007 aq; s acid, alkali
tellurate(VI) (monoclinic)	H_6TeO_6	229.66	3.068	-2H ₂ O, 120	320 → TeO	30 g/100 mL ¹⁸ aq
telluride	H_2Te	129.62	5.687 g/L	-49	-2	s aq d
trithiocarbonate	$(\text{HS})_2\text{CS}$	110.21	1.483 ₄ ⁰	-26.9	57.8	d aq, alc
tungstate(VI)(2-)	H_2WO_4	249.86	5.5	anhyd 100		i aq; s HF, alkalis
Hydroxylamine	HONH_2	33.03	1.204 ⁴⁰	33	58 ^{22mm}	v s aq, MeOH; sl s bz, eth
Hydroxylammonium chloride	HONH_3Cl	69.49	1.680 ²⁰	150.5	d	g/100 mL: 83 ¹⁷ aq, 12.5 ²⁰ MeOH, 5.1 ²⁰ EtOH; s glyc
sulfate	$(\text{HONH}_3)_2\text{SO}_4$	164.14		170		69 g/100 mL ²⁰ aq
Indium	In	114.82	7.31	156.60	2072	s acids
antimonide	InSb	236.58	5.77	525		i aq
arsenide	InAs	189.74	5.67	942		
chloride	InCl_3	221.18	4.0	583	subl 500	212 g/100 mL ²⁵ aq
fluoride	InF_3	171.82	4.39	1170		0.040 ²⁵ aq; s dilute acids
oxide	In_2O_3	277.63	7.179		850	s hot mineral acids
phosphide	InP	145.79	4.81	1062		v sl s acids
telluride	In_2Te_3	612.44	5.75	667		
trimethyl	$\text{In}(\text{CH}_3)_3$	159.93	1.568	88.4	135.8	d aq; s acet, bz
Iodine	I_2	253.809	4.63 ²⁵	113.60	185.24	g/100 mL ²⁵ ; 0.029 aq, 14.1 bz, 16.5 CS_2 , 21.4 EtOH, 25.2 eth, 2.6 CCl_4 ; s chl, HOAc

heptafluoride	IF ₇	259.89	lq: 2.8 ⁶	6.45	4.77 subl	s aq (d), s NaOH
monobromide	IBr	206.81	4.416	40	116 d	s aq, alc, eth, CS ₂
monochloride	ICl	162.36	3.10 ₄ ²⁹	27.2 α-form	97 d	d aq; s alc, eth, HOAc
pentafluoride	IF ₅	221.90	3.19 ²⁵	9.43	100.5	d aq viol
pentoxide	I ₂ O ₅	333.81	4.98	d 275		187 g/100 mL ¹³ aq
trichloride	ICl ₃	233.26	3.202 ⁻⁴	~33	64 subl	d aq; s alc, bz, HCl
Iridium	Ir	192.217	22.65 ₄ ²⁰	2447	~2550	s K ₂ SO ₄ fusion, KOH + KNO ₃
hexafluoride	IrF ₆	306.21	4.82	44.4	53.6	fusion
(III) oxide	Ir ₂ O ₃	432.43		d ~ 1000 to Ir + O ₂		d aq
(IV) oxide	IrO ₂	224.22	11.7	d 1100		s boiling HCl
trichloride	IrCl ₃	298.58	5.30	d 763		0.0002 ²⁰ aq; s HCl
Iron	Fe	55.845	7.86	1535	2861	i acids, alkalis
(III) arsenate 2-water	FeAsO ₄ · 2H ₂ O	230.79	3.18	1020		i aq; s acids
(II) bromide	FeBr ₂	126.75	3.16	677	1023	v sl s aq; s acids
(III) bromide	FeBr ₃	295.67	4.5	d		117 g/100 mL ²⁰ aq; v s alc
(<i>tri</i> -) carbide	Fe ₃ C	179.55	7.694	1227		s aq, alc, eth, HOAc
(II) carbonate	FeCO ₃	115.85	3.9	d		s acids
(II) chloride	FeCl ₂	126.75	3.16	677	1024	0.072 ¹⁸ aq; s acids
(III) chloride	FeCl ₃	162.20	2.898	304	≈316	62.5 g/100 mL ²⁰ aq; v s alc, acet
disulfide (pyrite)	FeS ₂	119.98	5.02	d 602		74 g/100 mL ⁰ aq; s alc, acet, eth
(II) fluoride	FeF ₂	93.84	4.09	1100	1837	s acids d
(III) fluoride	FeF ₃	112.84	3.87	subl 1000		sl s aq; s dil HF; i alc, bz, eth
(III) hexacyanoferrate(II)	Fe ₄ [Fe(CN) ₆] ₃	859.23	1.80	250 d		0.091 ²⁵ aq; s HF
(II) hydroxide	Fe(OH) ₂	89.86	3.4			i aq; s HCl
(III) hydroxide oxide	FeO(OH)	88.85	4.26	anhyd 136		0.006 aq; s acids
(II) iodide	FeI ₂	309.65	5.315	587	1093	i aq, alc; s HCl
(III) nitrate 9-water	Fe(NO ₃) ₃ · 9H ₂ O	404.00	1.684	47	d 100	s aq
(<i>di</i> -) nitride	Fe ₂ N	125.70	6.35	d 200		138 g/100 mL ²⁰ aq
(II) oxalate 2-water	FeC ₂ O ₄ · 2H ₂ O	179.89	2.28	d 150		s HCl
(II) oxide	FeO	71.84	6.0	1377	d 3414	0.044 ¹⁸ aq; s mineral acids
(II,III) oxide	Fe ₃ O ₄	231.53	5.17	1597		i aq; s acids
(III) oxide	Fe ₂ O ₃	159.69	5.25	1565		i aq; s acids
pentacarbonyl	Fe(CO) ₅	195.90	1.49	~20.0	103.9	i aq; s HCl
(II) phosphate 8-water	Fe ₃ (PO ₄) ₂ · 8H ₂ O	501.60	2.58			FP - 20; i aq; s alc, bz, eth
phosphide	Fe ₃ P	142.66	6.85	1370		i aq; s acids
						s hot mineral acids

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Iron (<i>continued</i>)						
(II) selenide	FeSe	134.81	6.78	d		s HCl
(II) silicate(2-)	FeSiO ₃	131.93	3.5	1140		
(II) silicate(4-)	Fe ₂ SiO ₄	203.77	4.30	1220		d HCl
(II) sulfate 7-water	FeSO ₄ · 7H ₂ O	278.01	1.89	anhyd 300	d 671	48 g/100 mL ²⁰ aq
(III) sulfate	Fe ₂ (SO ₄) ₃	399.88	3.097 ¹⁸	d 1178		slowly s aq (hyd); sl s alc
(II) sulfide	FeS	87.92	4.7	1190	d	0.0006 ¹⁸ aq; s acid
(III) thiocyanate	Fe(SCN) ₃	230.09				v s aq
Krypton	Kr	83.80	3.7493 g/L	-157.36	-153.22	5.94 mL/100 mL ²⁰ aq
difluoride	KrF ₂	121.80	3.24	subl -60		s anhyd HF
Lanthanum	La	138.9055	6.162	920	3464	i aq; s HCl
chloride	LaCl ₃	245.26	3.84	852	1812	v s aq
chloride 7-water	LaCl ₃ · 7H ₂ O	371.37		anhyd 852 (in HCl atm)		v s aq; s alc
fluoride	LaF ₃	195.90	5.9	1493	2327	
nitrate 6-water	La(NO ₃) ₃ · 6H ₂ O	433.01		40	d 126	181 g/100 mL ²⁰ aq; v s alc
oxide	La ₂ O ₃	325.81	6.51	2305	4200	s acids
sulfate	La ₂ (SO ₄) ₃	566.00	3.60	d white heat		2.33 g/100 mL ²⁰ aq; i alc
sulfate 9-water	La ₂ (SO ₄) ₃ · 9H ₂ O	728.14	2.821	anhyd 400		2.92 g/100 mL ²⁰ aq; i alc
Lawrencium	Lr	262		1627		
Lead	Pb	207.2	11.34 ²⁰ (fcc)	327.43	1749	s hot conc HNO ₃ , HCl, H ₂ SO ₄
(II) acetate 3-water	Pb(C ₂ H ₃ O ₂) ₂ · 3H ₂ O	427.3	2.55	75	d > 200	g/100 mL: 63 ¹⁵ aq, 3.3 alc
(IV) acetate	Pb(C ₃ H ₃ O ₂) ₄	443.4	2.228	≈ 75-180		s hot HOAc, bz, chl, conc HX acids
(II) azide	Pb(N ₃) ₂	291.2	4.7	expl 350 or when shocked		0.023 ¹⁸ aq; v s HOAc
(II) borate(1-) hydrate	Pb(BO ₂) ₂ · H ₂ O	310.8	5.598 anhyd	anhyd 160	mp 500	s acids
(II) bromide	PbBr ₂	367.0	6.69	371	912	0.450 ⁰ aq; s acids; i alc
(II) carbonate	PbCO ₃	267.2	6.61	d 340 → PbO		i aq; s acids, alkalis
(II) chlorate	Pb(ClO ₃) ₂	374.1	3.89	d 230		140 g/100 mL ¹⁸ aq; v s alc
(II) chloride	PbCl ₂	278.1	5.98	501	950	0.99 ²⁰ aq
(II) chloride fluoride	PbClF	261.7	7.05			

(II) chromate(VI)(2-)	PbCrO ₄	323.2	6.12	844	d	i aq; s dil HNO ₃ , alkalis
(II) fluoride	PbF ₂	245.2	8.445	830	1297	0.064 ²⁰ aq
(IV) fluoride	PbF ₄	283.2	6.7	≈ 600		hyd aq
(II) formate	Pb(CHO ₂) ₂	297.2	4.63	d 190		1.6 g/100 mL ²⁰ aq
(II) hydrogen arsenate	PbHAsO ₄	347.1	5.94	d 280 to Pb ₂ As ₂ O ₇		s HNO ₃ , alkalis
(II) hydroxide	Pb(OH) ₂	241.2	7.59	d 145		0.016 ²⁰ aq; s acids, alkalis
(II) iodide	PbI ₂	461.0	6.16	410	872	0.063 ²⁰ aq; s KI, Na ₂ S ₂ O ₃ , alkalis
(II) molybdate(VI)(2-)	PbMoO ₄	367.1	6.7	1065		s acids, alkalis
(II) nitrate	Pb(NO ₃) ₂	331.2	4.53	470		g/100 mL: 56 ²⁰ aq, 1.3 MeOH
(II) oleate	Pb(C ₁₈ H ₃₃ O ₂) ₂	770.1				s alc, bz, eth
(II) oxalate	PbC ₂ O ₄	295.2	5.28	d 300		s acids, alkalis
(II) oxide (litharge)	PbO	223.2	9.35 (red)	886	1472 d	0.0017 ²⁰ aq; s HNO ₃
(IV) oxide	PbO ₂	239.2	9.64	d 290, Pb ₃ O ₄	d 595, PbO	s HCl, dil HNO ₃ + H ₂ O ₂₃ , H ₂ C ₂ O ₄
(II,IV) oxide (red lead)	Pb ₃ O ₄	685.6	8.92	d 595 → PbO		s HNO ₃ , hot HCl
(II) phosphate	Pb ₃ (PO ₄) ₂	811.5	7.0	1014		s HNO ₃ , alkalis
(II) selenide	PbSe	286.2	8.15	1078		s HNO ₃
(II) silicate(2-)	PbSiO ₃	283.3	6.5	764		s acids
(II) silicate(4-)	Pb ₂ SiO ₄	506.5	7.60	743		
(II) stearate	Pb(C ₁₈ H ₃₅ O ₂) ₂	774.2	1.4	≈ 125		
(II) sulfate	PbSO ₄	303.3	6.29	1170		0.05 ³⁵ aq; s hot alc
(II) sulfide	PbS	239.3	7.60	1118	1300 subl	0.00425 aq; s NaOH
(II) telluride	PbTe	334.8	8.16	924		0.0006 ¹⁸ aq; s HNO ₃ , hot dil HCl
tetraethyl	Pb(C ₂ H ₅) ₄	323.45	1.653	- 137		i acids and alkalis
tetramethyl	Pb(CH ₃) ₄	267.35	1.995	- 30.2	≈ 200	i aq; s bz, hydrocarbons
(II) thiocyanate	Pb(SCN) ₂	323.4	3.82	d 190	110	s hydrocarbons
Lithium	Li	6.941	0.534 ²⁰	180.54	1341	0.44 ¹⁸ aq, s HNO ₃ , NaOH
acetate 2-water	LiC ₂ H ₃ O ₂ · 2H ₂ O	102.02	1.3	58	d	d aq to LiOH
aluminate(1-)	LiAlO ₂	65.92	2.554	1700	d 450 vacuo	63 g/100 mL ²⁰ aq; v s alc
amide	LiNH ₂	22.96	1.178	380		d aq (→ LiOH + NH ₃); i bz, eth
benzoate	LiC ₇ H ₅ O ₂	128.06		> 300		g/100 mL: 33 aq; 7.7 alc
borate(1-)	LiBO ₂	49.75	2.18	849	1719	2.7 g/100 mL ²⁰ aq; i alc
borohydride	Li[BH ₄]	21.78	0.66	268	d 380	s aq, eth, THF, aliphatic amines
bromate	LiBrO ₃	134.85	3.62			179 g/100 mL ²⁰ aq
bromide	LiBr	86.84	3.464	552	1289	164 g/100 mL aq; s alc, eth
carbonate	Li ₂ CO ₃	73.89	2.11	720	d 1300	1.3 g/100 mL ²⁰ aq; i alc; s acids

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Lithium (<i>continued</i>)						
chloride	LiCl	42.39	2.07	613	1360	77 g/100 mL ²⁰ aq; s alc, acet
chromate(VI)(2-) 2-water	Li ₂ CrO ₄ · 2H ₂ O	165.91	2.15	anhyd 75		142 g/100 mL ¹⁸ aq; s EtOH
citrate 4-water	Li ₃ C ₆ H ₅ O ₇ · 4H ₂ O	281.98		anhyd 105		61 g/100 mL ¹⁵ aq; sl s alc
fluoride	LiF	25.94	2.640	848	1681	0.13 ²⁵ aq; s acids
hexafluoroaluminate(3-)	Li ₃ [AlF ₆]	161.79		1012		
hydride	LiH	7.95	0.76–0.77	680	d 950	no solvent known; flammable
hydride- <i>d</i>	Li ² H or LiD	8.96	0.881	686		
hydroxide	LiOH	23.95	1.45	471.2	1626	12.4 g/100 mL ²⁰ aq; sl s alc
iodate	LiIO ₃	181.84	4.502	450		66 g/100 mL aq; in alc
iodide	LiI	133.84	4.061	469	1174	165 g/100 mL ²⁰ aq & alc; v s acet
nitrate	LiNO ₃	68.95	2.38	~255		50 g/100 mL ²⁰ aq; s alc
nitride	Li ₃ N	34.83	1.27	813		d aq
oxide	Li ₂ O	29.88	2.013	1570	2563	forms LiOH in aq
perchlorate	LiClO ₄	106.39	2.43	236	d ~ 400	47.4 g/100 mL ²⁵ aq; v s organic solv
					LiCl + O ₂	
peroxide	Li ₂ O ₂	45.88	2.31	d > 195 to Li ₂ O		
silicate(2-)	Li ₂ SiO ₃	89.97	2.52 ²⁵	1201		d dil HCl
sulfate	Li ₂ SO ₄	109.95	2.22	859		34.5 g/100 mL ²⁰ aq; i alc
tetraborate(2-)	Li ₂ B ₄ O ₇	169.12		917		sl s aq
tetrahydroaluminate	Li[AlH ₄]	37.95	0.917	d 137		d aq, alc; g/100 mL: 30 eth, 13 THF; flammable
tetrahydridoborate	LiBH ₄	21.79	0.666	268	d 380	s aq pH > 7; s eth, THF
Lutetium	Lu	174.967	9.841	1663	3402	s acids
chloride	LuCl ₃	281.33	3.98	892	subl > 750	s aq
sulfate 8-water	Lu ₂ (SO ₄) ₃ · 8H ₂ O	782.25				42.3 g/100 mL ²⁰ aq
Magnesium	Mg	24.305	1.738 ²⁰	651	1100	i aq; s dilute acids
acetate	Mg(C ₂ H ₃ O ₂) ₂	142.00	1.42	323 d		53.4 g/100 mL ²⁰ aq; v s alc
aluminate(2-)	MgAl ₂ O ₄	142.25	3.6	2135		v sl s HCl
amide	Mg(NH ₂) ₂	56.35	1.39 ²⁵	ign in air		d viol water giving NH ₃
borate(1-) 8-water	Mg(BO ₂) ₂ · 8H ₂ O	254.04	2.30			sl s aq; s acids
bromide	MgBr ₂	184.11	3.722	711 d	1158	101 g/100 mL ²⁰ aq

carbonate	MgCO ₃	84.31	3.05	990		0.01 aq; s acids
chloride	MgCl ₂	95.21	2.33	714	1412	54.6 g/100 mL ²⁰ aq
fluoride	MgF ₂	62.30	3.148	1263	2270	0.013 ²⁵ aq; s HNO ₃
(<i>di</i> -) germanide	Mg ₂ Ge	121.22	3.09	1115		
hexafluorosilicate 6-water	Mg[SiF ₆] · 6H ₂ O	274.47	1.788	– SiF ₄ , 120		51 g/100 mL ²⁰ aq; i alc
hydride	MgH ₂	26.32	1.45	d 200 vacuo	ign in air	d aq and alc violently
hydrogen phosphate	MgHPO ₄ · 3H ₂ O	174.33	2.13 ¹⁵	anhyd 205	d 550	sl s aq; s acids
3-water						
hydroxide	Mg(OH) ₂	58.32	2.36	350 d		0.00125 aq; s acids
iodide	MgI ₂	278.12	4.43	634	0	140 g/100 mL ²⁰ aq; s alc
lactate 3-water	MgC ₆ H ₁₀ O ₆ · 3H ₂ O	256.51				4 g/100 mL aq; sl s alc
mandelate	MgC ₁₆ H ₁₄ O ₆	326.59				0.004 ¹⁰⁰ aq; i alc
nitrate	Mg(NO ₃) ₂ · 6H ₂ O	256.41	1.464	95	d 129	120 g/100 mL ²⁰ aq; v s alc
nitride	Mg ₃ N ₂	100.93	2.712	d 270		d aq; s acids
oleate	Mg(C ₁₈ H ₃₃ O ₂) ₂	587.22				sl s alc, eth, PE
oxide	MgO	40.30	3.65–3.75	2800	3600	i aq, alc; s acids
perchlorate	Mg(ClO ₄) ₂	223.21	2.21	d > 251		g/100 mL ²⁵ ; 73 aq, 18 EtOH, 44.6 BuOH, 54 EtOAc, 32 acet
permanganate	Mg(MnO ₄) ₂	262.19				v s aq
peroxide	MgO ₂	56.30	≈3.0	d 100		s acids
peroxoborate 7-water	Mg(BO ₃) ₂ · 7H ₂ O	268.09				sl s aq d; s dilute acids
phosphate 5-water	Mg ₃ (PO ₄) ₂ · 5H ₂ O	352.96	1.64 ¹⁵	anhyd ~400		0.02 aq; s acids
silicate(2–)	MgSiO ₃	100.39	3.192 ²⁵	d 1557		i aq; v sl s HF
silicate(4–)	Mg ₂ SiO ₄	140.69	3.21	1898		i aq; d hot HCl
(<i>di</i> -) silicide	Mg ₂ Si	76.70	2.0	1100		d aq, HCl
(<i>di</i> -) stannide	Mg ₂ Sn	167.32	3.60	778		s aq, HCl
sulfate 7-water	MgSO ₄ · 7H ₂ O	246.47	1.67	anhyd 250		27.2 g/100 mL aq; sl s alc
sulfite 6-water	MgSO ₃ · 6H ₂ O	212.46	1.725	anhyd 200	mp: 2227	0.66 ²⁵ aq
tungstate(VI)(2–)	MgWO ₄	272.14	6.89			i aq; d acids
Manganese	Mn	54.9380	7.21 ²⁰	1244 fctetr	2095	d aq; s acids
acetate 4-water	Mn(C ₂ H ₃ O ₂) ₂ · 4H ₂ O	245.09	1.589	80		38 g/100 mL ⁵⁰ aq; v s alc
bromide	MnBr ₂	214.75	4.39	698	1027	147 g/100 mL ²⁰ aq; s alc
(<i>tri</i> -) carbide	Mn ₃ C	176.83	6.89	1520		d aq; s acid
carbonate	MnCO ₃	114.95	3.125	d > 200		0.0065 ²⁵ aq; s acids
chloride	MnCl ₂	125.84	2.977	650	1210	74 g/100 mL ²⁰ aq; s alc, pyr; i eth
chloride 4-water	MnCl ₂ · 4H ₂ O	187.91	2.01	97.5	anhyd 198	143 g/100 mL aq; s alc; i eth
decarbonyl	Mn ₂ (CO) ₁₀	389.98	1.75	d 110		i aq; s organic solvents

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Manganese (<i>continued</i>)						
diphosphate	$\text{Mn}_2\text{P}_2\text{O}_7$	283.82	3.707	1196		i aq; s acid
(II) fluoride	MnF_2	92.93	3.98	930	1820	0.66 ⁴⁰ aq; s HF, conc HCl
(III) fluoride	MnF_3	111.93	3.54	d > 600		hyd aq; s acid
hydroxide	$\text{Mn}(\text{OH})_2$	88.95	3.258	d		0.002 ¹⁸ aq; s acids
iodide	MnI_2	308.75	5.04	638	1017	s aq
nitrate 6-water	$\text{Mn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	287.04	1.8	25.8		v s aq, alc
(II) oxide	MnO	70.94	5.37	1840		i aq; s acids
(III) oxide	Mn_2O_3	157.87	4.89	877 d		i aq; s HCl giving off Cl_2
(IV) oxide	MnO_2	86.94	5.08	−O ₂ , 530		s HCl; i HNO ₃ , cold H ₂ SO ₄
(II,IV) oxide	Mn_3O_4	228.81	4.84	1567		i aq; s HCl
(VII) oxide	Mn_2O_7	221.87	2.396	ca. −20	ca. 25	explodes 85; v s aq
phosphinate hydrate	$\text{Mn}(\text{PH}_2\text{O}_2)_2 \cdot \text{H}_2\text{O}$	202.93		d to PH ₃		15 g/100 mL aq; i alc
silicate, meta-	MnSiO_3	131.02	3.48	1290		i aq, HCl
sulfate	MnSO_4	151.00	3.25	700	d 850	52 g/100 mL aq; i alc
sulfate hydrate	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$	169.02	2.95	anhyd 400–450		70 g/100 mL ²⁰ aq
sulfate 7-water	$\text{MnSO}_4 \cdot 7\text{H}_2\text{O}$	277.11	2.09	anhyd 280		115 g/100 mL ²⁰ aq
sulfide	MnS	87.00	3.99	1610		0.0006 ¹⁸ aq; s acids
titanate(IV)(2−)	Mn_2TiO_4	150.84	4.54	1360		
Mercury	Hg	200.59	13.534	−38.83	356.7	i aq; s HNO ₃ , hot conc H ₂ SO ₄
(II) acetate	$\text{Hg}(\text{C}_2\text{H}_3\text{O}_2)_2$	318.68	3.28	178–180 d		g/100 mL: 40 ¹⁰ aq, 7.5 ¹⁵ MeOH
(II) benzoate	$\text{Hg}(\text{C}_7\text{H}_5\text{O}_2)_2$	424.83		165		v s NaCl soln; sl s alc
(I) bromide	Hg_2Br_2	560.99	7.307	subl 393 d		i aq, alc, eth; d hot HCl
(II) bromide	HgBr_2	360.40	6.05	237	322 subl	g/100 mL: 0.56 ²⁰ aq; 20 ²⁵ alc; v s HCl, HBr
(I) chloride	Hg_2Cl_2	472.09	7.16	subl 382	d without melting	s aqua regia; i aq, alc, eth
(II) chloride	HgCl_2	271.50	5.4	277	304	g/100 mL ²⁰ : 7.15 aq, 26 alc, 4 eth
(II) cyanide	$\text{Hg}(\text{CN})_2$	252.63	4.00	d 320		8.3 glyc, 0.5 bz; s HOAc, EtAc
(I) fluoride	Hg_2F_2	439.18	8.73	>570 d		g/100 mL ²⁰ : 9.3 aq, 25 MeOH, 8 EtOH
						hydrolyses in water

(II) fluoride	HgF ₂	238.59	8.95	d 645	d > 650	hyd aq; s HF
(II) fulminate	Hg(ONC) ₂	284.62	4.42	explodes		sl s aq; s alc; dangerously flammable
(I) iodide	Hg ₂ I ₂	654.99	7.70	290 d	subl 140	i aq, alc, eth; s KI
(II) iodide	HgI ₂	454.40	6.28	259	350 subl	g/100 mL: 0.006 ²⁵ aq, 0.8 alc, 0.8 eth, 1.7 acet
(I) nitrate 2-water	Hg ₂ (NO ₃) ₂ · 2H ₂ O	561.22	4.79	70 d		hyd aq; s HNO ₃
(II) nitrate	Hg(NO ₃) ₂	324.60	4.3	79	d	v s aq; s acet
(I) oxide	Hg ₂ O	417.18	9.8	d 100		i aq; s HNO ₃
(II) oxide	HgO	216.59	11.14	d 500		0.005 ²⁵ aq; s dil HCl, HNO ₃ , I ⁻ , CN ⁻
(I) sulfate	Hg ₂ SO ₄	497.24	7.56	d		0.06 ²⁵ aq; s HNO ₃
(II) sulfate	HgSO ₄	296.65	6.47	d		d aq; s acid
(II) sulfide (cinnabar)	HgS	232.66	8.17	subl 583	→ blk HgO, 386	i aq; s aqua regia
(II) thiocyanate	Hg(SCN) ₂	316.76	3.71	d 165		0.063 ²⁵ aq; s HCl
Molybdenum	Mo	95.94	10.28	2622	4825	s hot H ₂ SO ₄ , HNO ₃ , fused KNO ₃
(III) bromide	MoBr ₃	335.65	4.89	subl 977		d alkalis
(IV) chloride	MoCl ₄	237.75		317	407	s conc acids
(V) chloride	MoCl ₅	273.19	2.928	194	268	s conc acids, dry eth, dry alc
(VI) fluoride	MoF ₆	209.93	2.54	17.6	35.0	hyd aq; s alkalis; 31 g/100 g HF
hexacarbonyl	Mo(CO) ₆	264.00	1.96	150 d	subl	s bz
(IV) oxide	MoO ₂	127.94	6.47	d ≈ 1100		i aq
(VI) oxide	MoO ₃	143.94	4.696 ²⁴ ₆	801	1155	0.05 ²⁸ aq; s conc mineral acids, alk
(III) sulfide	Mo ₂ S ₃	288.07	5.91 ¹⁵ ₄	1807	d 1867	d hot HNO ₃
(IV) sulfide	MoS ₂	160.07	5.06 ¹⁵ ₃	2375	subl 450	s aqua regia
Neodymium	Nd	144.24	7.01	1024	3074	s hot aq, acids
chloride	NdCl ₃	250.60	4.134	760	1600	98 g/100 mL ²⁰ aq; s alc
oxide	Nd ₂ O ₃	336.48	7.28	1900		s dilute acids
sulfate 8-water	Nd ₂ (SO ₄) ₃ · 8H ₂ O	720.79	2.85	d 700–800		8.87 g/100 mL ²⁰ aq
Neon	Ne	20.180	0.8999 g/L ⁰	– 248.67	– 246.05	1.05 mL ²⁰ aq
Neptunium	Np	237.0482	20.2	644	> 3900	s HCl
(IV) oxide	NpO ₂	269	11.1	2547		
Nickel	Ni	58.69	8.908 ²⁰	1453	2884	i aq; s HNO ₃
acetate 4-water	Ni(C ₂ H ₃ O ₂) ₂ · 4H ₂ O	248.86	1.744	d		16 g/100 mL aq; s alc
acetylacetonate	Ni(C ₅ H ₇ O ₂) ₂	256.91	1.455 ¹⁷	230	235 ^{11 atm}	s aq, alc, bz, chl; i eth
bromide	NiBr ₂	218.50	5.098	963	subl	100 g/100 mL ²⁰ aq
carbonate hydroxide (1/2)	NiCO ₃ · 2Ni(OH) ₂	304.12	2.6			s dilute acids

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Nickel (<i>continued</i>)						
carbonyl	Ni(CO) ₄	170.73	1.31	−19.3	43 (expl 60)	s EtOH, bz, acet
chloride	NiCl	129.60	3.51	1009	subl 973	61 g/100 mL ²⁰ aq
chloride 6-water	NiCl ₂ · 6H ₂ O	237.69				100 g/100 mL ²⁰ aq; s alc
cyanide 4-water	Ni(CN) ₂ · 4H ₂ O	182.79				0.006 ¹⁸ aq; s KCN, NH ₄ OH
dimethylglyoxime	Ni(HC ₂ H ₄ N ₂ O ₂) ₂	288.92				i aq; s abs alc, dilute acids
(<i>tri</i> -) disulfide	Ni ₃ S ₂	240.21	5.87	anhyd 400 subl 250	d 2967	s HNO ₃
fluoride	NiF ₂	96.69	4.72	1450	1740	4 g/100 mL ²⁰ aq; i alc, eth
formate 2-water	Ni(CHO ₂) ₂ · 2H ₂ O	184.78	2.154 ²⁰	anhyd 130	d 180–200	s aq; i alc
nitrate 6-water	Ni(NO ₃) ₂ · 6H ₂ O	290.81	2.05	56.7	136.7	150 g/100 mL ²⁰ aq
(II) oxide	NiO	74.71	7.45	2000		s acids
(III) oxide	Ni ₂ O ₃	165.42	4.83	−O ₂ , 600		s hot HCl, HNO ₃ , H ₂ SO ₄
sulfate	NiSO ₄	154.78	3.68	−SO ₃ , 840		29 g/100 mL ⁰ aq
sulfate 6-water	NiSO ₄ · 6H ₂ O	262.86	2.07	anhyd 280		40 g/100 mL ²⁰ aq
sulfide	NiS	90.77	5.3–5.6	976	d 2047	s HNO ₃ , KHS
tetracarbonyl	Ni(CO) ₄	170.74	1.3185 ¹⁷	−19.3	42.3	explodes 63; FP −4; s organic sol- vents
Niobium						
(V) chloride	NbCl ₅	92.9064	8.57 ²⁰	2468	4860	s fused alkali hydroxides
(V) fluoride	NbF ₅	270.20	2.75	206	247.0	s HCl, CCl ₄
(V) oxide	Nb ₂ O ₅	187.91	2.696 ⁸⁰	80.0	234.9	hyd aq, alc; sl s CS ₂ , CCl ₄
Nitrogen	N ₂	265.82	4.55	1512		s HF, hot H ₂ SO ₄
	¹⁵ N ₂	28.0341	1.165 g/L ²⁰	−210.01	−195.79	mL/100 mL: 1.6 ²⁰ aq, 0.112 alc
(I) oxide	N ₂ O	30.01	1.25 g/L ²⁰	−209.952	−195.73	
(II) oxide	NO	44.02	1.843 g/L ²⁰	−90.81	−88.46	130 ⁰ mL aq; s alc, eth
(III) oxide	N ₂ O ₃	30.01	1.249 g/L ²⁰	−163.64	−151.76	4.6 mL/100 mL ²⁰ aq
(IV) oxide dimer	N ₂ O ₄	76.02	1.447 g/L ²	−100.7	2	s eth
(V) oxide	N ₂ O ₅	92.02	1.448 ²⁰	−9.3	21.15 d	s conc HNO ₃ , conc H ₂ SO ₄ , chl
selenide	N ₄ Se ₄	108.01	2.05	30	47.0	v s chl; s CCl ₄
sulfide	N ₄ S ₄	371.87	4.2	explosive		sl s bz, CS ₂
trichloride	NCl ₃	184.28	2.24 ¹⁸	180	185	s organic solvents
trifluoride	NF ₃	120.37	1.653 ²⁰	−27	71	i aq; s bz, CS ₂ , CCl ₄
		70.01	2.96 g/L ²⁰	−208.5	−129.06	

Nitrosyl chloride	NOCl	65.47	1.592 ⁻⁵	-61.5	-5.5	hyd aq; s fuming H ₂ SO ₄
fluoride	NOF	49.01	2.788 g/L ²⁰	-132.5	-59.9	hyd aq
hydrogen sulfate	NOHSO ₄	127.08		d 73.5		d aq; s H ₂ SO ₄
tetrafluoroborate	NO[BF ₄]	116.83	2.185 ²⁵ ₄	subl 250 ^{0.01} mm		d aq
Nitryl chloride	NO ₂ Cl	81.46	2.81 g/L ¹⁰⁰	-145	-14.3	d aq
fluoride	NO ₂ F	65.00	2.7 g/L ²⁰	-166.0	-72.4	d aq
Osmium	Os	190.2	22.61 ²⁰	3045	5225	s molten alkali or oxidizing fluxes
hexafluoride	OsF ₆	304.2		32.1	45.9	hyd aq
tetrachloride	OsCl ₄	332.0	4.38 ⁴ ₄	subl 450		slow hyd aq
tetraoxide	OsO ₄	254.20	4.91	40.6	130.0	g/100 mL: 7.24 ²⁵ aq; 375 ²⁵ CCl ₄ ; s bz, eth, alc
Oxygen	O ₂	31.9988	1.331 g/L ²⁰	-218.4	-182.96	mL/100 mL ²⁰ : 3.13 aq, 14.3 alc
difluoride	OF ₂	54.00	2.26 g/L ²⁰	-223.8	-145.3	6.8 mL/100 mL ⁰ aq
(di-) difluoride	O ₂ F ₂	70.00	1.45 ^{bp} (lq)	-154	d - 100	
Ozone	O ₃	48.00	1.998 g/L ²⁰	-192.5	-111.9	49.4 mL/100 mL ⁰ aq
Palladium	Pd	106.42	12.023 ²⁰	1555	3167	s hot HNO ₃ , H ₂ SO ₄
acetate	Pd(C ₂ H ₃ O ₂) ₂	224.49		205 d		i aq, alc; s acet, chl, eth
chloride	PdCl ₂	177.30	4.0 ¹⁸	680	d > 680	s alc, acet, HCl
nitrate	Pd(NO ₃) ₂	230.42		d		s dil HNO ₃
oxide	PdO	122.40	8.70 ²⁰	879 d		s 48% HBr; sl s aqua regia
Perchloryl fluoride	ClO ₃ F	102.46	0.637 g/L	-147.74	-46.67	g/100 mL: 2.86 bz, 2.50 chl, 1.25 CS ₂ ; 0.025 abs alc, 1.0 eth
Phosphorus (white)	P ₄ molecules	123.8950	1.823 ²⁵	44.15	280.3	i aq; ignites in air, 260
(red)	P ₄	123.8950	2.34	597	subl 416	
hydride, see Phosphine						
pentabromide	PBr ₅	430.56	3.46 ²⁰	106 d		d aq; s CCl ₄ , CS ₂
pentachloride	PCl ₅	208.27	2.119 ²⁰	subl 100	166 d	hyd aq; s CCl ₄ , CS ₂
pentafluoride	PF ₅	125.98	5.805 g/L	-93.8	-84.6	hyd aq
pentoxide (dimer)	P ₄ O ₁₀	283.88	2.30	340	subl 360	d aq; s H ₂ SO ₄
pentasulfide	P ₂ S ₅	222.29	2.09	288	514	hyd aq; s alkali; 0.222 ¹⁷ CS ₂
tribromide	PBr ₃	270.73	2.85 ¹⁵	-41.5	173.2	d aq, alc; s acet, CS ₂
trichloride	PCl ₃	137.35	1.575 ²⁰ ₄	-93.6	76.1	d aq, alc; s bz, chl
trifluoride	PF ₃	87.98	3.907 g/L	-151.30	-101.38	hyd aq
trioxide (dimer)	P ₄ O ₆	219.90	2.136 ²⁰ ₄	23.8	173 (N ₂ atm)	hyd aq; s bz, CS ₂
(tetra-) triselenide	P ₄ Se ₃	360.80	1.31	245-246	360-400	flammable in air; s bz, acet, chl, CS ₂
(tetra-) trisulfide	P ₄ S ₃	220.09	2.03 ¹⁷	167	407	100 g/100 mL ¹⁷ CS ₂ ; s toluene

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Phosphine	PH ₃	34.00	1.529 g/L	−133.81	−87.78	mL/100 mL ¹⁷ : 1025 CS ₂ , 726 bz, 319 HOAc, 26 aq; s alc, eth
Phosphonium iodide	PH ₄ I	161.91	2.86	18.5	subl 62.5	d aq
Phosphoryl chloride difluoride	POClF ₂	120.43	1.656 ⁰	−96.4	3.1	
dichloride fluoride	POCl ₂ F	136.89	1.5497 ²⁰	−80.1	52.90	
tribromide	POBr ₃	286.72	2.822	56	191.7 d	s bz, CS ₂ , eth
trichloride	POCl ₃	153.35	1.645 ²⁵	1.25	105	d aq, alc
Platinum	Pt	195.08	21.09 ²⁰	1769	3824	s aqua regia, fused alkali
(II) chloride	PtCl ₂	266.00	5.87	d 581		i aq, alc; s HCl, NH ₄ OH
(IV) chloride	PtCl ₄	336.90	4.303 ²⁵	d 370		143 g/100 mL ²⁵ aq
(VI) fluoride	PtF ₆	309.08	3.826 (lq)	61.3	69.14	
(II) oxide	PtO	211.09	14.91 ⁵	d 550		i aq; s HCl
(IV) oxide	PtO ₂	227.09	10.2	450		i aqua regia
(IV) sulfide	PtS ₂	259.22	7.66	d 225		s HCl, HNO ₃
Plutonium	Pu	239.052	19.816 ²⁰	639.5	3230	i aq; s acids
(III) bromide	PuBr ₃	478.79	6.69	681	d >1300	s aq
(III) chloride	PuCl ₃	345.42	5.70	760	1767	i aq; v s acids
(III) fluoride	PuF ₃	296.06	9.32	1425	d 2000	hyd aq
(IV) fluoride	PuF ₄	315.05	7.00	1037 d		i aq
(VI) fluoride	PuF ₆	353.05	4.86	51.59	62.16	
(II) hydride	PuH ₂	241.08	10.40	ca. 727		
(III) hydride	PuH ₃	242.08	9.61	ca. 327		
(II) oxide	PuO	255.05	13.9	1900		
(III) oxide	Pu ₂ O ₃	526.12	10.2	2085 (in He)		
(IV) oxide	PuO ₂	271.05	11.46	2390 (in He)	d 2800	
(III) sulfide	Pu ₂ S ₃	574.30	9.95	1727		
Polonium	Po	208.9824	9.196 alpha 9.398 beta	254	962	sl s aq; s acids
(IV) chloride	PoCl ₄	350.79		300 (in Cl ₂)	390 (in Cl ₂)	sl hyd aq; v s HCl; s alc, acet
(IV) oxide	PoO	240.98	d 550			v s dilute HCl

Potassium	K	39.0983	0.89	63.38	759	d aq to KOH; s acids
acetate	KC ₂ H ₃ O ₂	98.14	1.57	292		g/100 mL: 200 aq, 34 alc
arsenate	K ₃ AsO ₄	256.21	2.8	1310		19 g/100 mL aq; slowly s glyc; s alc
borate(1-)	KBO ₂	81.91		947	1401	71 g/100 mL ³⁰ aq
bromate	KBrO ₃	167.00	3.27	≈350	d 370	6.9 g/100 mL ²⁰ aq
bromide	KBr	119.00	2.75	734	1435	g/100 mL: 65 ²⁰ aq, 22 glyc, 0.4 alc
carbonate	K ₂ CO ₃	138.21	2.29	901	d to K ₂ O	90 g/100 mL ²⁰ aq; i alc
chlorate	KClO ₃	122.55	2.32	368	d > 400	g/100 mL: 7.3 ²⁰ aq, 2 glyc
chloride	KCl	74.55	1.988	771	1437	g/100 mL: 34 ²⁰ aq, 7 glyc, 0.4 alc
chromate(VI)	K ₂ CrO ₄	194.19	2.732	975		64 g/100 mL ²⁰ aq; i alc
citrate hydrate	K ₃ C ₆ H ₅ O ₇ · H ₂ O	324.42	1.98	anhyd 180	d 230	g/100 mL: 154 aq; 40 glyc
cyanate	KOCN	81.11	2.05	d ≈700		s aq; sl s alc
cyanide	KCN	65.12	1.55	634	1625	g/100 mL: 50 aq, 50 glyc, 4 MeOH
dichromate(VI)	K ₂ Cr ₂ O ₇	294.19	2.67 ⁶²⁵	398	d 500	11.7 g/100 mL ²⁰ aq
dicyanoargentate(I)	K[Ag(CN) ₂]	199.01	2.36			25 g/100 mL ³⁰ aq
dihydrogen arsenate	KH ₂ AsO ₄	180.03	2.867	288		g/100 mL: 19 ⁶ aq, 63 glyc; i alc
dihydrogen phosphate	KH ₂ PO ₄	136.09	2.338	d 400 (KPO ₃)		22.6 g/100 mL ²⁰ aq; i alc
dioxide	KO ₂	71.10	2.14	509	d	v s aq with decomposition
diphosphate(V) 3-water	K ₄ P ₂ O ₇ · 3H ₂ O	384.38	2.33	anhyd 300	mp: 1090	s aq; i alc
disulfate(IV)	K ₂ S ₂ O ₅	222.32				s aq; flammable if ground
disulfate(VI) (pyrosulfate)	K ₂ S ₂ O ₇	254.32	2.28	≈325		s aq
ethyldithiocarbonate	KOCSSC ₂ H ₅	160.30	1.558	d 200		v s aq
fluoride	KF	58.10	2.48	859.9	1505	95 g/100 mL ²⁰ aq
formate	KCHO	84.12	1.91	167.5	d > mp	250 g/100 mL aq
gluconate	KC ₆ H ₁₁ O ₇	234.25		d 180		v s aq; i alc, bz, chl
heptaiodobis-muthate(III)(4-)	K ₄ [BiI ₇]	1253.82				d aq; s alkali iodide solutions
hexachloroplatinate(IV)	K ₂ [PtCl ₆]	485.99	3.50	d 250		0.48 ²⁰ aq
hexacyanoferrate(II) 3-water	K ₄ [Fe(CN) ₆] · 3H ₂ O	422.39	1.85	anhyd 100	d	28 g/100 mL ²⁰ aq
hexacyanoferrate(III)	K ₃ [Fe(CN) ₆]	329.25	1.89	d		40 g/100 mL ²⁰ aq (slow); sl s alc
hexafluorosilicate	K ₂ [SiF ₆]	220.27	2.27	d		sl s aq; i alc
hexafluorozirconate	K ₂ [ZrF ₆]	283.41	3.58			2.7 g/100 mL ²⁰ aq
hexanitritocobaltate(III) 1.5-water	K ₃ [Co(NO ₂) ₆] · 1.5H ₂ O	479.30		d 200		0.089 ¹⁸ aq; s HOAc; v sl s alc
hydride	KH	40.11	1.43	417 d		d aq
hydrogen carbonate	KHCO ₃	100.11	2.17	d > 100		34 g/100 mL ²⁰ aq; i alc

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Potassium (<i>continued</i>)						
hydrogen difluoride	KHF	78.10	2.37	238.80 d to $K_2P_2O_7$	d 477	39 g/100 mL ²⁰ aq; s alc
hydrogen phosphate	K_2HPO_4	174.18		d		150 g/100 mL aq
hydrogen phthalate	$KHC_8H_4O_4$	204.22	1.636			8.3 g/100 mL aq; sl s alc
hydrogen sulfate	$KHSO_4$	136.17	2.24	197	d to $K_2S_2O_7$	48 g/100 mL ²⁰ aq
hydrogen sulfide	KHS	72.17	1.70	≈455		s aq, alc
hydrogen tartrate	$KHC_4H_4O_6$	188.18	1.956			0.5 ²⁰ aq; s acids; v sl s alc
hydroxide	KOH	56.11	2.044	406	1323	g/100 mL: 112 ²⁰ aq, 33 alc, 40 glyc
iodate	KIO_3	214.00	3.89	560 d		8.1 g/100 mL ²⁰ aq; i alc
iodide	KI	166.00	3.12	681	1345	g/100 mL: 144 ²⁰ aq, 4.5 alc, 50 glyc
manganate(VI)	K_2MnO_4	197.13		190 d		s aq; stable in KOH
molybdate(VI)	K_2MoO_4	238.14	2.3	919	d 1400	160 g/100 mL aq
nitrate	KNO_3	101.10	2.11	333	d 400	g/100 mL: 32 ²⁰ aq, 0.16 alc, s glyc
nitrite	KNO_2	85.10	1.915	441	d 350	306 g/100 mL ²⁰ aq; sl s alc
oxalate hydrate	$K_2C_2O_4 \cdot H_2O$	184.23	2.13	anhyd 160	d to K_2CO_3	36 g/100 mL ²⁰ aq
oxide	K_2O	94.20	2.35	350 d		d aq to KOH, s alc
oxobisoxalatodiaquatitanate(IV)	$K_2[TiO(C_2O_4)_2(H_2O)_2]$	354.18				v s aq
perchlorate	$KClO_4$	138.55	2.52	d 400		2.04 ²⁵ aq; 0.0036 ²⁵ BuOH; 0.0013 EtOAc
periodate	KIO_4	230.010	3.618	582		0.42 ²⁰ aq, sl s KOH
permanganate	$KMnO_4$	158.03	2.7	d 240 → O ₂		6.34 g/100 mL ²⁰ aq; d HCl
peroxide	K_2O_2	110.20		490		d aq
peroxodicarbonate hydrate	$K_2C_2O_6 \cdot H_2O$	216.24				6.5 g/100 mL aq; d hot aq
peroxodisulfate	$K_2S_2O_8$	270.32	2.48	d 100		2.5 g/100 mL ²⁰ aq; i alc
perrenate	$KReO_4$	289.30	4.38	555	1370	0.99 ²⁰ aq
phenolsulfonate hydrate	$KC_6H_4(OH)SO_3 \cdot H_2O$	240.28	1.87			s aq, alc
phosphate	K_3PO_4	212.27	2.564 ¹⁷	1340		50.8 g/100 mL ²⁰ aq; i alc
selenocyanate	KSeCN	144.08		d 100		s aq
silicate(2-)	K_2SiO_3	154.29		976		s aq
sodium hexanitritocobaltate(III) hydrate	$K_3Na[Co(NO_2)_6] \cdot H_2O$	454.18	1.633	d 135		0.07 aq

sodium tartrate 4-water	$\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	282.23	1.790	70–80	anhyd 130–140	54 g/100 mL ¹⁵ aq
sorbate	$\text{KC}_6\text{H}_7\text{O}_2$	150.22	1.363 ₃₀ ⁵	d > 270		g/100 mL: 58.2 ²⁰ aq, 6.5 alc
stannate(IV) 3-water	$\text{K}_2\text{SnO}_3 \cdot 3\text{H}_2\text{O}$	298.94	3.197	anhyd 140		100 g/100 mL ²⁰ aq; i alc
stearate	$\text{KOCC}_{17}\text{H}_{35}$	322.57				readily soluble hot aq or alc
sulfate	K_2SO_4	174.26	2.66	1069	1670	g/100 mL: 11 ²⁰ aq, 1.3 glyc, i alc
sulfide	K_2S	110.26	1.74	948		
sulfite 2-water	$\text{K}_2\text{SO}_3 \cdot 2\text{H}_2\text{O}$	194.29		d		28.6 g/100 mL ²⁰ aq
tartrate hemihydrate	$\text{K}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 0.5\text{H}_2\text{O}$	235.28	1.98	anhyd 155	d 200	138 g/100 mL ²⁰ aq
tellurate(IV)	K_2TeO_3	253.79				s aq
tetrachloroaurate(III)	$\text{K}[\text{AuCl}_4]$	377.88	3.75	d 357		61.8 g/100 mL ²⁰ aq
tetrafluoroborate	$\text{K}[\text{BF}_4]$	125.90	2.505 ₄ ²⁰	530		0.45 ²⁰ aq
tetrahydridoborate	$\text{K}[\text{BH}_4]$	53.94	1.11	d 497		g/100 mL: 21 ²⁵ aq, 3.5 ²⁰ MeOH
tetraiodocadmate 2-water	$\text{K}_4[\text{CdI}_4] \cdot 2\text{H}_2\text{O}$	698.21	3.359 ₄ ¹			g/100 mL: 137 ¹⁵ aq, 71 ¹⁵ alc, 4 eth
tetraiodomercurate(II)	$\text{K}_2[\text{HgI}_4]$	786.48				v s aq; s alc, acet, eth
thiocyanate	KSCN	97.18	1.89	173	d 500	g/100 mL: 217 ²⁰ aq, 200 acet, 8 alc
thiosulfate	$\text{K}_2\text{S}_2\text{O}_3$	190.33		d 400		155 g/100 mL ²⁰ aq; i alc
trihydrogen bisoxalate 2-water	$\text{KH}_3(\text{C}_2\text{O}_4) \cdot 2\text{H}_2\text{O}$	254.20	1.836	d		1.8 aq
trioxalatoantimonate(III)	$\text{K}_3[\text{Sb}(\text{C}_2\text{O}_4)_3]$	503.12				a aq
trithiocarbonate	K_2CS_3	186.41	3.296 ¹⁵	d		v s aq
uranyl(VI) acetate hydrate	$\text{K}(\text{UO}_2)(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$	504.28	6.475 α -form	anhyd 275		s aq
Praseodymium chloride	Pr	140.9077	4.0	935	3520	s hot water and acids
(III) oxide	PrCl_3	247.27	7.07	769 to 782	1710	104 g/100 mL ¹³ aq; s alc
	Pr_2O_3	329.81		oxidizes to Pr_6O_{11}		i aq; s acids
(IV)	PrO_2	172.91	6.82	tr 350 to Pr_6O_{11}		
Promethium-147	Pm	146.915	7.22	1080	3000 est	
bromide	PmBr_3	386.7	5.38	727	1667	s aq
chloride	PmCl_3	153.4		737	1670	s aq
Protoactinium	Pa	231.0359	15.37	1568(8)	4227	
(IV) chloride	PaCl_4	372.85	4.72	subl 400		i aq; s HCl
(V) chloride	PaCl_5	408.31	3.74	301	420	hyd aq; s THF, CH_3CN
Radium	Ra	226.03	5.5	700.1	1737	d aq; s acids
bromide	RaBr_2	385.88	5.79	728	subl 900	s aq
chloride	RaCl_2	296.93	4.91	1000		s aq
Radon	Rn	222.0	9.73 g/L	– 71	– 62	23 mL/100 mL ²⁰ aq; s org solv

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Rhenium	Re	186.207	21.02	3180	5678	s HNO ₃
chloride trioxide	ReClO ₃	269.66		4.5	128	hyd in water to HReO ₄ ; s CCl ₄
(IV) fluoride	ReF ₄	262.20	5.38	124.5	795	hyd aq
(VI) fluoride	ReF ₆	300.20	3.58	18.5	33.8	52.5 g/100 mL anhyd HF; s HNO ₃
(VII) fluoride	ReF ₇	319.20	3.65	48.3	73.7	hyd aq
(VI) oxide	ReO ₃	234.20	6.9–7.4	disprop 400	750	s HNO ₃
(VII) oxide	Re ₂ O ₇	484.41	6.1	300.3	360.3	v s aq, org solv
(VII) sulfide	Re ₂ S ₇	596.88	4.866	d 460		i aq; s HNO ₃
(VI) tetrachloride oxide	ReCl ₄ O	344.02	3.309	29.3	225	hyd aq; s CCl ₄
Rhodium	Rh	102.9055	12.41 ²⁰	1963	3727	s fused KHSO ₄
(III) chloride	RhCl ₃	209.26	5.38	d 450		i aq; s KOH, KCN
(III) fluoride	RhF ₃	159.90	5.4	subl 600		i acids, alkalis
(III) oxide	Rh ₂ O ₃	253.81	8.20	d 1100		i aq reg, KOH
tetracarbonyl-di-μ-chloro-dichloride	Rh ₂ (CO) ₄ Cl ₂	388.76		124–125		s org solv except hydrocarbons
Rubidium	Rb	85.4678	1.532	39.31	691	d aq to RbOH
acetate	RbC ₂ H ₃ O ₂	144.52		246		86 g/100 mL ⁴⁵ aq
bromide	RbBr	165.37	3.35	682	1346	108 g/100 mL ²⁰ aq
carbonate	Rb ₂ CO ₃	230.95		837	d 900	g/100 mL: 450 ²⁰ aq, 0.74 ₁₉ alc
chlorate	RbClO ₃	168.94	3.184	342		5.4 g/100 mL ²⁰ aq
chloride	RbCl	120.92	2.76	715	1390	g/100 mL: 91 ²⁰ aq, 1.1 MeOH
dihydrogen phosphate	RbH ₂ PO ₄	182.47		840		s aq
fluoride	RbF	104.47	3.2	833	1410	131 g/100 mL ¹⁸ aq
hexachloroplatinate(IV)	Rb ₆ [PtCl ₆]	578.75	3.94	d		0.028 ²⁰ aq
hydroxide	RbOH	102.47	3.20	301		180 g/100 mL ¹⁸ aq; s alc
iodide	RbI	212.37	3.55	642	1304	163 g/100 mL ²⁵ aq; s alc
nitrate	RbNO ₃	147.47	3.11	305		19.5 g/100 mL ²⁰ aq
oxide	Rb ₂ O	186.93	4.0	400 d		s aq → RbOH
sulfate	Rb ₂ SO ₄	267.00	3.5	1050		48 g/100 mL ²⁰ aq
Ruthenium	Ru	101.07	12.45 ²⁰	2334	4150	s fused alkali, oxidizing fluxes
(III) chloride (hexagonal)	RuCl ₃	207.43	3.11	d > 500		i aq; s HCl, alc
(V) fluoride	RuF ₅	196.06	3.90	86.5	227	d aq
(IV) oxide	RuO ₂	133.07	6.97	d		i aq; s fused alkali

Samarium	Sm	150.36	7.52	1074	1794	s acids
(II) chloride	SmCl ₂	221.27	3.687	855	2030	s aq dec; i alc
(III) chloride	SmCl ₃	256.72	4.46	682	d	93.4 g/100 mL ²⁰ aq
(III) fluoride	SmF ₃	207.36	6.643	1306	2427	i aq; s H ₂ SO ₄
(III) oxide	Sm ₂ O ₃	348.72	8.347	2335		s acids
(III) sulfate 8-water	Sm ₂ (SO ₄) ₃ · 8H ₂ O	733.03	2.93	anhyd 450		2.7 g/100 mL ²⁰ aq
Scandium	Sc	44.956	2.985 hex	1541	2836	d aq
chloride	ScCl ₃	151.31	2.39	967	967	v s aq; i alc
oxide	Sc ₂ O ₃	137.91	3.864	2485		s hot or conc acids
sulfate 5-water	Sc ₂ (SO ₄) ₃ · 5H ₂ O	468.17	2.519	anhyd 250	d 550	54.6 g/100 mL ²⁵ aq
Selenium (hexagonal)	Se	78.96	4.81 ²⁰	217	685	s eth, KOH, KCN; i aq, alc
(IV) bromide	SeBr ₄	398.58	4.029	123		d aq; s HBr, chl, CS ₂
(IV) chloride	SeCl ₄	220.77	2.6	305	subl 196	d aq
(di-) dibromide	Se ₂ Br ₂	317.73	3.604 ¹⁵		225 d	d aq; s chl, CS ₂
dibromide oxide	SeBr ₂ O	254.77	3.38 ⁵⁰	41.6	217 d	d aq
(di-) dichloride	Se ₂ Cl ₂	228.83	2.774 ²⁵	— 85	127 dec	d aq; s bz, chl, CS ₂
dichloride oxide	SeCl ₂ O	165.867	2.44	8.5	177.2	d aq; misc bz, chl, CCl ₄ , CS ₂
difluoride oxide	SeF ₂ O	132.96	2.8	15	125	d aq
(IV) fluoride	SeF ₄	154.95	2.75	— 10	106	reacts aq viol; misc alc, eth; s chl
(VI) fluoride	SeF ₆	192.95	8.467 g/L	— 34.6		
(di-) hexasulfide	Se ₂ S ₆	350.32	2.44	121.5		s CS ₂ ; 1.2 g/100 mL ²⁰ bz
(IV) oxide	SeO ₂	110.96	3.95	340	subl 315	w/w %: 38 ¹⁴ aq, 10 ¹² MeOH, 4.35 acet, 6.7 ¹⁴ EtOH, 1.1 ¹² HOAc; s H ₂ SO ₄
(<i>retra</i> -) tetrasulfide	Se ₄ S ₄	444.10	3.20	113 d		i aq; 0.04 g/100 mL ²⁰ bz; s CS ₂
Silane	SiH ₄	32.12	1.409 g/L	— 185	— 111.9	d aq slowly; i alc, bz, chl, eth
chloro-	SiH ₃ Cl	66.56	2.921 g/L	— 118	— 30.4	
dichloro-	SiH ₂ Cl ₂	101.01	4.432 g/L	— 122	8.3	d aq
iodo-	SiH ₃ I	158.01	2.035	— 57	45.5	d aq
trichloro-	SiHCl ₃	135.45	1.331	— 128	33	d aq; s bz, chl
Silicon	Si	28.0855	2.33	1412	3265	s HF + HNO ₃ , fused alkali oxides
carbide (beta)	SiC	40.10	3.16	2830		s fused alkali oxides
dioxide (α quartz)	SiO ₂	60.08	2.648	573 tr	2950	i aq; s HF
				β quartz		v s aq, alc
dioxide - tungsten trioxide - water (silicotungstic acid)	SiO ₂ · 12WO ₃ · 26H ₂ O	3310.66				
disulfide	SiS ₂	92.22	2.04	1090		s d aq, alc; i bz

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
<i>Silicon (continued)</i>						
tetrabromide	SiBr ₄	347.70	2.81	5.2	154	hyd aq viol
tetrachloride	SiCl ₄	169.90	1.5	-68.8	57.6	hyd aq; s bz, CCl ₄ , eth
tetrafluoride	SiF ₄	104.08	4.567 g/L	-90.3	-86	hyd aq; s HF
tetraiodide	SiI ₄	535.70	4.1	120.5	287.3	d aq; 2.2 g/100 mL ²⁷ CS ₂
(<i>tri</i> -) tetranitride	Si ₃ N ₄	140.28	3.17	1878		i aq; s HF
Silver	Ag	107.8682	10.49	961.78	2164	s HNO ₃
acetate	AgC ₂ H ₃ O ₂	166.91	3.259	d		1.04 ²⁰ aq; s dil HNO ₃
antimonide	Ag ₃ Sb	445.35		559		
azide	AgN ₃	149.89	4.9	exp ~252		i aq; s KCN, HNO ₃ (explosive)
bromide	AgBr	187.77	6.473	432	1500	i aq; s KCN
carbonate	Ag ₂ CO ₃	275.75	6.077	218		0.003 ²⁰ aq; s KCN, HNO ₃ , NH ₄ OH
chlorate	AgClO ₃	191.32	4.430 ²⁰	231	d 270	10 g/100 mL ¹⁵ aq
chloride	AgCl	143.32	5.56	455	1547	i aq; 7.7 g/100 mL NH ₄ OH, KCN, Na ₂ S ₂ O ₃
chromate(VI)	Ag ₂ CrO ₄	331.73	5.625 ²⁵			0.002 ²⁰ aq; s HNO ₃ , NH ₄ OH
cyanide	AgCN	133.89	3.95	320 d		i aq; s KCN
fluoride	AgF	126.87	5.852	435	≈1150	182 g/100 mL ²⁰ aq; s HF, CH ₃ CN
(II) fluoride	AgF ₂	145.87	4.57	690	d 700	hyd viol aq
iodate	AgIO ₃	282.77	5.525 ²⁰	>200	d	0.053 ²⁵ aq; 40 g/100 mL 10% NH ₄ OH
iodide (alpha)	AgI	234.77	5.683 ³⁰	558	1505	i aq; s KCN, KI, (NH ₄) ₂ CO ₃
nitrate	AgNO ₃	169.87	4.352 ¹⁹	212	d 440	g/100 mL: 216 ²⁰ aq, 3.3 alc, 0.4 acet
nitrite	AgNO ₂	153.87	4.453	d > 140		0.33 ²⁵ aq; d dilute acids
oxalate	Ag ₂ C ₂ O ₄	303.76	5.03 ⁴	explodes 140		0.004 ²⁰ aq; s HNO ₃ , NH ₄ OH
oxide	Ag ₂ O	231.73	7.22 ²⁵	d 200 (d light)		0.002 ²⁵ aq; s dil HNO ₃ , NH ₄ OH
(II) oxide	AgO	123.87	7.483 ²⁵	d > 100		i aq; d alk and acids
perchlorate	AgClO ₄	207.32	2.806 ²⁵	d 486		557 g/100 mL ²⁰ aq; s bz, glyc, pyr
permanganate	AgMnO ₄	226.80	4.49	d by light		0.9 aq; d alc

phosphate	Ag_3PO_4	418.62	6.37	849	0.006 aq; v s dil HNO_3 , KCN, $(\text{NH}_4)_2\text{CO}_3$
selenate(IV)	Ag_2SeO_3	342.69	5.93	530	sl s aq; s HNO_3
sulfate	Ag_2SO_4	311.80	5.45	660	0.80 ²⁰ aq (slow); s HNO_3 , NH_4OH , H_2SO_4
sulfide (argentite)	Ag_2S	247.80	7.234 ²⁰	845	i aq; s HNO_3 , alk CN's
Sodium	Na	22.98977	0.968 ²⁰	97.82	d aq to NaOH
acetate	$\text{NaC}_2\text{H}_3\text{O}_2$	82.03	1.528	324	75 g/100 mL ²⁰ aq
acetate 3-water	$\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$	136.08	1.45	anhyd 120	g/100 mL: 125 ²⁰ aq, 5.1 alc
aluminate(1-)	NaAlO_2	81.97	4.63	1650	v s aq; i alc
aluminum sulfate 12-water	$\text{NaAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	458.28	1.61	-60	110 g/100 mL ¹⁵ aq; i alc
amide	NaNH_2	39.01	1.39	210	d > 500, reacts aq viol
ammonium phosphate 4-water	$\text{NaNH}_4\text{HPO}_4 \cdot 4\text{H}_2\text{O}$	209.07	1.54	≈80	14.3 g/100 mL aq
arsenate(III)(1-)	NaAsO_2	129.91	1.87		v s aq; sl s alc
ascorbate	$\text{NaC}_6\text{H}_7\text{O}_6$	198.11		d 218	62 g/100 mL ²⁰ aq
azide	NaN_3	65.01	1.846 ²⁰	d to Na + N ₂	41 g/100 mL ²⁰ aq; 0.3 alc
benzoate	$\text{NaO}_2\text{C}_6\text{H}_5$	144.11		d	g/100 mL: 63 ²⁵ aq; 1.3 alc
bismuthate(V)(1-)	NaBiO_3	279.96		d	i cold aq; dec by hot aq & acids
bismuthide	Na_3Bi	277.95		766	d aq
bromate	NaBrO_3	150.89	3.34	381 d	40 g/100 mL ²⁰ aq; i alc
bromide	NaBr	102.89	3.200 ²⁰	755	g/100 mL: 90 ²⁰ aq, 6 alc; 16 MeOH
carbonate	Na_2CO_3	105.99	2.533 ²⁰	858.1	29 g/100 mL ²⁰ aq; s glyc; i alc
carbonate hydrate	$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$	124.00	2.25	anhyd 100	g/100 mL: 33 aq, 14 glyc; i alc
carbonate 10-water	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	286.14	1.46	34 d	50 g/100 mL aq; s glyc
carbonate - hydrogen	$\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3$	226.02	2.112		13 g/100 mL ⁰ aq
carbonate 2-water (trona)	$\cdot 2\text{H}_2\text{O}$				
chlorate(V)	NaClO_3	106.44	2.5	248	g/100 mL: 96 ²⁰ aq, 0.77 alc, 25 glyc
chloride	NaCl	58.44	2.17	800.8	g/100 mL: 36 ²⁰ aq, 10 glyc
chlorite	NaClO_2	90.44		d 180-200	34 g/100 mL ¹⁷ aq
chromate(VI)	Na_2CrO_4	161.97	2.72	792	84 g/100 mL ²⁰ aq
citrate 2-water	$\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$	294.10		anhyd 150	77 g/100 mL ²⁵ aq; i alc
cyanate	NaOCN	65.01	1.89	550	s aq d; 0.22 ⁰ alc
cyanide	NaCN	49.01	1.6	563	58.7 g/100 mL ²⁰ aq
cyanohydrinborate	$\text{Na}[\text{BH}_3\text{CN}]$	62.84	1.12	>240 d	g/100 mL: 212 aq, 37.2 THF; v s NaOH; i bz, eth

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Sodium (continued)						
dichromate 2-water	$\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$	298.00	2.348 ²⁵	anhyd 100; mp 356	d 400	73.1 g/100 mL ²⁰ aq
diethyldithiocarbamate	$\text{NaS}_2\text{CN}(\text{C}_2\text{H}_5)_2 \cdot 3\text{H}_2\text{O}$	225.31		anhyd 94–96		s aq, alc
dihydrogen arsenate(V) hydrate	$\text{NaH}_2\text{AsO}_4 \cdot \text{H}_2\text{O}$	181.94	2.53	anhyd 130	d 200	s aq
dihydrogen diphos- phate(V)	$\text{Na}_2\text{H}_2\text{P}_2\text{O}_7$	221.94	1.9	d 220		4.5 g/100 mL ⁰ aq
dihydrogen phosphate(V) dihydrate	$\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$	156.01	1.91	anhyd 100	d NaPO_3 , 200	71 g/100 mL ⁰ aq; i alc
dimethylarsenate 3-water (cacodylate)	$\text{NaO}_2\text{As}(\text{CH}_3)_2$	214.03		anhyd 120		g/100 mL: 200 aq, 40 alc
dioxide	NaO_2	54.99		552		
diphosphate(V)	$\text{Na}_4\text{P}_2\text{O}_7$	265.90	2.53	988		2.26 ⁰ aq
dithionate(V) 2-water	$\text{Na}_2\text{S}_2\text{O}_6 \cdot 2\text{H}_2\text{O}$	242.14	2.19	anhyd 110	d 267 to $\text{Na}_2\text{SO}_4 + \text{SO}_2$	13.4 g/100 mL ²⁰ aq; i alc
dithionate(III)	$\text{Na}_2\text{S}_2\text{O}_4$	174.11		d		22 g/100 mL ²⁰ aq; sl s alc i aq; s acids
diuranate(VI)	$\text{Na}_2\text{U}_2\text{O}_7$	634.03				
dodecylbenzenesulfonate	$\text{NaO}_3\text{SC}_6\text{H}_4\text{C}_{12}\text{H}_{25}$	348.49				10 g/100 mL aq d aq; s abs alc
dodecylsulfate	$\text{NaO}_3\text{SOC}_{12}\text{H}_{25}$	288.38				103 g/100 mL aq
ethoxide	NaOC_2H_5	68.06		>300		
ethylenebis(imino- diacetate) (EDTA)	$(\text{NaOOCCH}_2)_2\text{NC}_2\text{H}_4\text{-N}(\text{CH}_2\text{COONa})_2$	380.20				
ethylsulfate	$\text{NaO}_3\text{SOC}_2\text{H}_5$	148.12				140 g/100 mL aq; s alc
fluoride	NaF	41.99	2.78	996	1704	4 g/100 mL ¹⁵ aq; i alc
formate	NaHCO_2	68.01	1.92	253	d >253	81 g/100 mL ²⁰ aq; s glyc; sl s alc
gluconate	$\text{NaC}_6\text{H}_{11}\text{O}_7$	218.14				59 g/100 mL ²⁵ aq; sl s alc; i eth
glycerophosphate	$\text{Na}_2\text{C}_3\text{H}_5(\text{OH})_2\text{PO}_4$	216.04		d >130		67 g/100 mL aq; i alc
hexachloroplatinate(IV) 6-water	$\text{Na}_2[\text{PtCl}_6] \cdot 6\text{H}_2\text{O}$	561.88	2.50	–6H ₂ O, 110		v s aq; s alc

hexacyanoferrate(II) 10-water	$\text{Na}_4[\text{Fe}(\text{CN})_6] \cdot 10\text{H}_2\text{O}$	484.06	1.46	anhyd 82	d 435	28 g/100 mL ²⁰ aq
hexacyanoferrate(III) hydrate	$\text{Na}_3[\text{Fe}(\text{CN})_6] \cdot \text{H}_2\text{O}$	298.93				18.9 g/100 mL ⁰ aq
hexafluoroaluminate	$\text{Na}_3[\text{AlF}_6]$	209.94	2.97	1009		s aq
hexanitrocobaltate(III) hydride	$\text{Na}_3[\text{Co}(\text{NO}_2)_6]$ NaH	403.98 24.00	1.39	425 d		v s aq; sl s alc ign spontaneously moisture; d alc viol
hydrogen arsenate(V) 7-water	$\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$	312.01	1.87	anhyd 130	d 150	61 g/100 mL ¹⁵ aq; s glyc; sl s alc
hydrogen carbonate	NaHCO_3	84.01	2.20			
hydrogen difluoride	NaHF_2	62.00	2.08	to Na_2CO_3 d > 160	270	8 g/100 mL ²⁰ aq; i alc
hydrogen phosphate 7-water	$\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$	268.07	1.7	d		3.7 g/100 mL ²⁰ aq 25 g/100 mL ⁴⁰ aq; v sl s alc
hydrogen sulfate	NaHSO_4	120.06	2.435	315	d	50 g/100 mL ²⁰ aq; d alc
hydrogen sulfide	NaHS	56.06	1.79	350		s aq, alc, eth
hydrogen sulfite	NaHSO_3	104.06	1.48	d		g/100 mL: 29 aq, 1.4 alc
hydroxide	NaOH	40.00	2.130	323	1388	g/100 mL: 108 ²⁰ aq, 14 abs alc, 24 MeOH; s glyc
hydroxymethanesulfinate dihydrate	$\text{Na}[\text{HOCH}_2\text{SO}_2] \cdot 2\text{H}_2\text{O}$	154.12		63–64	d > 64	v s aq; i abs alc, bz, eth
hypochlorite 5-water	$\text{NaClO} \cdot 5\text{H}_2\text{O}$	164.52	1.6	18	d by CO_2 from air	29 g/100 mL ⁰ aq
iodate	NaIO_3	197.89	4.28	d		8.1 g/100 mL ²⁰ aq
iodide	NaI	149.89	3.67	660	1304	g/100 mL: 200 ²⁰ aq, 100 glyc, 50 alc; s acet
lactate	NaOOCCHOHCH_3	112.06		d		misc aq, alc
methoxide	NaOCH_3	54.02		>300		d aq; s alc
molybdate(VI) 2-water	$\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$	241.95	≈3.5	anhyd 100	mp 687	65 g/100 mL ²⁰ aq
nitrate	NaNO_3	85.00	2.26	307	d ≈ 500	g/100 mL: 88 ²⁰ aq, 0.8 alc
nitrite	NaNO_2	69.00	2.17	271	d > 320	67 g/100 mL ²⁰ aq
oxalate	$\text{Na}_2\text{C}_2\text{O}_4$	134.00	2.34	d ≈ 250		3.4 g/100 mL ²⁰ aq; i alc
oxide	Na_2O	61.98	2.27	dull red heat	d > 400	d aq to NaOH violently
pentacyanonitrosylfer- rate(III) 2-water (nitro- prusside)	$\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}] \cdot 2\text{H}_2\text{O}$	297.65	1.72			40 g/100 mL ¹⁶ aq

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Sodium (<i>continued</i>)						
perchlorate	NaClO_4	122.44	2.52	480 d		$\text{g}/100 \text{ mL}^{25}$; 114 aq, 1.5 BuOH, 8.4 EtOAc
periodate	KIO_4	213.89	3.865	d $\approx$ 300		10.3 $\text{g}/100 \text{ mL}^{20}$ aq
peroxide	Na_2O_2	77.98	2.805	675	d	v s aq (dec)
peroxoborate 4-water	$\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$	153.88		d > 60		2.5 $\text{g}/100 \text{ mL}$ aq
peroxodisulfate(VI)	$\text{Na}_2\text{S}_2\text{O}_8$	238.11		d		55 $\text{g}/100 \text{ mL}$ aq; d by alc
perrhenate	NaReO_4	273.19	5.24	300		33 $\text{g}/100 \text{ mL}^{20}$ aq
phosphate	Na_3PO_4	163.94	2.537	1340		12.1 $\text{g}/100 \text{ mL}^{20}$ aq
phosphate 12-water	$\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$	380.12	1.62	73.4	−11H ₂ O, 100 d to PH ₃	28.3 $\text{g}/100 \text{ mL}^{20}$ aq; i alc
phosphinate hydrate	$\text{NaPH}_2\text{O}_2 \cdot \text{H}_2\text{O}$	105.99		anhyd 200		100 $\text{g}/100 \text{ mL}^{20}$ aq; s glyc, alc
propanoate	$\text{NaOOCCH}_2\text{H}_5$	96.06				$\text{g}/100 \text{ mL}^{25}$; 100 aq, 4.1 alc
salicylate	$\text{NaOOCCH}_6\text{H}_4\text{OH}$	160.10				$\text{g}/100 \text{ mL}$; 110 ²⁰ aq, 11 alc, 25 glyc
selenate(VI)	Na_2SeO_4	188.94	3.098			27 $\text{g}/100 \text{ mL}^{20}$ aq
silicate(2−) meta-	Na_2SiO_3	122.06	2.614	1089		s aq; hyd by hot aq; i alc
silicate(2−) 5-water	$\text{Na}_2\text{SiO}_3 \cdot 5\text{H}_2\text{O}$	212.14	1.749	72.2	anhyd 100	v s aq
silicate(4−)	Na_4SiO_4	184.04		1018		s aq
stannate(IV) 3-water	$\text{Na}_2\text{SnO}_3 \cdot 3\text{H}_2\text{O}$	266.71		d 140 (slow)		59 $\text{g}/100 \text{ mL}^{20}$ aq; i alc
stearate	$\text{NaOOC}_{17}\text{H}_{35}$	306.47		d		sl s aq
sulfate	Na_2SO_4	142.04	2.7	8800	d 2227	28 $\text{g}/100 \text{ mL}^{20}$ aq
sulfate 10-water	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	322.20	1.46	32.4	anhyd 100	67 $\text{g}/100 \text{ mL}^{25}$ aq; s glyc; i alc
sulfide	Na_2S	78.05	1.856	1172 vacuo		18.6 $\text{g}/100 \text{ mL}^{20}$ aq; sl s alc
sulfide 9-water	$\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$	240.18	1.43	d $\approx$ 50		200 $\text{g}/100 \text{ mL}$ aq; sl s alc
sulfite	Na_2SO_3	126.04	2.63	d		31 $\text{g}/100 \text{ mL}^{20}$ aq; s glyc; i alc
tartrate dihydrate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 2\text{H}_2\text{O}$	230.08	1.82	anhyd $\sim$ 120		29 $\text{g}/100 \text{ mL}^6$ aq; i alc
tetraborate	$\text{Na}_2\text{B}_4\text{O}_7$	201.22	2.4	742.5		2.6 ²⁰ aq
tetraborate 10-water (bo- rax)	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$	381.37	1.73	75 d	anhyd 320	$\text{g}/100 \text{ mL}$: 6.3 aq, 100 glyc
tetrachloroaluminate	$\text{Na}[\text{AlCl}_4]$	191.78	2.01	151		s aq
tetrachloroaurate	$\text{Na}[\text{AuCl}_4] \cdot 2\text{H}_2\text{O}$	397.80		d > 100		166 $\text{g}/100 \text{ mL}^{27}$ aq; s alc, chl
tetrafluoroborate	$\text{Na}[\text{BF}_4]$	109.82	2.47	384	d	108 $\text{g}/100 \text{ mL}^{27}$ aq
tetrahydridoborate	$\text{Na}[\text{BH}_4]$	37.83	1.074	497	d 315	18 ²⁵ DMF; 16.4 ²⁰ MeOH (reacts)

thiocyanate	NaSCN	81.07		287		134 g/100 mL ²⁰ aq s aq; i alc
thiosulfate	Na ₂ S ₂ O ₃	158.11				70 g/100 mL ²⁰ aq (dec slowly)
thiosulfate 5-water	Na ₂ S ₂ O ₃ · 5H ₂ O	248.19			d > 100	22 g/100 mL aq; i alc
trimetaphosphate 6-water	(NaPO ₃) ₃ · 6H ₂ O	414.04			anhyd 100	88 g/100 mL ⁰ aq; i alc
tungstate(VI) dihydrate	Na ₂ WO ₄ · 2H ₂ O	329.85			mp: 695.6	s hot aq
vanadate(V)	NaVO ₃	121.93				d to Sr(OH) ₂ in water
Strontium	Sr	87.62		757	1366	100 g/100 mL ²⁰ aq
bromide	SrBr ₂	247.43		657	2045	i aq; s acids
carbonate	SrCO ₃	147.63		d 1100 to SrO + CO ₂		
chlorate	Sr(ClO ₃) ₂	254.52		120 d → O ₂		167 g/100 mL ²⁰ aq
chloride	SrCl ₂	158.53		874	1250	52.9 g/100 mL ²⁰ aq
chromate(VI)	SrCrO ₄	203.61		d		0.12 ²⁰ aq; s HCl
fluoride	SrF ₂	125.62		1477	2460	0.011 ²⁰ aq; s hot HCl
hydrogen phosphate	SrHPO ₄	183.60				i aq; s acids
hydroxide	Sr(OH) ₂	121.64		535	– H ₂ O, 744	0.8 ²⁰ aq
iodate	Sr(IO ₃) ₂	437.43				0.03 ¹⁵ aq
iodide	SrI ₂	341.43		402	1773 d	178 g/100 mL ²⁰ aq; s alc
lactate 3-water	Sr(OOCCHOHCH ₃) ₂ · 3H ₂ O	319.81		anhyd 150		33 g/100 mL aq
nitrate	Sr(NO ₃) ₂	211.63		570	645	69.5 g/100 mL ²⁰ aq; sl s alc, acet
oxide	SrO	103.62		2430		0.69 ²⁰ aq
perchlorate	Sr(ClO ₄) ₂	286.52				g/100 mL ²⁵ : 157 aq, 71 BuOH, 77 EtOAc, 90 acet
peroxide	SrO ₂	119.62		215 d		0.018 ²⁰ aq; d hot aq
sulfate	SrSO ₄	183.68		1607		0.013 ²⁰ aq; sl s acid
sulfide	SrS	119.69		2227		sl s aq; s acid (dec)
Sulfinyl bromide (Thionyl)	SOBr ₂	207.87		– 52	140	hyd aq (slow); misc bz, chl, CCl ₄
chloride	SOCl ₂	118.97		– 104.5	76	hyd aq; misc bz, chl, CCl ₄
fluoride	SOF ₂	86.06		– 129.5	– 43.8	hyd aq; s bz, chl, eth
Sulfonyl chloride (Sulfonyl)	SO ₂ Cl ₂	134.97		– 54.1	69.3	hyd aq; misc bz, eth, HOAc
diamide	SO ₂ (NH ₂) ₂	96.11		93	d 250	s aq, hot EtOH, acet
fluoride	SO ₂ F ₂	102.06		– 135.8	– 55.38	mL gas/100 mL: 4 aq, 24 alc, 136 CCl ₄ , 210 toluene
Sulfur (gamma)	S	32.066		106.8	444.72	23 g/100 mL ⁰ CS ₂ ; s alc, bz
(alpha) orthorhombic	S ₈	256.53		tr 94.5 to beta form	444.6	i aq; s organic solvents
(beta) monoclinic tr slowly to rhombic	S ₈	256.53		115.21	444.6	23 g/100 mL ⁰ CS ; s alc, bz

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Sulfur (<i>continued</i>)						
(di-) decafluoride	S ₂ F ₁₀	254.11	2.08	-52.7	30	d fusion with KOH
(di-) dichloride	ClSSCl	135.04	1.688	-77	137	hyd aq; s alc, bz, eth, CS ₂ , CCl ₄
dichloride	SCl ₂	102.97	1.622	-122	59.5	hyd aq
dioxide	SO ₂	64.07	2.811 g/L	-75.47	-10	mL/100 mL: 3937 ²⁰ aq, 25 alc, 32 MeOH; s chl, eth
hexafluoride	SF ₆	146.06	6.409 g/L	-50.8	subl -63.8	sl s aq; s alc, KOH
tetrafluoride	SF ₄	108.06	4.742 g/L	-121.0	-38	d aq viol; v s bz
trioxide (alpha)	SO ₃	80.06		62.3	vp 73mm at 25	stable modification
(beta)	SO ₃	80.06		32.5	vp 344mm at 25	
(gamma)	SO ₃	80.06	1.92	16.8	44.8	v s aq (slow)
Sulfuryl, see Sulfonyl						
Tantalum	Ta	180.9479	16.69	2996	5429	s HF, fused alkali (slowly)
(V) bromide	TaBr ₅	580.47	4.99	265	349	hyd aq; s abs alc, eth
carbide	TaC	192.96	14.3	3880	4780	sl s HF
(di-) carbide	Ta ₂ C	373.91	15.1	3327		
(V) chloride	TaCl ₅	358.21	3.68	216	239.3	hyd aq; s abs alc
diboride	TaB ₂	202.57	11.2	3140		
(V) fluoride	TaF ₅	275.94	4.74 ²⁰	96.8	229.5	s aq, eth, conc HNO ₃
(V) iodide	TaI	815.47	5.80	496	543	hyd aq; s eth
nitride	TaN	194.95	13.7	3090		sl s aq reg; reacts alkalis
(V) oxide	Ta ₂ O ₅	441.89	8.2	1785		s HF; d fused KHSO ₄ or KOH
Technetium-98	Tc	97.9072	11	2157	4265	s HNO ₃ , aq reg, conc H ₂ SO ₄
(VI) fluoride	TcF ₆	212.91	3.0	37.4	55.3	s HCl
(IV) oxide	TcO ₂	130.91	6.9	subl 1000		s acid, alkali
(VII) oxide	Tc ₂ O ₇	309.81		119.5	310.6	s aq
Tellurium	Te	127.60	6.24	449.8	989.9	s HNO ₃ , KOH, conc H ₂ SO ₄
(IV) bromide	TeBr	447.22	4.3	380	≈20 d	s HBr, eth, HOAc
(II) chloride	TeCl ₂	198.51	6.9	208	328	disprop with eth, diox; s acid
(IV) chloride	TeCl ₄	269.41	3.0	225	380	hyd aq; s HCl, abs alc, bz
(IV) fluoride	TeF ₄	203.59		129	d > 195	d aq
(VI) fluoride	TeF ₆	241.59	10.601 g/L	-37.68	subl -38.9	hyd aq, KOH

(IV) iodide	Tel ₄	635.22	5.05	280	hyd aq; s HI, alkali; sl s acet
(IV) oxide	TeO ₂	159.60	5.9	733	s HCl, HF, NaOH
Terbium	Tb	158.9254	8.23	1356	s acids
chloride	TbCl ₃	265.28	4.35	588	v s aq
nitrate 6-water	Tb(NO ₃) ₃ · 6H ₂ O	453.03		89.3	s aq
Thallium	Tl	204.383	11.85	303.5	i aq; s HNO ₃
(I) bromide	TlBr	284.29	7.5	460	0.05 ²⁰ aq; s alc
(I) carbonate	Tl ₂ CO ₃	468.78	7.11	272	4.1 g/100 mL ²⁰ aq; i alc
(I) chloride	TlCl	239.84	7.00	430	0.33 ²⁰ aq; i alc
(I) cyanide	TlCN	230.40	6.523	d	16.8 g/100 mL ²⁸ aq; s alc, acid
(I) ethoxide	TlOC ₂ H ₅	249.44	3.49	-3	s eth; sl s alc; d aq
(I) fluoride	TlF	223.38	8.36	326	78.6% ¹⁵ aq
(III) fluoride	TlF ₃	261.38	8.65	550 d	d aq
(I) iodide (rhombic)	TlI	331.29	7.1	442	i aq, alc; s KI
(I) nitrate	TlNO ₃	266.39	5.55	206	9.55 g/100 mL ²⁰ aq; i alc
(I) oxide	Tl ₂ O	424.77	9.52	579	v s aq; s acid, alc
(III) oxide (hexagonal)	Tl ₂ O ₃	456.77	10.2	834	i aq; d by HCl, H ₂ SO ₄
(I) selenate(VI)	Tl ₂ SeO ₄	551.73	6.875	>400	2.8 g/100 mL ²⁰ aq; i alc, eth
(I) selenide	Tl ₂ Se	487.73	9.05	340	i aq, acid
(I) sulfate	Tl ₂ SO ₄	504.83	6.77	632	4.87 g/100 mL ²⁰ aq
(I) sulfide	Tl ₂ S	440.83	8.39	448	0.02 ²⁰ aq; s mineral acids
Thiocarbonyl chloride	S=CCl	114.98	1.509 ¹⁵	73.5	d aq; s eth
Thiocyanogen	(SCN) ₂	116.16		ca. -2	d aq; s alc, CS ₂ , eth
Thionyl, see Sulfenyl					
Thiophosphoryl tribromide	PSBr ₃	302.78	2.85 ¹⁷	209 d	s aq, eth, CS ₂
trichloride (alpha)	PSCl ₃	169.41	1.635	125	hyd aq; s bz, chl, CS ₂
trifluoride	PSF ₃	120.03		-52.2	
Thiosulfenyl difluoride	S=SF ₂	102.13		-10.6	
Thorium	Th	232.038	11.7	1750	hyd aq
chloride	ThCl ₄	373.85	4.59	770	s acids
fluoride	ThF ₄	308.03	6.1	1110	s aq, alc
iodide	ThI ₄	739.66	6.00	570	s acids
nitrate	Th(NO ₃) ₄	400.06		d 630, ThO ₂	hyd aq
oxide	ThO ₂	264.04	10.0	3390	191 g/100 mL ²⁰ aq; v s alc
sulfate 9-water	Th(SO ₄) ₂ · 9H ₂ O	586.30	2.77	anhyd 400	s hot H ₂ SO ₄
Thullium	Tm	168.9342	9.32	1545	1.57 g/100 mL ²⁵ aq
chloride	TmCl ₃	275.29		824	s acids
fluoride	TmF ₃	225.93	7.971	1158	s aq, alc
					s H ₂ SO ₄

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Tin (white)	Sn	118.710	7.265	231.928	2602	s conc HCl, hot H ₂ SO ₄
(II) acetate	Sn(C ₂ H ₃ O ₂) ₂	236.80	2.31	182.5	240	d aq; s dilute HCl
(II) bromide	SnBr ₂	278.52	5.12	215	639	85 g/100 mL ⁰ aq; s alc, eth
(IV) bromide	SnBr ₄	438.33	3.34	31	205	v a (hyd) aq; s acet, alc
(II) chloride	SnCl ₂	189.61	3.90	246.9	623	84 g/100 mL ⁰ aq; s acet, alc, eth
(IV) chloride	SnCl ₄	260.52	2.234	-3.3	114.1	s aq (hyd), alc, acet, bz, eth
(II) fluoride	SnF ₂	156.71	4.57	213	850	30% aq
(IV) fluoride	SnF ₄	194.70	4.78		subl 705	hyd aq
hexafluorozirconate	Sn[ZrF ₆]	323.92	4.21			s aq
(II) iodide	SnI ₂	372.52	5.285	320	714	0.98 ²⁰ aq (d); s bz, chl, alk Cl ⁻ or I ⁻
(IV) iodide	SnI ₄	626.33	4.46	143	364	hyd aq; s alc, bz, chl, eth, CCl ₄ , CS ₂
(II) oxalate	SnC ₂ O ₄	206.73	3.56	280 d		s dilute HCl
(II) oxide	SnO	134.71	6.45	to SnO ₂ , 300		s acids, conc KOH
(IV) oxide	SnO ₂	150.71	6.95	1630		s hot conc KOH (slow)
(II) selenide	SnSe	197.67	6.179	861		s aqua regia, alkali sulfides
(II) sulfate	SnSO ₄	214.77	4.15	to SnO ₂ , 378		18.9 g/100 mL ²⁰ aq; s dilute H ₂ SO ₄
(II) sulfide	SnS	150.78	5.08	880	1210	s conc HCl, hot conc H ₂ SO ₄
(IV) sulfide	SnS ₂	182.84	4.5	d 600		s aq reg, alkali hydroxides & sul- fides
(II) telluride	SnTe	246.31	6.5	790		i aq
Titanium (hexagonal)	Ti	47.867	4.506	1668	3287	s hot acid, HF
(III) bromide	TiBr ₃	287.58	4.24		subl 794	
(IV) bromide	TiBr ₄	367.48	3.37	39	230	hyd aq; 187 g/100 mL abs alc
(II) chloride	TiCl ₂	118.77	3.13	1035	1500	d aq; s alc
(III) chloride	TiCl ₃	154.23	2.64	425 d		s aq (heat evolved), alc
(IV) chloride	TiCl ₄	189.68	1.73	-25	136.4	s cold aq, alc
dihydride	TiH ₂	49.88	3.752	d 450		
(IV) fluoride	TiF ₄	123.86	2.798	>400	subl 285.5	s aq (slow hyd); s alc, pyr
(IV) iodide	TiI ₄	555.49	4.3	150	377	s dry nonpolar solvents
(IV) isopropoxide	Ti[OCH(CH ₃) ₂] ₄	284.22	0.9711 ⁴⁰	~20	220	d aq; s bz, chl, eth
(II) oxide	TiO	63.87	4.95	1750	3660	s H ₂ SO ₄

(III) oxide	Ti ₂ O ₃	143.73	4.486	1842	s H ₂ SO ₄ , hot HF
(IV) oxide (rutile)	TiO ₂	79.87	4.23	1843	s HF, hot conc H ₂ SO ₄
oxide sulfate	TiOSO ₄	159.94			d aq
(III) sulfate	Ti ₂ (SO ₄) ₃	383.93			s dilute HCl, dilute H ₂ SO ₄
Tungsten	W	183.84	19.25	3387	s HNO ₃ + HF, fusion NaOH + NaNO ₃
(V) bromide	WBr ₅	583.36		286	hyd aq; s chl, eth
(VI) bromide	WBr ₆	663.26	6.9	309	hyd aq; s eth CS ₂
(V) chloride	WCl ₅	361.10	3.875	242	hyd aq
(VI) chloride	WCl ₆	396.56	3.52	279	hyd aq; s CS ₂ , CCl ₄
dichloride dioxide	WCl ₂ O ₂	286.74	4.67	265	hyd aq; s HCl
(VI) fluoride	WF ₆	297.83	3.441	2.3	hyd aq; s anhyd HF
(IV) oxide	WO ₂	215.84	10.8	1550	s acids, KOH
(VI) oxide	WO ₃	231.84	7.16	1472	i aq; s hot alkali
(IV) sulfide	WS ₂	247.97	7.6	d 1250	s HNO ₃ + HF
tetrachloride oxide	WCl ₄ O	341.65	11.92	211	hyd aq
tetrafluoride oxide	WF ₄ O	275.83	5.07	106	s acid
Uranium	U	238.0289	19.1	1135	v s aq
(IV) bromide	UBr ₄	557.65	5.55	519	v s aq
(III) chloride	UCl ₃	344.39	5.51	837	v s aq
(IV) chloride	UCl ₄	379.84	4.725	590	v s aq (d); s polar org solvents
(V) chloride	UCl ₅	415.29		287	d aq; s CS ₂
(VI) chloride	UCl ₆	450.75	3.6	177	hyd aq; s chl
(IV) fluoride	UF ₄	314.02	6.70	1036	s conc acids (d); alk (d)
(VI) fluoride	UF ₆	352.02	5.09	64.0	hyd aq; s chl, CCl ₄
(III) hydride	UH ₃	241.05	11.1		i aq
(IV) iodide	UI ₄	745.65	5.6	506	s aq
(IV) oxide (pitchblende)	UO ₂	270.03	10.97	2827	s conc HNO ₃
(VI) oxide	UO ₃	286.03	7.29	d 1300	i aq; s HCl, HNO ₃
octaoxide [(V, VI) oxide]	U ₃ O ₈	842.08	8.38	d 1300 to UO ₂	s HNO ₃
peroxide 2-water	UO ₄ · 2H ₂ O	338.06		d 90–195 to U ₂ O ₇ (slow)	d by HCl
Uranyl(VI) acetate 2-water	UO ₂ (C ₂ H ₃ O ₂) ₂ · 2H ₂ O	422.13	2.893	anhyd 110	7.7 g/100 mL ¹⁵ aq; sl s alc
chloride	UO ₂ Cl ₂	340.93	5.43	577	320 g/100 mL ¹⁸ aq; s acet, alc
fluoride	UO ₂ F ₂	308.03	6.37	d 300	v s aq
nitrate 6-water	UO ₂ (NO ₃) ₂ · 6H ₂ O	502.13	2.807	60	155 g/100 mL ²⁰ aq; v s alc, eth
sulfate 3-water	UO ₂ SO ₄ · 3H ₂ O	420.14	3.28	d 100	g/100 mL: 21 aq, 4 alc

TABLE 3.2 Physical Constants of Inorganic Compounds (*Continued*)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Vanadium	V	50.9415	6.11 ¹⁹	1917	3421	s HF, HNO ₃ , hot H ₂ SO ₄ , aq reg
(IV) chloride	VCl ₄	192.75	1.82	-25.7	148	hyd aq; s nonpolar solvents
dichloride oxide	VCl ₂ O	137.86	2.88	disprop 384		hyd (slow) aq; s abs alc, HOAc
(III) fluoride	VF ₃	107.94	3.363	≈1400	subl 800	i almost all organic solvents
(IV) fluoride	VF ₄	126.94	3.15	subl 120 (vac) & disprop		s aq, acet, HOAc
(V) fluoride	VF ₅	145.93	2.50	19.5	48	hyd aq; v s anhyd HF, acet, alc
(II) oxide	VO	66.94	5.76	1790		s HCl
(III) oxide	V ₂ O ₃	149.88	4.87	1940		sl s acids
(IV) oxide	VO ₂	82.94	4.34	1967		s acids, alkalis
(V) oxide	V ₂ O ₅	181.88	3.35	670	d 1800	0.07 aq; s conc acids, alkalis
(IV) oxide sulfate	VOSO ₄	163.00		410 (vac)		s aq
(III) sulfate	V ₂ (SO ₄) ₃	390.07		d 600		s (slow) aq, HNO ₃
(III) sulfide	V ₂ S ₃	198.08	4.72			s hot acids, alkali sulfides
Xenon	Xe	131.29	5.761 g/L	-111.8	-108.04	10.8 mL/100 mL ²⁰ aq
difluoride	XeF ₂	169.29	4.32	129.0	subl 114.3	2.5 g/100 mL ⁹ aq
hexafluoride	XeF ₆	245.28	3.56	49.5	75.6	hyd aq
tetrafluoride	XeF ₄	207.28	4.04	117.1	subl 115.7	hyd aq; s F ₃ CCOOH
trioxide	XeO ₃	179.29	4.55	explodes 25		s aq giving xenic acid
Ytterbium	Yb	173.04	6.90	819	1196	s acids
(II) chloride	YbCl ₂	243.95	5.27	721	1930	s aq
(III) chloride 6-water	YbCl ₃ · 6H ₂ O	387.49	2.57	anhyd 180	mp: 865	v s aq
(III) fluoride	YbF ₃	230.04	8.17	1157	2230	s H ₂ SO ₄
(III) nitrate 4-water	Yb(NO ₃) ₃ · 4H ₂ O	431.12		2435		s aq
(III) oxide	Yb ₂ O ₃	394.08	9.18			s dilute acids
(III) sulfate 8-water	Yb ₂ (SO ₄) ₃ · 8H ₂ O	778.39	3.3			34.8 g/100 mL ²⁰ aq
Yttrium	Y	88.9059	4.472	1522	3345	s hot water (d)
chloride	YCl ₃	195.26	2.61	721	1510	79 g/100 mL ²⁰ aq; s alc
fluoride	YF ₃	145.90	4.0	1152	2230	s conc acids (d)

nitrate 6-water	$\text{Y}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$	383.01	2.68	$-3\text{H}_2\text{O}$, 100	4300	171 g/100 mL ²⁰ aq
oxide	Y_2O_3	225.81	5.03	2440		s acids
sulfate 8-water	$\text{Y}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$	610.12	2.56	anhyd 400	d > 1000	9.6 g/100 mL ²⁰ aq
Zinc	Zn	65.39	7.14	419.527	907	i aq; s acids, alkalis (slow)
acetate dihydrate	$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$	219.51	1.735	237 d		g/100 mL: 41.6 ²⁰ aq, 3.3 alc
arsenate(III)(1-)	$\text{Zn}(\text{AsO}_2)_2$	279.23				s acids
arsenate(V)(3-) 8-water	$\text{Zn}_3(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$	618.13	3.33		697	s acids and alkalis
bromide	ZnBr_2	225.20	4.5	394		g/100 mL: 471 ²⁵ aq, 200 alc; s KOH, eth
carbonate	ZnCO_3	125.40	4.4	$-\text{CO}_2$, 300		0.02 ²⁵ aq; s acids, KOH, NH_4 salts
chloride	ZnCl_2	136.29	2.907	290	732	g/100 mL: 395 ²⁰ aq, 77 alc, 50 glyc; v s acet
chromate(VI)	ZnCrO_4	181.39	3.40			s acids
cyanide	$\text{Zn}(\text{CN})_2$	117.43	1.852	d 800	1500	0.058 ¹⁸ aq; s acids, KCN, KOH
fluoride	ZnF_2	103.39	4.9	872		s HNO_3 , HCl, NH_4OH
hexafluorosilicate 6-water	$\text{Zn}[\text{SiF}_6] \cdot 6\text{H}_2\text{O}$	315.56	2.104	d 100		v s aq
iodate	$\text{Zn}(\text{IO}_3)_2$	415.20	5.063	d	625 d	0.87 ²⁰ aq; s HNO_3 , KOH
iodide	ZnI_2	319.20	4.74	446		g/100 mL: 332 ²⁰ aq, 50 glyc; v s alc
nitrate 6-water	$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$	297.49	2.067	$-6\text{H}_2\text{O}$, 131		146 g/100 mL ⁰ aq; v s alc
oxide	ZnO	81.39	5.60	1975		i aq; s acids, KOH, NH_4OH
peroxide	ZnO_2	97.39	1.57	d > 150	explodes 212	d (slow) aq; s dilute acids (d)
1,4-phenolsulfonate 8-water	$\text{Zn}[\text{C}_6\text{H}_4(\text{OH})\text{SO}_3]_2 \cdot 8\text{H}_2\text{O}$	555.84		anhyd 120		g/100 mL: 63 aq, 56 alc
phosphate(V)	$\text{Zn}_3(\text{PO}_4)_2$	386.11	3.998	900		s acids, NH_4OH
phosphide	Zn_3P_2	258.12	4.55	420	1100	d aq, HCl (viol); s bz, CS_2
propionate	$\text{Zn}(\text{C}_3\text{H}_5\text{O}_2)_2$	211.53				32% ¹⁵ aq; 2.8% ¹⁵ alc
selenide	ZnSe	144.35	5.65	> 1100		d dilute HNO_3
silicate(2-)	Zn_2SiO_4	222.86	4.10	1512		i aq or dilute acids
stearate	$\text{Zn}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2$	632.34	1.095	130		d dil acids; s bz; i aq, alc, eth
sulfate	ZnSO_4	161.45	3.8	680 d		53.8% ²⁰ aq
sulfate 7-water	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$	287.56	1.97	anhyd 280	d > 500	g/100 mL: 167 aq, 40 glyc; i alc
sulfide (wurzite)	ZnS	97.46	4.09	1722		i aq; s dilute mineral acids
telluride	ZnTe	192.99	6.34	1239		d (slow) aq or dilute HCl
thiocyanate	$\text{Zn}(\text{SCN})_2$	181.56				0.14 aq; s alc

TABLE 3.2 Physical Constants of Inorganic Compounds (Continued)

Name	Formula	Formula weight	Density	Melting point, °C	Boiling point, °C	Solubility in 100 parts solvent
Zirconium	Zr	91.224	6.52	1852	3577	s aq reg, HF, hot H ₃ PO ₄ , fusion with KOH + KNO ₃
(IV) bromide	ZrBr ₄	410.84	3.98	450	subl 357	
carbide	ZrC	103.23	6.73	3532	5100	sl s conc H ₂ SO ₄
(II) chloride	ZrCl ₂	162.13	3.6	727	1292	d aq
(IV) chloride	ZrCl ₄	233.03	2.80	437 (25 atm)	subl 334	hyd aq to ZrCl ₂ O; s alc, eth
diboride	ZrB ₂	112.85	6.17	3245	d 4193	
dichloride oxide 8-water	ZrCl ₂ O · 8H ₂ O	322.25	1.91	anhyd 210	d 410	v s aq, alc
dihydride	ZrH ₂	93.24	5.61			i aq
(IV) fluoride	ZrF ₄	167.22	4.436	932 ^{ip}	subl 912	1.32 g/100 mL ²⁰ aq
(IV) hydroxide	Zr(OH) ₄	159.25	3.25	to ZrO ₂ , 500		s mineral acids
(IV) iodide	ZrI ₄	598.84		499 (sealed tube)	subl 432.5	s aq (d), eth
(IV) nitrate 5-water	Zr(NO ₃) ₄ · 5H ₂ O	429.32		d 100		v s aq; s alc
(IV) oxide	ZrO ₂	123.22	5.68	2678	4300	s hot H ₂ SO ₄ , HF (slow)
(IV) silicate(4-)	ZrSiO ₄	183.31	4.56	d 1540 to ZrO ₂ + SiO ₂		unaffected by aqueous reagents
sulfate 4-water	Zr(SO ₄) ₂ · 4H ₂ O	355.41	2.80	anhyd 380		52.5 g/100 g aqueous solution