

Oxygen Overview

The discovery of Oxygen is generally attributed to Joseph Priestley in 1774 although Scheele made the same discovery at a similar time but failed to register his findings. Lavoisier's name is often associated with the discovery of oxygen but his work followed on from that of Priestley by identifying oxygen as an element and by further developing the modern theory of combustion. Lavoisier also named oxygen (acid former). The connection between oxygen, hydrogen and water was made by Cavendish in 1781.

Oxygen is a colourless, tasteless, odourless and highly reactive paramagnetic gas and whilst not flammable itself actively supports combustion. It is paramagnetic in the liquid state with a faint blue colour. It readily combines with other elements to form oxides, the most common of which is water.

It is vital for life and its solubility in water enables marine life to exist. It is the most abundant element in the earth's crust (49.2% by weight) and makes up about 21% of atmospheric air by volume.

Massive amounts of oxygen are produced every year by fractional distillation of air, a very significant portion of which is used in steel making. About 1 tonne of oxygen is needed to make 1 tonne of steel.

Oxygen has three stable isotopes but only ¹⁶O is in abundance. It also has O₃, Ozone, as an unstable isotope.

Oxygen reacts vigorously with oil and grease under appropriate conditions and no contact between the two should be permitted.

Properties

Property	Units	Value
Formula		O ₂
Relative atomic mass		15.994 915
Atomic radius	Å	0.65
Molecular weight		31.999
Density of liquid @ -140 C	gm cc ⁻¹	0.876
*Density of gas @ 21.1 C	kg m ³	1.325
*Relative density of gas @21.1 C	Air=1	1.105
Melting point (MP)	K	54.36
*Boiling point (BP)	K	90.17
Enthalpy of fusion at MP	kJ kg ⁻¹	13.88
Enthalpy of vaporization at BP	kJ kg ⁻¹	210.63
Enthalpy of (gas) combustion @ 25 C	kJ kg ⁻¹	119,950

Property	Units	Value
CAS Number		7782-44-7
Critical temperature	K	154.58
Critical pressure	bar	50.43
Accentric factor		0.022
Gas Cp @25 C	kJ kg ⁻¹ K ⁻¹	0.921
Gas Cv @ 25 C	kJ kg ⁻¹ K ⁻¹	0.661
Ratio of gas specific heats	---	1.393
Heat capacity of liquid @ -173 C	kJ kg ⁻¹ K ⁻¹	1.729
Solubility in water @ 25C	ppm	39.45
Viscosity of gas @ 25 C	micropoise	201.74
Thermal conductivity of gas @25 C	W m ⁻¹ K ⁻¹	0.02571
Viscosity of liquid @ -130 C	centipoise	0.071
Thermal conductivity of liquid @-150 C	W m ⁻¹ K ⁻¹	0.1206

Note:

1)* Indicates properties at 101.325 kPa

2) Properties are given at room temperature