DETECTING OXYGEN

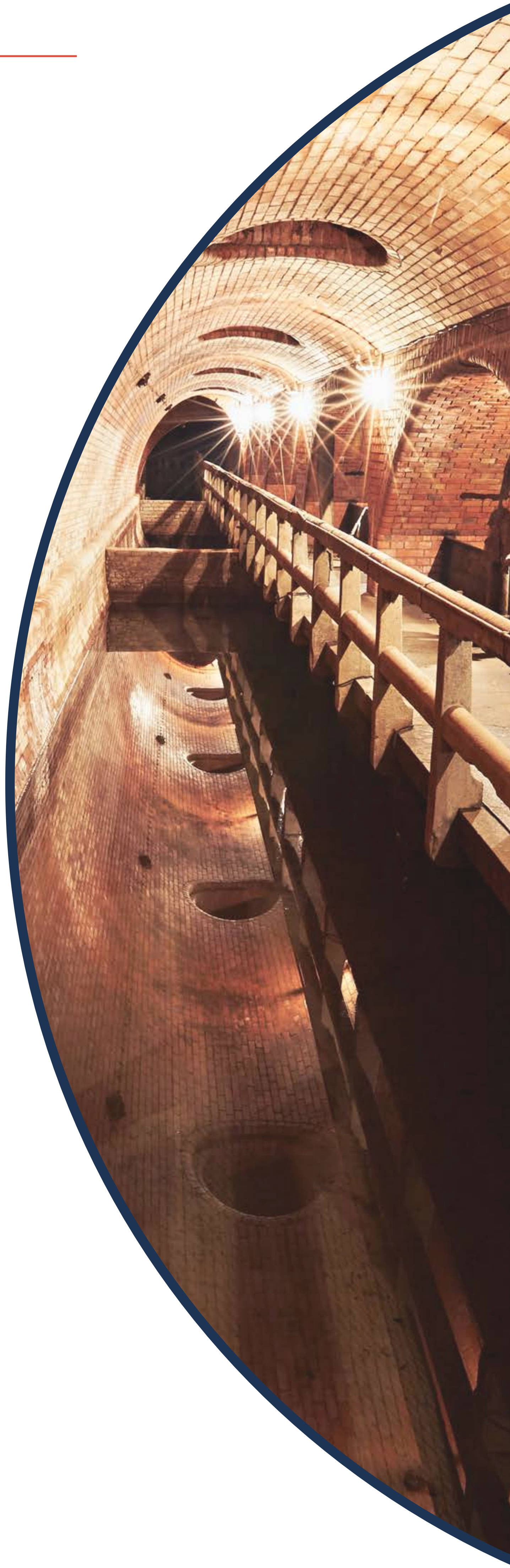
FORMULA: O_2 | CAS: 7782-44-7

ionscience.com

Unrivalled Gas Detection.

DETECTING OXYGEN

FORMULA: O_2 | CAS: 7782-44-7



Oxygen

Formula: O_2 | **CAS:** 7782-44-7

Oxygen (O_2), also known as Dioxygen, is a colourless, tasteless, and odourless gas making up almost 21% of the Earth's atmosphere. Many organisms use oxygen as a method of aerobic cellular respiration and are continuously replenished through the process of photosynthesis. While the question of who first discovered oxygen as an element is questionable, scientists began to realise its high importance and focused more attention on its characteristics.

Oxygen is the third most abundant chemical element in the universe, after **Hydrogen** and **Helium**. It is a major component of the world's oceans and is present at its highest concentration known to man in our atmosphere when compared to other planets. The Oxygen cycle describes its movement within and between Earth's three reservoirs: the atmosphere, biosphere and lithosphere, with the main variable being photosynthesis.

- **Atmosphere:** Encyclopedic entry. We live at the bottom of an invisible ocean called the atmosphere, a layer of gases surrounding our planet. Nitrogen and oxygen account for 99 percent of the gases in dry air, with argon, carbon dioxide, helium, neon, and other gases making up minute portions.
- **Biosphere:** The biosphere is made up of the parts of Earth where life exists. The biosphere extends from the deepest root systems of trees to the dark environment of ocean trenches, to lush rain forests and high mountaintops.
- **Lithosphere:** The lithosphere is the rocky outer part of the Earth. It is made up of the brittle crust and the top part of the upper mantle. The lithosphere is the coolest and most rigid part of the Earth.

+44 (0) 1763 208503 info@ionscience.com

The Industrial Production Of Oxygen & Uses

An estimated one hundred million tons of oxygen gas is extracted from the air for industrial uses, with two primary ways of production. One method is passing a stream of clean, dry air through one bed of a pair of identical zeolite molecular sieves, absorbing the nitrogen and resulting in a gas stream that is between 90-93% oxygen gas. The second is through fractional distillation of liquefied air, with Dinitrogen stilling as a vapour while Dioxygen is left as a liquid.

There are a variety of applications using oxygen gas. Most commonly, medical institutions use it as medicine to not only increase oxygen levels in the patient's blood but also decreasing resistance to blood flow for many types of diseased lungs to ease the pressure on the heart. Other diseases such as pneumonia, some heart disorders and emphysema utilizing Dioxygen gas. Oxygen tanks can be used for scuba divers since the pressure of containment with the oxygen provides the diver the ability to breathe as if they were on land. An estimated 55% of commercially produced oxygen is used in industrial applications (like smelting of iron ore into steel) and about 25% for chemical industries. The remaining 20% is used in the medical field.

Storage

Oxygen gas is usually stored in high-pressure oxygen tanks and transported in bulk as a liquid in specially insulated tankers, containing one litres of liquefied oxygen to an estimated 840 litres of oxygen gas at atmospheric pressure and 68°F. These containers can be found outside of hospitals and other institutions that need large volumes of pure oxygen gas. Oxygen can also be stored and shipped in smaller cylinders containing the gas in high pressures, like portable oxygen tanks for medical patients.

Oxygen may ignite or explode on contact with combustible materials such as wood, paper, oil, grease, and fuels. The gas is not compatible with halogenated hydrocarbons, metals, strong bases, reducing agents, amines, metal salts and oxidizing agents. It is standard for oxygen gas to be stored in tightly closed containers in a cool, well-ventilated area away from heat.

Workplace Exposure Limits

The NFPA 704 standard rates compressed oxygen gas as non-hazardous to health, non-flammable and non-reactive, but an oxidizer. OSHA defines an oxygen-deficient atmosphere as having less than 19.5% oxygen by volume. This is created when oxygen is displaced by inert gases, for example carbon dioxide. Oxygen can also be reduced through the presence of rusting metal, ripening fruits, drying pain, combustion or bacterial activities. OSHA also defines an oxygen-rich environment containing more than 22% oxygen by volume. Oxygen-rich environments may be produced through certain chemical reactions or leaking oxygen hoses and torches.

Safety and Precautions

The toxicity of oxygen gas becomes a concern when in environments with elevated partial pressures, leading to symptoms of convulsions and more. Toxicity begins at partial pressures of more than 50 kPa at standard pressure and 21 kPa at sea-level. At one point, oxygen was used in incubators for premature babies, resulting in mutations and side effects such as blindness. Highly concentrated sources of oxygen result in rapid combustion, increasing fire and explosion risks due to the mix of concentrated oxidants and fuels close to each other. Heat or a spark can trigger combustion reactions. Since concentrated O_2 gas allows combustion reactions to occur rapidly and energetically, steel pipes and storage vessels can become a risk when housing it in an industrial facility. The importance of knowing its reactions from special training can ensure ignition sources are minimized as much as possible.

- **Acute Health Effects:** Breathing in pure O_2 gas at high pressures outside it's standard can result in nausea, dizziness, muscle twitching, vision loss, convulsion, and loss of consciousness.
- **Chronic Health Effects:** Overexposure can result in mutations (genetic changes), though further study is being conducted to see what genetic changes may occur across a variety of segments. Oxygen-rich and oxygen-deficient environments can lead to asphyxiation.

Detection Of Oxygen (O_2) Gas

Since oxygen is colourless and odourless when changing the environment from its standard to oxygen-rich or oxygen-deficient, a personal gas detector such as the ION Science ARA O_2 Single Gas Detector should be considered. This portable detector alerts the worker to O_2 gas exposure, providing an instantaneous alarm within a critical safety scenario. The device features a fast response time and sturdy construction, both important for use within hard environments.

The ARA O_2 single gas detector is a cost effective personal detector with 24 months of continuous operation. This wearable gas detector has only one button to make use simple and alerts workers when health levels exceed set safety levels.
The product is available from ION Science.
Visit **ionscience.com/products/ara-o2-single-gas-detector/** for more information.

Specification	Value/Information
Formula	O2
CAS no.	7782-44-7
Gas Response Factor, 11.7 eV	NA
Gas Response Factor, 10.6 eV	ZR
Gas Response Factor, 10.0 eV	ZR
ppm per mg/m^{-3}, (20 °C, 1 bar)	0.752

Specification	Value/Information
Molecular Weight, g/mole	32.0
Melting point, °C	-219
Boiling point, °C	-183
Flash point, °C	-
Lower Explosive Limit, %	-
Ionisation Energy, eV	12.0697

References

1. National Geographic

https://www.nationalgeographic.org/encyclopedia/atmosphere/

https://www.nationalgeographic.org/encyclopedia/biosphere/

https://www.nationalgeographic.org/encyclopedia/lithosphere/

2. Wikipedia (Oxygen)

https://en.wikipedia.org/wiki/Oxygen

3. New Jersey Department Of Health & Senior Services

https://nj.gov/health/eoh/rtkweb/documents/fs/1448.pdf

4. United States Department Of Labor (OSHA)

https://www.osha.gov/SLTC/etools/shipyard/shiprepair/confinedspace/oxygendeficient.html#:~:text=While%20normal%20atmosphere%20con-
tains%20between,contains%20more%20than%2022%20percent.&text=Oxygen%20enriched%20atmospheres%20present%20a%20significant%20
fire%20and%20explosion%20risk.

5. CMC Pro (Imagery)

https://www.cmcpro.com/classes/confined-space-rescue-technician/

Disclaimer

The information provided in this guide is for informational purposes only. The materials are general in nature; they are not offered as advice on a particular matter and should not be relied on as such. Use of this guide does not constitute a legal contract. While we make every effort to ensure that the material in this guide is accurate and up-to-date when we publish it, you should exercise your own independent skill and judgment before you rely on it. In any important matter, you should seek professional advice relevant to your own circumstances.

About ION Science

ION Science provide a range of portable, personal, fixed and semi-portable gas detection instruments and sensors for the rapid, accurate detection of hazardous gases. Find out more about our industry leading range of gas detection solutions by visiting ionscience.com.

ION Science Offices

UK (HEAD OFFICE)

USA

CHINA

INDIA

GERMANY

ITALY

FRANCE

ionscience.com

Unrivalled Gas Detection.