

Oxygen

Odorless, highly oxidizing, light blue cryogenic liquid.

CAS Number	7782 - 44 - 7
UN Number	1073
Shipping Name	Oxygen Refrigerated Liquid
Hazard Class	2.2
Label	Nonflammable Gas, Oxidizer Gas

Applications

Oxygen is generally liquefied so that it can be more effectively transported and stored in large volumes. However, most applications use oxygen after it is vaporized to the gaseous form. The primary uses of oxygen relate to its strong oxidizing and life-sustaining properties. Oxygen is commonly relied upon in health and medical applications. Liquid oxygen is used as an oxidant for liquid fuels in the propellant systems of missiles and rockets.

Oxygen is widely applied in the metal industries in conjunction with acetylene and other fuel gases for metal cutting, welding, scarfing, hardening, cleaning and melting. Steel and iron manufacturers also extensively use oxygen or oxygen-enriched air to affect chemical refining and heating associated with carbon removal and other oxidation reactions. Benefits such as fuel and energy savings plus lower total emission volumes are often achieved when air is enriched or replaced with higher-purity oxygen.

In the chemical and petroleum industries, oxygen is used as a feed component to react with hydrocarbon building blocks to produce chemicals such as alcohols and aldehydes. In many processes, the oxygen for reaction can be obtained from the use of air. However,

direct use of oxygen, or enrichment of the air with oxygen, is necessary for some processes. There are several major petrochemical intermediates that are presently manufactured with high-purity oxygen, including ethylene and propylene oxide (antifreeze), vinyl chloride (for PVC), and caprolactam (for nylon).

The pulp and paper industry uses oxygen as a bleaching and oxidizing agent. A variety of process (liquor) streams show enhanced physical properties after treatment with oxygen; plant operating costs also improve. Similarly, oxygen enhances the combustion process in industries that manufacture glass, aluminum, copper, gold, lead, and cement, or that are involved in waste incineration or remediation. There are corresponding productivity, energy, maintenance, and emissions benefits end users may realize.

Wastewater treatment plants successfully employ oxygen to enhance their chemical process efficiency. Aquaculturists such as fish-farmers also see benefits in the health or size of their livestock when the host environment is oxygenated.

Oxygen *(continued)*

Physical Properties

Chemical formula	O ₂	Triple point temperature	-361.89°F (-218.79°C)
Molecular weight	31.9988	Specific heat, BTU/lb °F	
Specific gravity (Air = 1),		At constant pressure (1 atm)	
70°F (2.11°C), 1 atm	1.105	70°F (211.1°C)	0.2193
Specific volume, cu ft/lb		At constant volume (1 atm),	
70°F (2.11°C), 1 atm	12.08	70°F (211.1°C)	0.1566
Density, saturated vapor		Ratio of specific heats at	
lb/cu ft, 1 atm	0.27876	70°F (211.1°C), 1 atm	1.400
Normal boiling point, 1 atm	-297.33°F (-182.96°C)	Coefficient of viscosity, micropoises	
Heat vaporization, BTU/lb (1 atm)	91.7	77°F (25°C), 1 atm	205.3
Critical pressure		Thermal conductivity,	32°F (0°C)
Absolute atmospheres	49.77	BTU/(sq ft) (hr) (°F)/ft	0.014
Absolute psi	731.4	Ionization potential, volts	13.6
Critical point temperature	-181.42°F (-118.57°C)	Excitation potential, first resonance potential, volts	9.1
Triple point pressure		Weight per gallon liquid, at boiling point, lb	9.55
Absolute atmospheres	0.00146		
Absolute psi	0.0215		

Oxygen Specifications (Units in ppm [v/v] unless shown otherwise)

Limiting Characteristics	USP	Liquid CGA G-4.3 Type II, Grade B	MTG Typical	Gaseous CGA G-11.1 Type II, Grade C
Oxygen Min. %	99	99.5	99.7	99.5
Water	NA	6.6	1	5
Dewpoint, °F	NA	-82	-105	
Total Hydrocarbons as methane	NA	NA	40	

Conversion Data

	WEIGHT		GAS		LIQUID	
	POUNDS Lb	KILOGRAMS Kg	CUBIC FEET SCF	CUBIC METERS Nm ³	GALLONS Gal	LITERS L
1 Pound	1.0	0.4536	12.078	0.3173	0.1050	0.3975
1 Kilogram	2.205	1.0	26.632	0.6996	0.2315	0.8762
1 Ton	2000	907.2	24,157	635.0	209.9	794.5
1 SCF Gas	0.08279	0.03755	1.0	0.02629	0.008689	0.03289
1 Nm ³ Gas	3.1491	1.4282	38.04	1.0	0.3305	1.2511
1 Gal Liquid	9.528	4.321	115.1	3.026	1.0	3.785
1 L Liquid	2.517	1.1416	30.41	0.7995	0.2642	1.0

SCF (standard cubic feet) gas measured at 1 atmosphere and 70°F.

Liquid measured at 1 atmosphere and boiling temperature.

All values rounded to nearest 4/5 significant numbers.

Nm³ (normal cubic meter) gas measured at 1 atmosphere and 0°C.