

CID 5362487

Sulfur

Chemical and Physical Properties



1.1 Computed Properties



Property Name	Property Value	Reference
Molecular Weight	32.07	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	0.5	Computed by XLogP3 3.0 (PubChem release 2021.05.07)
Hydrogen Bond Donor Count	0	Computed by Cactvs 3.4.8.18 (PubChem release 2021.05.07)
Hydrogen Bond Acceptor Count	1	Computed by Cactvs 3.4.8.18 (PubChem release 2021.05.07)
Rotatable Bond Count	0	Computed by Cactvs 3.4.8.18 (PubChem release 2021.05.07)
Exact Mass	31.97207117	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	31.97207117	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	1 Å ²	Computed by Cactvs 3.4.8.18 (PubChem release 2021.05.07)
Heavy Atom Count	1	Computed by PubChem
Formal Charge	0	Computed by PubChem
Complexity	0	Computed by Cactvs 3.4.8.18 (PubChem release 2021.05.07)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2021.05.07)

[▶ PubChem](#)

1.2 Experimental Properties



1.2.1 Physical Description



Sulfur, molten appears as a pale yellow crystalline solid with a faint odor of rotten eggs. Insoluble in [water](#). A fire and explosion risk above 450° F. Transported as a yellow to red liquid. Handled at elevated temperature (typically 290°F) to prevent solidification and makes transfers easier. Hot enough that plastic or rubber may melt or lose strength. Causes thermal burns to skin on contact. Cools rapidly and solidifies if released. Equipment designed to protect against ordinary chemical exposure is ineffective against the thermal hazard. Exercise caution walking on the surface of a spill to avoid breakthrough into pockets of molten [sulfur](#) below the crust. Do not attempt to remove [sulfur](#) impregnated clothing because of the danger of tearing flesh if a burn has resulted. May be irritatin to skin, eyes and

mucous membranes. Used in [sulfuric acid](#) production, petroleum refining, and pulp and paper manufacturing.

▶ [CAMEO Chemicals](#)

DryPowder; DryPowder, PelletsLargeCrystals; GasVapor; Liquid; OtherSolid; PelletsLargeCrystals; PelletsLargeCrystals, Liquid; PelletsLargeCrystals, WetSolid; WetSolid

▶ [EPA Chemicals under the TSCA](#)

YELLOW SOLID IN VARIOUS FORMS.

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.2 Color/Form



Pure [sulfur](#) exists in two stable crystalline forms, alpha and beta, and at least two amorphous (liquid) forms. Alpha-[sulfur](#): rhombic, octahedral, yellow crystals; beta-[sulfur](#): monoclinic, prismatic, pale-yellow crystals

Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 15th Edition. John Wiley & Sons, Inc. New York, NY 2007., p. 1191

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Yellow orthorhombic crystals /[Sulfur](#) (rhombic) (alpha)/

Hide, D.R. CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Yellow monoclinic needles, stable 95.3-120 °C /[Sulfur](#) (monoclinic) (beta)/

Hide, D.R. CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Yellow solid or amber-colored molten liquid.

Ashford, R.D. Ashford's Dictionary of Industrial Chemicals. London, England: Wavelength Publications Ltd., 1994., p. 853

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.3 Odor



Pure [sulfur](#) is odorless, but traces of hydrocarbon impurity may impart an oily and/or rotten egg odor

U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.4 Taste



Faint taste

Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996., p. 1535

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Tasteless

Seiler, H.G., H. Sigel and A. Sigel (eds.). *Handbook on the Toxicity of Inorganic Compounds*. New York, NY: Marcel Dekker, Inc. 1988., p. 649

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.5 Boiling Point



832.3 °F at 760 mm Hg (USCG, 1999)

U.S. Coast Guard. 1999. *Chemical Hazard Response Information System (CHRIS) - Hazardous Chemical Data. Commandant Instruction 16465.12C*. Washington, D.C.: U.S. Government Printing Office.

▶ [CAMEO Chemicals](#)

444.61 °C

Lide, D.R. *CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008*. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

445 °C

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.6 Melting Point



251 °F (USCG, 1999)

U.S. Coast Guard. 1999. *Chemical Hazard Response Information System (CHRIS) - Hazardous Chemical Data. Commandant Instruction 16465.12C*. Washington, D.C.: U.S. Government Printing Office.

▶ [CAMEO Chemicals](#)

95.3 °C /(Sulfur rhombic transforms to monoclinic)/; 115.21 °C /Sulfur (monoclinic)/

Lide, D.R. *CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008*. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Ignites in air above 261 °C, in [oxygen](#) below 260 °C, burning to the dioxide; combines readily with [hydrogen](#); combines in the cold with [fluorine](#), [chlorine](#), and [bromine](#); combines with [carbon](#) at high temperatures; reacts with [silicon](#), [phosphorus](#), [arsenic](#), [antimony](#) and [bismuth](#) at their melting points; combines with nearly all metals; with [lithium](#), [sodium](#), [potassium](#), [copper](#), [mercury](#) and [silver](#) in the cold on contact with the solid; with [magnesium](#), [zinc](#) and [cadmium](#) very slightly in the cold, more readily on heating; with other metals at high temperatures. Does not react with [iodine](#), [nitrogen](#), [tellurium](#), [gold](#), [platinum](#) and [iridium](#).

O'Neil, M.J. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

MP: 106.8 °C /gamma-Sulfur/

O'Neil, M.J. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

120 °C (amorphous)

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.7 Flash Point



405 °F (USCG, 1999)

U.S. Coast Guard. 1999. *Chemical Hazard Response Information System (CHRIS) - Hazardous Chemical Data*. Commandant Instruction 16465.12C. Washington, D.C.: U.S. Government Printing Office.

▶ [CAMEO Chemicals](#)

405 °F (207 °C) (Closed cup)

National Fire Protection Association; *Fire Protection Guide to Hazardous Materials*. 14TH Edition, Quincy, MA 2010, p. 325-104

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

160 °C c.c.

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.8 Solubility



Insoluble in [water](#); slightly soluble in [ethanol](#), [benzene](#), [ethyl ether](#); soluble in [carbon disulfide /Sulfur](#) (rhombic)/

Lide, D.R. *CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008*. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Insoluble in [water](#); slightly soluble in [ethanol](#), [benzene](#), [ethyl ether](#); soluble in [carbon disulfide /Sulfur](#) (monoclinic)/

Lide, D.R. *CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008*. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Insoluble in [water](#). Sparingly soluble in alcohol, in ether; soluble in [carbon disulfide](#) (one gram/2 mL), in [toluene](#)

O'Neil, M.J. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Liquid [ammonia](#) (anhydrous) dissolves 38.5% [sulfur](#) at -78 °C; [acetone](#) dissolves 2.65% at 25 °C; [methylene iodide](#) dissolves 9.1% at 10 °C; [chloroform](#) dissolves about 1.5% at 18 °C

O'Neil, M.J. (ed.). *The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Soluble in [carbon disulfide](#), [benzene](#), warm [aniline](#) and [carbon tetrachloride](#), and liquid [ammonia](#).

Environment Canada; Tech Info for Problem Spills: Sulphur (Draft) p.5 (1981)

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Solubility in water: none

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.9 Density



1.8 at 248 °F (USCG, 1999)

U.S. Coast Guard. 1999. Chemical Hazard Response Information System (CHRIS) - Hazardous Chemical Data. Commandant Instruction 16465.12C. Washington, D.C.: U.S. Government Printing Office.

▶ [CAMEO Chemicals](#)

2.07 g/cu cm ([Sulfur](#) (rhombic)); 2.00 ([Sulfur](#) (monoclinic)/

Lide, D.R. CRC Handbook of Chemistry and Physics 88TH Edition 2007-2008. CRC Press, Taylor & Francis, Boca Raton, FL 2007, p. 4-92

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Amber-colored crystals. The stable at ordinary temperature, density: 2.06; when heated to 94.5 °C becomes opaque owing to formation of monoclinic [sulfur](#) /alpha-[Sulfur](#)/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Opaque, light- yellow, brittle, needle-like crystals; stable between 94.5 to 120 °C. Passes slowly into the rhombic form on standing; density 1.96; mp 115.21 °C /beta-[Sulfur](#)/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

2.1 g/cm³

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.10 Vapor Density



Density of vapor/density of air, 470 °C: 7.837

Nehb W, Vydra K; Ullmann's Encyclopedia of Industrial Chemistry. 7th ed. (1999-2011). New York, NY: John Wiley & Sons; Sulfur. Online Posting Date: 15 Dec 2006

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.11 Vapor Pressure



3.95X10⁻⁶ mm Hg at 30.4 °C

Ashford, R.D. *Ashford's Dictionary of Industrial Chemicals*. London, England: Wavelength Publications Ltd., 1994., p. 934

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.12 Stability/Shelf Life



Preparations containing [sulfur](#) may react with metals including [silver](#) and [copper](#), resulting in discoloration of the metal.

American Society of Health-System Pharmacists 2011; *Drug Information* 2011. Bethesda, MD. 2011

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.13 Autoignition Temperature



450 °F (USCG, 1999)

U.S. Coast Guard. 1999. *Chemical Hazard Response Information System (CHRIS) - Hazardous Chemical Data*. Commandant Instruction 16465.12C. Washington, D.C.: U.S. Government Printing Office.

▶ [CAMEO Chemicals](#)

450 °F (232 °C)

National Fire Protection Association; *Fire Protection Guide to Hazardous Materials*. 14TH Edition, Quincy, MA 2010, p. 325-104

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

232 °C

▶ [ILO International Chemical Safety Cards \(ICSC\)](#)

1.2.14 Viscosity



Dynamic viscosity of liquid (Pa.s): 0.17 at 120 °C; 0.008 at 140 °C; 0.0064 at 158 °C; 5.952 at 160 °C; 86.304 at 180 °C; 93.0 at 187.8 °C; 78.864 at 200 °C; 3.72 at 300 °C

Nehb W, Vydra K; *Ullmann's Encyclopedia of Industrial Chemistry*. 7th ed. (1999-2011). New York, NY: John Wiley & Sons; Sulfur. Online Posting Date: 15 Dec 2006

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.15 Corrosivity



[Sulfur](#) is not considered corrosive to the usual construction materials. However, acid-generating impurities, which may be introduced in handling and storage, create corrosive conditions.

Staff; *Kirk-Othmer Encyclopedia of Chemical Technology*. (1999-2011). New York, NY: John Wiley & Sons; Sulfur. Online Posting Date: 14 Jul 2006

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.16 Heat of Combustion



-4.741 BTU/lb = -2,634 cal/g = -110.3x10+5 J/kg

U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.17 Heat of Vaporization



120 BTU/lb = 69 cal/g = 2.9x10+5 J/kg

U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.18 Surface Tension



58.1 mN/m at 125 °C; 52.3 mN/m at 200 °C; 47.0 mN/m at 300 °C; 41.1 mN/m at 400 °C

Nehb W, Vydra K; Ullmann's Encyclopedia of Industrial Chemistry. 7th ed. (1999-2011). New York, NY: John Wiley & Sons; Sulfur. Online Posting Date: 15 Dec 2006

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.19 Refractive Index



Index of refraction: 1.947 /alpha/; 2.038 /beta/

Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 15th Edition. John Wiley & Sons, Inc. New York, NY 2007., p. 1191

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

1.2.20 Other Experimental Properties



Atomic Number 16; Valences 2, 4, 6

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Mol wt approx 200,000; insoluble in solvents used for orthorhombic form; amorphous form; metastable, gradually reverts to alpha-form /Polymeric [sulfur](#)/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1539

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Sublimed and washed [sulfur](#) are in form of fine, yellow crystalline powder /[Sulfur](#), pharmaceutical/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2006., p. 1540

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Liquid-[water](#) interfacial tension: (est) 50 dynes/cm = 0.05 N/m at 127 °C; ratio of specific heats of vapor (gas): 1.582

(est)

U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

For more Other Experimental Properties (Complete) data for [Sulfur, Elemental](#) (13 total), please visit the [HSDB record page](#).

▶ [Hazardous Substances Data Bank \(HSDB\)](#)

Occurs in ... various molecular aggregations /allotropes/ which differ in solubility, specific gravity, crystalline form, etc. ... [Sulfur](#) also exhibits dynamic allotropy, ie, the various allotropes exist together in equilibrium in definite proportions, depending on the temperature and pressure. [Sulfur](#) crystalizes in at least two distinct systems: the rhombic and monoclinic forms. Rhombic [sulfur](#) is stable at atmospheric pressures up to 95.5 °C ... Monoclinic [sulfur](#) is then stable up to its natural melting point of 114.5 °C

Staff; Kirk-Othmer Encyclopedia of Chemical Technology. (1999-2011). New York, NY: John Wiley & Sons; Sulfur. Online Posting Date: 14 Jul 2006

▶ [Hazardous Substances Data Bank \(HSDB\)](#)