APPLICATIONS OF OXYGEN

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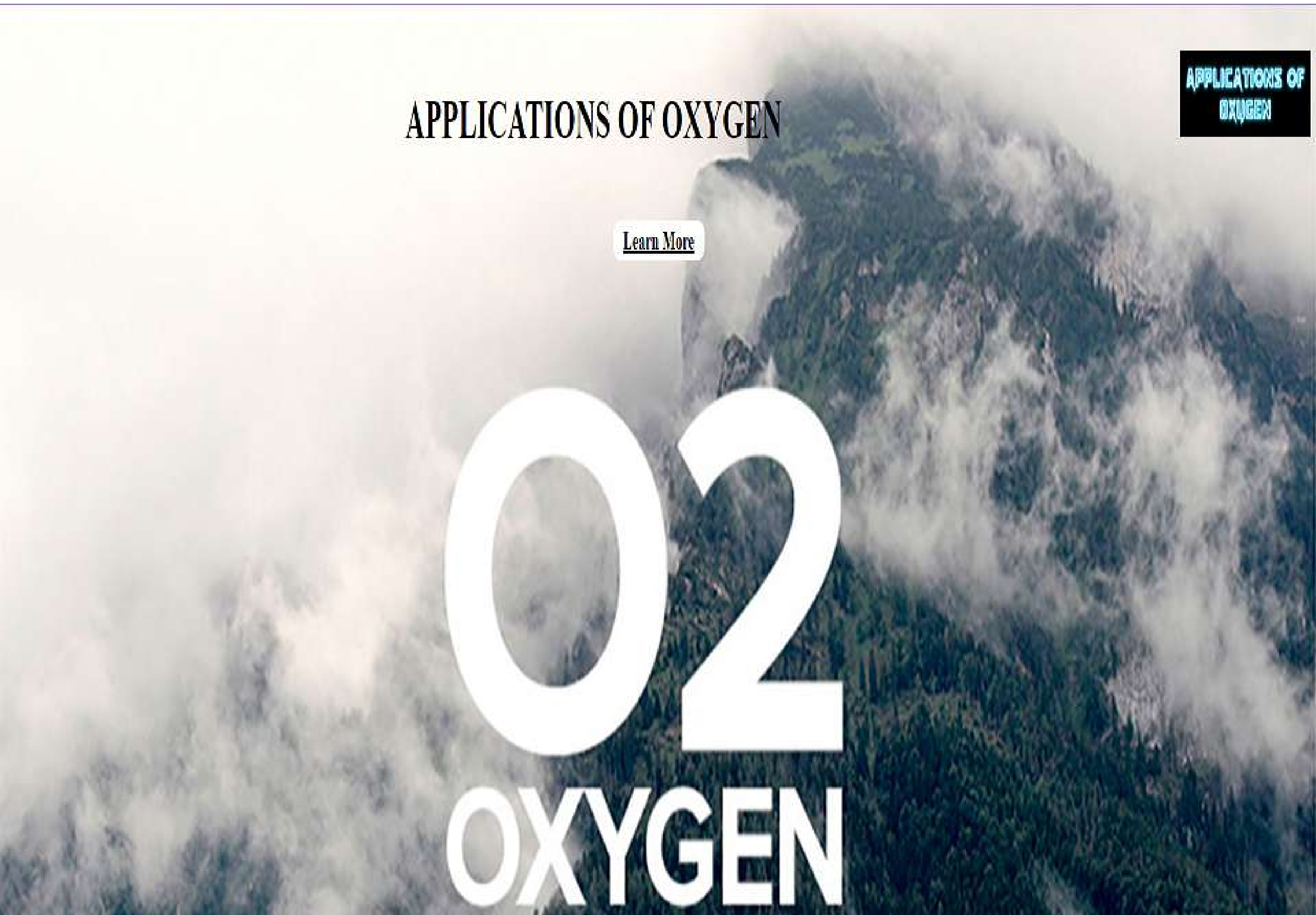
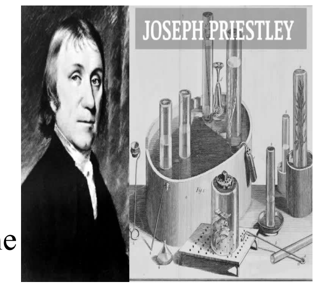
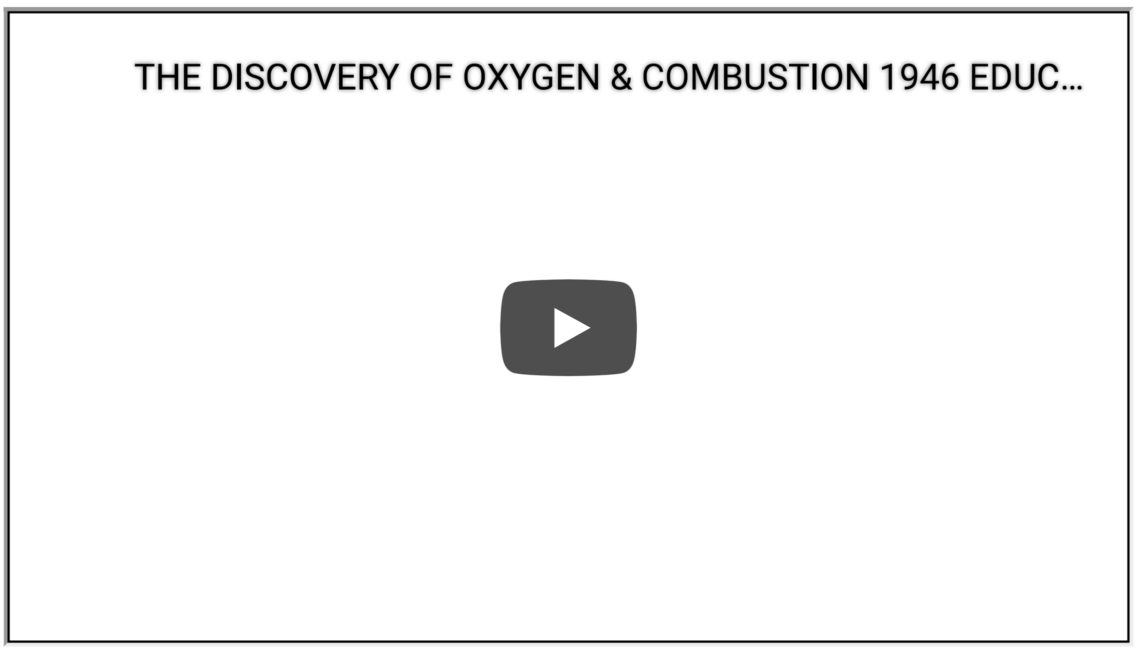


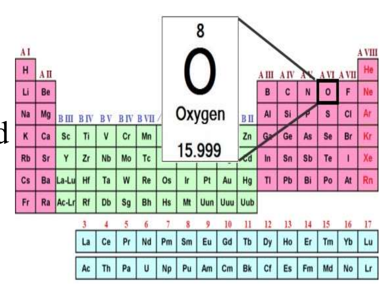
Who discover Oxygen and How?



Oxygen was discovered about 1772 by a Swedish chemist, Carl Wilhelm Scheele, who obtained it by heating potassium nitrate, mercuric oxide, and many other substances. An English chemist, Joseph Priestley, independently discovered oxygen in 1774 by the thermal decomposition of mercuric oxide and published his findings the same year, three years before Scheele published. In 1775–80, French chemist Antoine-Laurent Lavoisier, with remarkable insight, interpreted the role of oxygen in respiration as well as combustion, discarding the phlogiston theory, which had been accepted up to that time; he noted its tendency to form acids by combining with many different substances and accordingly named the element oxygen (oxygène) from the Greek words for “acid former.”



What actually is Oxygen?



Oxygen is the chemical element with the symbol O and atomic number 8. It is a member of the chalcogen group in the periodic table, a highly reactive nonmetal, and an oxidizing agent that readily forms oxides with most elements as well as with other compounds. Oxygen is Earth's most abundant element, and after hydrogen and helium, it is the third-most abundant element in the universe. At standard temperature and pressure, two atoms of the element bind to form dioxygen, a colorless and odorless diatomic gas with the formula O_2 Diatomic oxygen gas currently constitutes 20.95% ofthe Earth's atmosphere, though this has changed considerably over long periods of time. Oxygen makes up almost half of the Earth's crust in the form of oxides.

Dioxygen provides the energy released in combustion and aerobic cellular respiration, and many major classes of organic molecules in living organisms contain oxygen atoms, such as proteins, nucleic acids, carbohydrates, and fats, as do the major constituent inorganic compounds of animal shells, teeth,and bone. Most of the mass of living organisms is oxygen as a component of water, the major constituent of lifeforms. Oxygen is continuously replenished in Earth's atmosphere by photosynthesis, which uses the energy of sunlight to produce oxygen from water and carbon dioxide. Oxygen is too chemically reactiveto remain a free element in air without being continuously replenished by the photosynthetic action of living organisms. Another form (allotrope) of oxygen, ozone O_3, strongly absorbs ultraviolet UVB radiation and the high-altitude ozone layer helps protect the biosphere from ultraviolet radiation. However, ozone present at the surface is a byproduct of smog and thus a pollutant.

Allotropes of Oxygen

S.N.	Allotropes	Remarks
1.	Dioxygen(O_2)	Common Oxygen for life
2.	Ozone(O_3)	Strong oxidizing agent
3.	Tetra Oxygen(O_4)	metastable
4.	Octaoxygen(O_8)	metastable

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Aerospace benefitsof oxygen

Oxygen systems are designed to store or to generate a supply of pure oxygen and to regulate, dilute as required and then distribute that oxygen to crew or passengers. Oxygen systems are installed in many military aircraft and in most commercial and business aircraft types. Aerospace oxygen is used to:

- Oxygen is used as oxidizing agents in missiles and rockets.
- Oxygen is used in fue1s cells for the production of electricity. In hydrogen fuel cells, hydrogen and oxygen are allowed to react to generate electricity.
- Astronaut spacesuits consists of pure oxygen.

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Industrial Benefits Of Oxygen

1. In Multi-industry, Oxygen is used with fuel gases in gas welding, gas cutting, oxygen scarfing, flame cleaning, flame hardening, and flame straightening. In gas cutting, the oxygen must be of high quality to ensure a high cutting speed and a clean cut.
2. The Steel industries remains the largest users of Oxygen**(Metal Manufacturer).** Modern steelmaking relies heavily on the use of oxygen to enrich air and increase combustion temperatures in blast furnaces and open hearth furnaces as well as to replace coke with other combustible materials. During the steel making process, unwanted carbon combines with oxygen to form carbon oxides, which leave as gases. Oxygen is fed into the steel bath through a special lance and is used to allow greater use of scrap metal in electric arc furnaces. Large quantities of oxygen are also used to make other metals, such as copper, lead, and zinc.
   Oxygen enrichment of combustion air, or oxygen injection through lances, is used to an increasing extent in cupola furnaces, open-hearth furnaces, smelters for glass and mineral wool, and lime and cement kilns, to enhance their capacity and reduce energy requirements. Smelting times and energy consumption can also be reduced by special oxy-oil or oxy-gas burners in electro-steel furnaces and induction smelters for aluminum. A high thermal efficiency is achieved by these “oxy-fuel” burners, which mix fuel and oxygen at the tip of the burner. As a result, rapid combustion occurs at approximately 2800o C (5072oF).
3. In aspect of **Chemical, Pharmaceuticals and Petroleum uses**,Oxygen is used as a raw material in many oxidation processes, including the manufacturing of ethylene oxide,propylene oxide, synthesis gas using partial oxidation of a wide range of hydrocarbons, ethylene dichloride, hydrogen peroxide, nitric acid, vinyl chloride and phthalic acid.
   Very large quantities of oxygen are also used in coal gasification — to generate a synthesis gas that can be used as a chemical feedstock or precursor for more easily- transported and easily-used fuels.
   In refineries, oxygen is used to enrich the air feed to catalytic cracking regenerators, which increases capacity of the units. It is used in sulfur recovery units to achieve similar benefits. Oxygen is also used to regenerate catalysts. Oxygen is used to achieve more complete combustion and destruction of hazardous and waste materials in incinerators.
4. In **Pulp and Paper Maufacturing**, Oxygen is increasingly important as a bleaching chemical. In the manufacture of high-quality bleached pulp, the lignin in the pulp must be removed in a bleaching process. Chlorine has been used for this purpose but new processes using oxygen reduce water pollution. Oxygen plus caustic soda can replace hypochlorite and chlorine dioxide in the bleaching process, resulting in lower costs.
   In a chemical pulp mill, oxygen added to the combustion air increases the production capacity of the soda recovery boiler and the lime-reburning kiln. The use of oxygen in black liquor oxidation reduces the discharge of sulfur pollutants into the atmosphere.

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Medical Use of Oxygen

Most living things need oxygen to survive and oxygen’s importance in the field of healthcare cannot be underestimated.Oxygen is widely used in every healthcare setting, with applications from resuscitation to inhalation therapy. Oxygen was known to be the only element that supports respiration as early as 1800 and was first used in the medical field in 1810. However, it took about 150 years for the gas to be used throughout medicine. In the early to mid 20th century oxygen therapy became rational and scientific, and today modern medicine could not be practiced without the support that oxygen supplies.

Medical oxygen is used to:

- provide a basis for virtually all modern anaesthetic techniques
- restore tissue oxygen tension by improving oxygen availability in a wide range of conditions such as COPD, cyanosis, shock, severe hemorrhage, carbon monoxide poisoning, major trauma, cardiac/respiratory arrest
- aid resuscitation
- provide life support for artificially ventilated patients
- aid cardiovascular stability