

Argon (Ar)

What is it and where does it come from ?

Argon occurs naturally and is all around us in the air we breathe.

Properties of Argon:

Elemental Symbol	Ar
% in the atmosphere	0.93%
Boiling Point	-186°C
Density (Air = 1)	1.38
Atomic Mass	18
Molecular Mass	40
Discovered by: Sir William Ramsey (1894)	

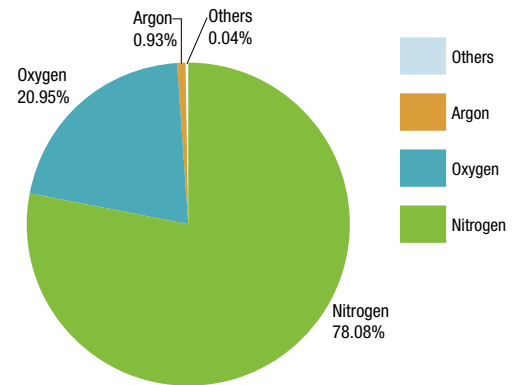
Characteristics:

- One volume of liquid argon expands to produce 840 volumes of gaseous argon
- It is colourless – you can not see it
- It is odourless – you can not smell it
- It is tasteless – you can not taste it
- It is not toxic or flammable
- It is completely inert – it does not react with any other elements

Interesting facts about Argon:

- It is heavier than air
- It does not support life
- It does not support combustion
- It does not form any known chemical compounds
- Argon belongs to a family of very rare elements known as the noble gases. This family includes helium, krypton, neon and xenon. Many of these gases are used in the production of light bulbs – often to produce different colours. The noble gases are also used in many different laser applications

The air we breath



Argon (Ar)

What can we use it for?

Argon is extremely inert and is used where very pure atmospheres are needed for manufacturing processes.

Welding

- Argon is used in most welding gas mixtures to exclude oxygen and protect the welding joint. Oxygen reacts with metal and can weaken a welded joint resulting in defects

Fibre Optic Cables

- Argon is one of the gases used to create a high temperature fluid known as “plasma.” This is used to spray special coatings onto very fine hollow cables. Digital information travels at the speed of light down fibre optic cables – much faster than that in electrical cables. They are used widely for communication and the internet would not be possible without them

Light Bulbs

- Argon is used to fill light bulbs as it does not react with the hot light bulb filament

Double Glazing

- Argon is used to fill the space between sheets of glass in high efficiency double glazing panels. It is a better insulator than air, which is used in normal glazing, and can help to reduce heat loss



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Carbon Dioxide (CO₂)

What is it and where does it come from?

It is produced as a by-product of numerous industrial and chemical processes.

It is produced naturally when sugar is fermented to make alcohol (beer).

It can also be found in natural 'wells'.

Properties:

Chemical Formula	CO ₂
% in the atmosphere	0.038%
Boiling Point	-78.5°C
Density (Air = 1)	1.53
Molecular Mass	44

Discovered by: Joseph Black (1752)

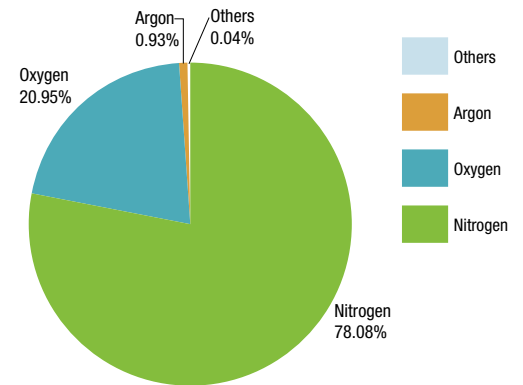
Characteristics:

- One volume of carbon dioxide expands to produce 500 volumes of gaseous carbon dioxide
- It is colourless – you can not see it
- It has a slight odour – you can smell it in high concentrations
- It has an acrid taste – you can taste it in high concentrations
- It is not flammable
- It can be toxic in high concentrations

Interesting facts about Carbon Dioxide:

- It is heavier than air
- It does not support life
- It does not support combustion and is commonly used in fire extinguishers
- It can form a corrosive acid when combined with moisture
- Carbon dioxide is unique in that it can change from a solid to a gas under normal atmospheric conditions without passing through the liquid phase.
- Carbon dioxide is generated by burning fossil fuels like wood, coal, oil, gas and petrol. It is one of the "greenhouse gases" that causes global warming

The air we breath



Carbon Dioxide (CO₂)

What can we use it for?

CO₂ is used widely in the food industry, and also for welding, oil recovery and water treatment.

Food Packaging

- Carbon dioxide is combined with other gases to replace the oxygen when packing food. This is known as Modified Atmosphere Packaging or MAP.
- It slows down the growth of mould and bacteria, and helps to increase “shelf-life” so that food stays fresher for longer.
- Using carbon dioxide reduces the need to put artificial additives and preservatives into our food. However it is absorbed by moist and fatty foods and too much carbon dioxide can affect the flavour.

Drinks Industry

- Carbon dioxide is used when producing spring water, beer, sparkling wine and soft drinks. The gassy bubbles in a glass of lemonade are carbon dioxide.

Water Treatment

- Carbon dioxide is used to control the alkaline pH level when processing waste water

Entertainment

- Solid carbon dioxide, known as dry ice, is used to produce fog and special effects for films, concerts and pop videos. Carbon dioxide is also used in high pressure cartridges as the propellant for paint-ball guns



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Helium (He)

What is it and where does it come from?

Helium is formed by radioactive decay and is found underground where it occurs in oil and natural gas wells. There are tiny amounts of helium in the atmosphere.

Properties:

Elemental Symbol	He
% in the atmosphere	0.0005%
Boiling Point	-269°C
Density (Air = 1)	0.14
Atomic Mass	2
Molecular Mass	4

Discovered by: Sir William Ramsey (1895)

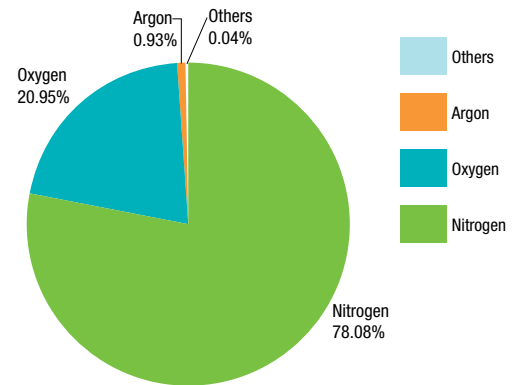
Characteristics:

- One volume of liquid helium expands to produce 800 volumes of gaseous helium
- It is colourless – you can not see it
- It is odourless – you can not smell it
- It is tasteless – you can not taste it
- It is not toxic or flammable
- It is completely inert – it does not react with any other elements

Interesting facts about Helium:

- It is much lighter than air
- It does not support life
- It does not support combustion
- It has the smallest molecules of any of the elements
- It is the second lightest of all the elements
- It is the second most abundant element in the universe
- There is a limited amount on helium on earth
- As with fossil fuels where it occurs, our supplies will one day run out

The air we breath



Helium (He) **What can we use it for?**

How high can you go ?

How low can you go ?

Balloons and Airships

- Helium is much lighter than air so it is used to inflate party balloons. It is also used to inflate airships.

Deep Sea Diving

- Helium is mixed with oxygen to make special breathing gases for deep sea divers. It helps to prevent decompression sickness or “The Bends” which occurs when nitrogen gets trapped in the blood.

Leak Detection

- Helium molecules are the smallest of any element, making it an ideal gas for leak detecting. Helium will identify very small leaks and is inert so will be safe when released into the atmosphere.

Medicine

- Liquid Helium is used to cool the magnets used in Magnetic Resonance Imaging (MRI) scanners.
- MRI scanners are used in hospitals when scanning the body. Cooling the magnets to extremely low temperatures allows them to be “super conductive” and create very detailed images. This is important when treating patients with cancer or tumours.



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Hydrogen (H₂)

What is it and where does it come from?

Hydrogen is produced as a by-product of numerous chemical processes.

The primary source is the reforming of natural gas but it also produced from butane, propane, petroleum and coke in steel smelting furnaces.

There are, however, tiny trace elements of hydrogen in the atmosphere.

Properties:

Elemental Symbol	H
Chemical Formula	H ₂
% in the atmosphere	0.001%
Boiling Point	-253°C
Density (Air = 1)	0.07
Atomic Mass	1
Molecular Mass	2
Discovered by:	
Henry Cavendish (1766)	

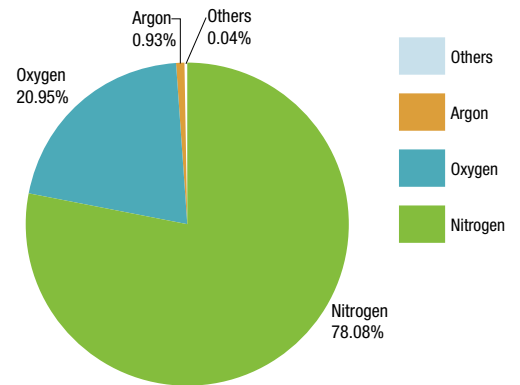
Characteristics:

- One volume of liquid hydrogen expands to produce 800 volumes of gaseous hydrogen
- It is colourless – you can not see it
- It is odourless – you can not smell it
- It is tasteless – you can not taste it
- It is not toxic
- It is extremely flammable

Some interesting facts about hydrogen:

- It is the lightest of all the elements
- It is the most abundant element in the universe
- 93% of all atoms in the universe are hydrogen atoms
- It does not support life
- It will combine readily with oxygen to form water:
- 2 Hydrogen atoms (H₂) + 1 Oxygen atom (O) = Water (H₂O)

The air we breath



Hydrogen (H₂) **What can we use it for?**

Hydrogen is used in the manufacture of food, metals, electronics and as a fuel.

Alternative Fuels

- Hydrogen is being investigated as an alternative to fossil fuels. It is an extremely efficient and clean fuel which produces only water as an emission. It is also being used in fuel cells as an alternative way to generate electricity. This research will help to improve the environment by reducing 'greenhouse' gases which damage the Ozone layer

Space Travel

- Liquid hydrogen is used as a fuel in the space shuttle. It is mixed with liquid oxygen to aid combustion making a very powerful propellant

Food Industry

- Hydrogen is used to make margarine and other related products from vegetable oils

Power Stations

- Hydrogen is used to cool the huge generators that are used to make electricity

Welding

- Hydrogen is used to produce special atmospheres around joints when welding stainless steel. It has small molecules which make it a good conductor of heat which allows the welder to work faster



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Nitrogen (N₂)

What is it and where does it come from ?

Nitrogen occurs naturally and is all around us in the air we breathe

Properties:

Elemental Symbol	N
Chemical Formula	N ₂
% in the atmosphere	78.08%
Boiling Point	-196°C
Density (Air = 1)	0.967
Atomic Mass	14
Molecular Mass	28

Discovered by Daniel Rutherford (1772)

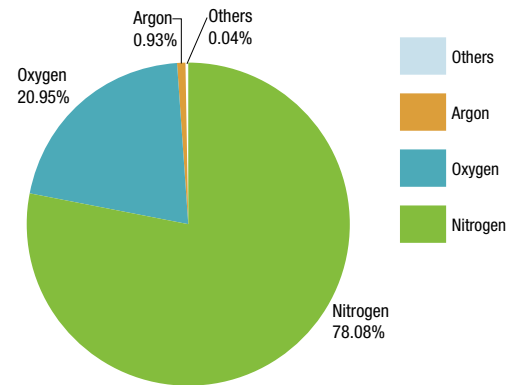
Characteristics:

- One volume of liquid nitrogen expands to produce 694 volumes of gaseous nitrogen
- It is colourless – you can not see it
- It is odourless – you can not smell it
- It is tasteless – you can not taste it
- It is not toxic or flammable
- It is inert – it does not react with other elements under normal conditions

Interesting facts about nitrogen:

- It is slightly lighter than air
- It does not support life
- It does not support combustion
- When measured by volume, nitrogen is the most widely used of all inorganic chemicals throughout the world today
- As a liquid, nitrogen is the coldest of the three main gases that make up the atmosphere. Its low temperature freezes food extremely quickly. This makes it very good for freezing delicate food like raspberries and strawberries which would turn mushy if frozen in an ordinary freezer like you have at home

The air we breath



Nitrogen (N₂) **What can we use it for?**

Nitrogen is used in the manufacture of many things that we see, use and eat around the home everyday...

Food Freezing

- Liquid nitrogen is extremely cold (-196°C) and is used to quickly freeze many types of food such as burgers and raspberries

Industrial Freezing

- Liquid nitrogen is used to make old rubber components brittle so that they can be ground into a fine powder and recycled.

Making Snow

- Liquid nitrogen is mixed with water and compressed air in a special “gun” to make real snow for indoor events and competitions.

Manufacturing Chemicals

- Nitrogen is inert. It prevents fires and explosions during the manufacturing process. When making things that contain hazardous or flammable chemicals it is used to remove oxygen from the environment.
- Many of these chemicals find their way into cleaning products, air fresheners, perfumes, cosmetics and other household items.

Food Packaging

- Nitrogen is used as a preservative in Modified Atmosphere Packaging (MAP) for foods:
- It is used to exclude air and oxygen
- It is used to pack snacks and dried food such as bags of crisps and jars of coffee



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