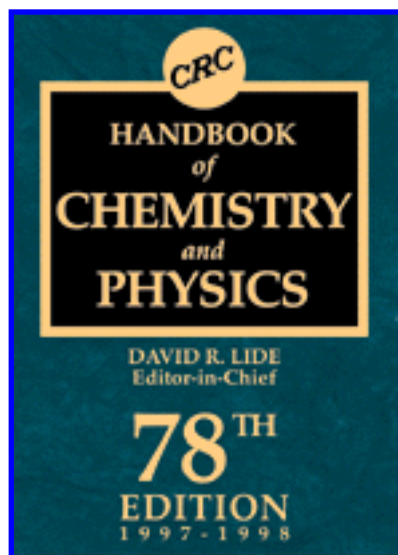


Chemical Fact Sheet

Oxygen

Chemical Abstract Number (CAS #)	7782-44-7
Synonyms	Liquid-oxygen-; LOX-; MOLECULAR-OXYGEN-; OXYGEN-MOLECULE-; Oxygen,-liquified-; OXYGEN-16; PURE-OXYGEN-; Hyperoxia-; Oxigeno- (Spanish); Oxygene- (French)
Analytical Methods	SM4500-O
Molecular Formula	O
Synopsis	<p>Oxygen - (Gr. oxys, sharp, acid, and genes, forming; acid former), O; at. wt. 15.9994(3); at. no. 8; t.p. -218.7916 deg C; b.p. -182.95 deg C; valence 2. For many centuries, workers occasionally realized air was composed of more than one component. The behavior of oxygen and nitrogen as components of air led to the advancement of the phlogiston theory of combustion, which captured the minds of chemists for a century. Oxygen was prepared by several workers, including Bayen and Borch, but they did not know how to collect it, did not study its properties, and did not recognize it as an elementary substance. Priestley is generally credited with its discovery, although Scheele also discovered it independently. Oxygen is the third most abundant element found in the sun, and it plays a part in the carbon-nitrogen cycle, one process thought to give the sun and stars their energy. Oxygen under excited conditions is responsible for the bright red and yellow-green colors of the aurora. Oxygen, as a gaseous element, forms 21% of the atmosphere by volume from which it can be obtained by liquefaction and fractional distillation. The atmosphere of Mars contains about 0.15% oxygen. The element and its compounds make up 49.2%, by weight, of the earth's crust. About two thirds of the human body and nine tenths of water is oxygen. In the laboratory it can be prepared by the electrolysis of water or by heating potassium chlorate with manganese dioxide as a catalyst. The gas is colorless, odorless, and tasteless. The liquid and solid</p>



forms are a pale blue color and are strongly paramagnetic. Ozone (O_3), a highly active compound, is formed by the action of an electrical discharge or ultraviolet light on oxygen. Ozone's presence in the atmosphere (amounting to the equivalent of a layer 3 mm thick at ordinary pressures and temperatures) is of vital importance in preventing harmful ultraviolet rays of the sun from reaching the earth's surface. There has been recent concern that pollutants in the atmosphere may have a detrimental effect on this ozone layer. Ozone is toxic and exposure should not exceed 0.2 mg/cu m (8-hour time-weighted average - 40-hour work week). Undiluted ozone has a bluish color. Liquid ozone is bluish black, and solid ozone is violet-black. Oxygen is very reactive and capable of combining with most elements. It is a component of hundreds of thousands of organic compounds. It is essential for respiration of all plants and animals and for practically all combustion. In hospitals it is frequently used to aid respiration of patients. Its atomic weight was used as a standard of comparison for each of the other elements until 1961 when the International Union of Pure and Applied Chemistry adopted carbon 12 as the new basis. Oxygen has thirteen recognized isotopes. Natural oxygen is a mixture of three isotopes. Oxygen 18 occurs naturally, is stable, and is available commercially. Water (H_2O with 1.5% ^{18}O) is also available. Commercial oxygen consumption in the U.S. is estimated to be 20 million short tons per year and the demand is expected to increase substantially in the next few years. Oxygen enrichment of steel blast furnaces accounts for the greatest use of the gas. Large quantities are also used in making synthesis gas for ammonia and methanol, ethylene oxide, and for oxyacetylene welding. Air separation plants produce about 99% of the gas, electrolysis plants about 1%. The gas costs 5 cents/cu ft (\$1.75/cu. meters) in small quantities.

Use

MFR OF SYNTHESIS GAS FOR PRODN OF AMMONIA, METHYL ALCOHOL, ACETYLENE, ETC; TO COUNTERACT EFFECT OF EUTROPHICATION IN LAKES & RESERVOIRS; COAL GASIFICATION. OXIDIZING AGENT IN IRON AND STEEL INDUSTRY, SYNTHETIC CHEMICAL MANUFACTURE; AIR ENRICHER FOR COMBUSTION IN LEAD BLAST FURNACES AND IN FLASH SMELTERS FOR COPPER AND NICKEL; OXIDIZING AGENT FOR URANIUM LEACHING AND IN PULP AND PAPER INDUSTRY; AIR REPLACEMENT IN OXIDATION OF ORGANIC WASTES; LIFE SUPPORTING GAS-EG, FOR MEDICINAL USE & SPACE TRAVEL; CONSTITUENT OF GASEOUS ANESTHETICS AND WELDING GASES; LIQUID OXIDIZER USED IN ROCKET PROPELLANTS; GAS FOR PURGING AND PRESSURIZING ROCKET ENGINES. MEDICATION: MEDICINAL GAS TO RELIEVE HYPOXIA; AT HYPERBARIC PRESSURES IN

	CARDIAC OR OTHER SURGERY, ANAEROBIC INFECTIONS, CARBON MONOXIDE POISONING; LIQ: IN CRYOTHERAPY. 1978: Used for feedstock and enrichment purposes. In oxyhydrogen or oxyacetylene flame for welding metals and for lighting (calcium light, etc); submarine work by divers. In the production of synthesis gas which can be used in the Fischer-Tropsch for liquid fuels.
Consumption Patterns	STEEL INDUSTRY USE, 65.4% (BASIC OXYGEN PROCESS, 39.6%); OPEN HEARTH, 9.3%; ELECTRIC 9.3%; ELECTRIC FURNACE, 1.7%; OTHER, 14.8%); NONFERROUS METAL INDUSTRY, 12.0%; OXIDIZING AGENT IN CHEM SYNTH, 12.0% (ETHYLENE OXIDE, 4.9%; ACETYLENE, 2.3%; TITANIUM DIOXIDE, 1.7%; PROPYLENE OXIDE, 1.4%; VINYL ACETATE, 1.4%; MISC CHEMS, 0.3%); MISC APPLICATIONS, 10.6% (1977). Steel manufacturing, 65%; chemicals, 20%; metal fabrication, 4%; non-ferrous metals, 3%; waste water treatment, 3%; pulp and and paper, 3%; misc, 2% (1981).
Apparent Color	COLORLESS GAS; HEXAGONAL CRYSTALS; SLIGHTLY BLUISH LIQUID @ -183 DEG C; BLUE CRYSTALS
Odor	ODORLESS
Boiling Point	-182.96 DEG C
Melting Point	-218.4 DEG C
Molecular Weight	32.00
Density	GAS: 1.429 G/L @ 0 DEG C; LIQ: 1.14 G/ML @ -183 DEG C
Sensitivity Data	Liq: Irritant to skin & tissues. THE INHALATION, AT 1 ATM, OF 80% O2 FOR MORE THAN ABOUT 12 HR CAUSES IRRITATION OF RESP TRACT.
Chemical and Physical Properties	ATOMIC NUMBER: 8; VALENCE: 2; OCCURS NORMALLY AS DIATOMIC GAS O2; ALSO OCCURS AS OZONE O3; THREE NATURALLY OCCURRING ISOTOPES: 16 (99.759%); 17 (0.037%); 18 (0.204%); ARTIFICIAL RADIOACTIVE ISOTOPES: 13-15; 19; 20; NEUTRAL GAS LIQ & SOLID: STRONGLY PARAMAGNETIC ATOMIC RADIUS: 0.66 A; IONIC (CRYSTAL) RADII: 1.26 A (-2 OXIDATION STATE); ELECTRONEGATIVITY (PAULING SCALE): 3.44; ORBITAL ELECTRONS: [HE]2S2-2P4 T/2: (14)O= 74 SEC; (15)O= 2.1 MIN; (19)O= 29.4 SEC; WHEN EXPOSED TO UV RADIATION, DIATOMIC OXYGEN MOLECULE IS BROKEN DOWN & OZONE IS FORMED TRIPLE POINT TEMP: 54.4 DEG K; TRIPLE POINT PRESSURE: 0.0015 ATM; HEAT OF FUSION: 3.3 CAL/G Gas: Ratio of specific heats of vapor: 1.3962

Environmental Impact	Industrial exposures to high oxygen pressure are uncommon. Sea diving is probably the most frequent. Caisson workers & tunnel makers may also be exposed to pressures that are high enough to cause lung damage. Some potential risks for intoxication with oxygen also exist for drivers and persons living or working in closed compartments, where the air is reconditioned by the addition of pure oxygen (eg, submarines and spacecraft), should the regulation system malfunction.
Environmental Fate	OXYGEN, AS A GASEOUS ELEMENT, FORMS 21% OF ATMOSPHERE BY VOLUME. ABOUT TWO THIRDS OF HUMAN BODY & NINE TENTHS OF WATER IS OXYGEN. EVEN THOUGH LARGE QUANTITIES OF ATMOSPHERIC O ₂ ARE CONSTANTLY BEING CONSUMED IN RESPIRATION, COMBUSTION & OTHER OXIDATION PROCESSES, THE CONCEN OF O ₂ IS KEPT @ VIRTUALLY CONSTANT LEVEL, PRIMARILY AS A RESULT OF O ₂ LIBERATED IN THE PROCESS OF PHOTOSYNTHESIS IN GREEN PLANTS.
Drinking Water Impact	Aquatic Fate: Not harmful to aquatic life.
Disposal	Remove waste containers or leaking cylinders to exhaust hood or outdoors away from combustibles and allow to discharge at moderate rate. Tag cylinder to indicate defect, close valve and return to supplier. /Liquid and compressed oxygen. Evaporation: Remove waste containers or leaking cylinders to exhaust hoods or outdoors away from combustibles and allow to discharge @ a moderate rate. Tag cylinder to indicate defect, close valve and return to supplier.
Atmosphere	Normal air consists of 20.94% oxygen.

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