

AQA ELC Science Component 3 – Chemistry: Elements, mixtures and compounds

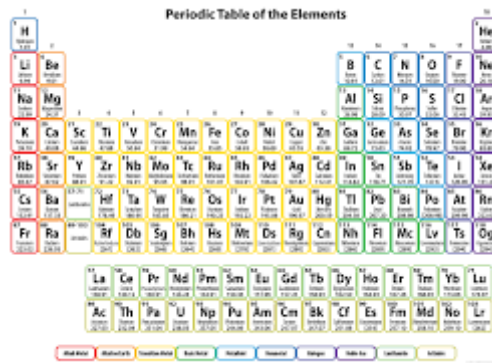
Atoms, Elements and Compounds

All substances are made of atoms. An atom is the smallest part of an element that can exist.

A substance that is made of only one sort of atom is called an element.

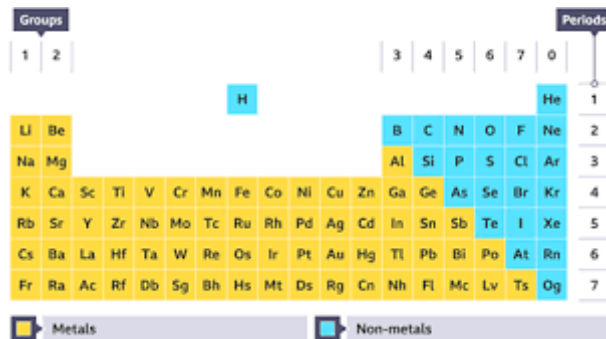
There are about 100 different elements.

Elements are shown in the periodic table.



A standard periodic table of elements with color-coded groups. The groups are labeled at the bottom: Alkali Metals, Alkaline Earth Metals, Transition Metals, Halogens, Noble Gases, Lanthanides, and Actinides. The table shows elements from Hydrogen (H) to Oganesson (Og).

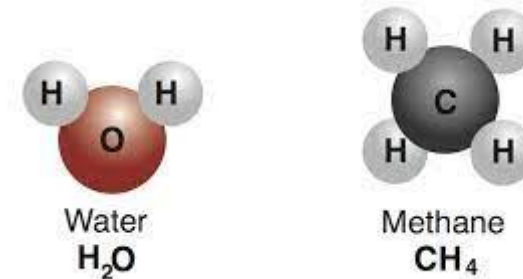
Metals are towards the left and the bottom of the periodic table and non-metals towards the right and the top of the periodic table.



A simplified periodic table with a legend at the bottom. The legend shows a yellow box for 'Metals' and a blue box for 'Non-metals'. The table highlights these categories: Metals (yellow) include Li, Be, Na, Mg, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Se, Br, Kr, Rb, Sr, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, In, Sn, Sb, Te, I, Xe, Cs, Ba, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Po, At, Rn, Fr, Ra, Ac, Rf, Db, Sg, Bh, Hs, Mt, Ds, Rg, Cn, Nh, Fl, Mc, Lv, Ts, Og. Non-metals (blue) include H, He, B, C, N, O, F, Ne, Al, Si, P, S, Cl, Ar.

Elements in the same group of the periodic table have similar chemical properties.

When elements react, their atoms join with other atoms to form compounds.



Some compounds are made from metals combined with non-metals, for example sodium chloride and magnesium oxide.



Some compounds are made from only non-metals, for example carbon dioxide.

Chemical reactions can be represented by word equations.

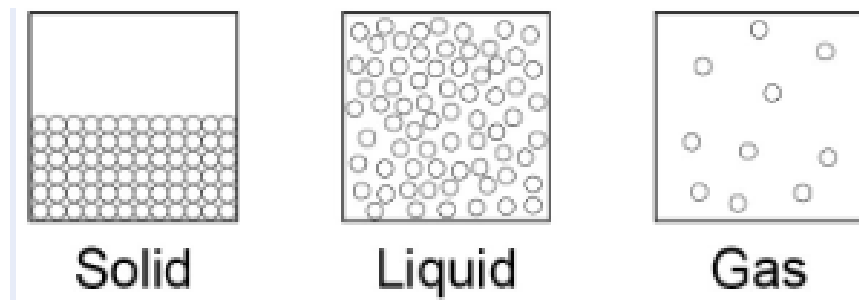
Sodium + chlorine → sodium chloride

Carbon + oxygen → carbon dioxide

How structure affects properties

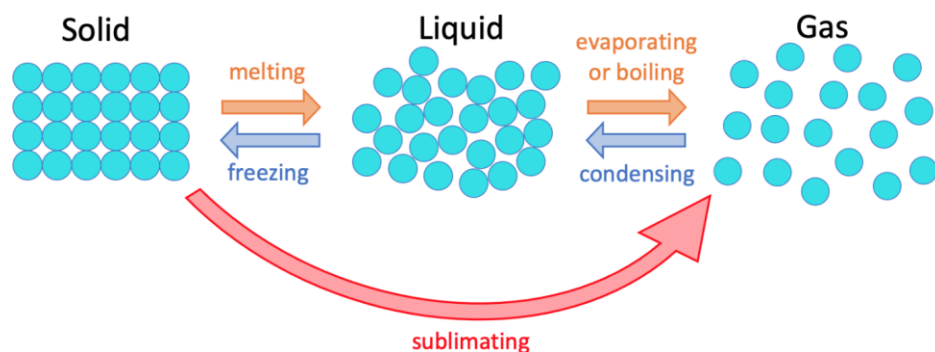
The three states of matter are solid, liquid and gas. Melting and freezing take place at the melting point, boiling and condensing take place at the boiling point.

The three states of matter can be represented by a simple model. In this model, particles are represented by small solid spheres.

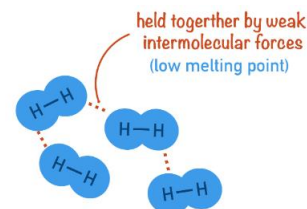


When a solid melts to become a liquid the particles are able to move about but stay close together.

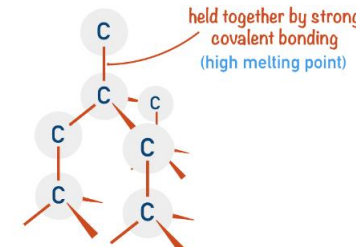
When a liquid boils and becomes a gas the particles separate and move about rapidly.



Substances with high melting points have strong forces that hold their particles together. Substances with low boiling points have weak forces between their particles.



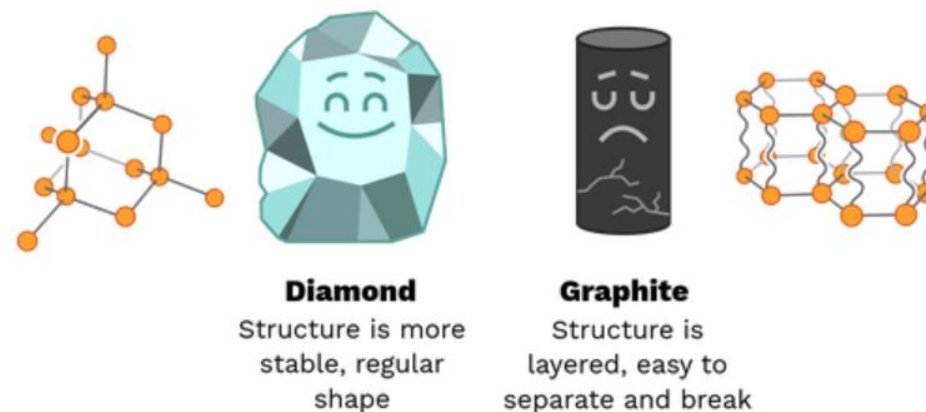
Hydrogen gas, $H_{2(g)}$



Carbon (diamond), $C_{(s)}$

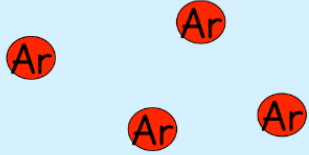
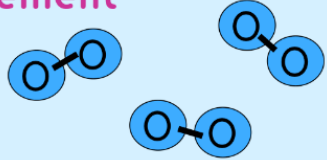
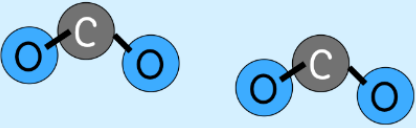
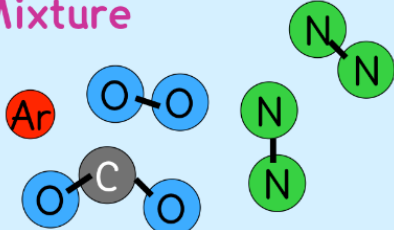
Diamond and graphite are forms of the element carbon with different properties because of their different structures. Diamond is hard because the carbon atoms are joined together in a giant three-dimensional structure.

Graphite is slippery because the carbon atoms are joined together in layers that can slide over each other.

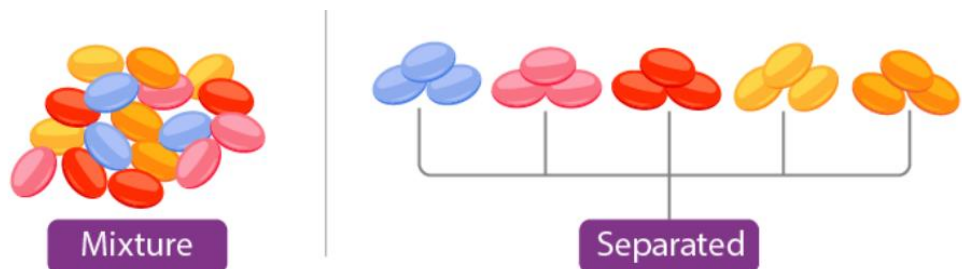


Separating mixtures

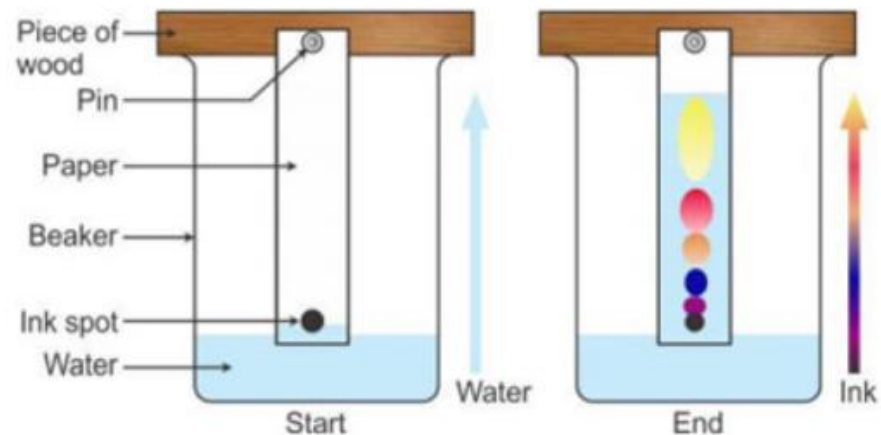
A mixture contains two or more substances not chemically combined together.

<p>Element</p>  <p>Atoms of the element argon exist on their own.</p>	<p>Element</p>  <p>Oxygen atoms join in pairs. Argon and oxygen are elements</p>
<p>Compound</p>  <p>Carbon and oxygen atoms are joined together in carbon dioxide.</p>	<p>Mixture</p>  <p>Air is a mixture of elements and compounds</p>

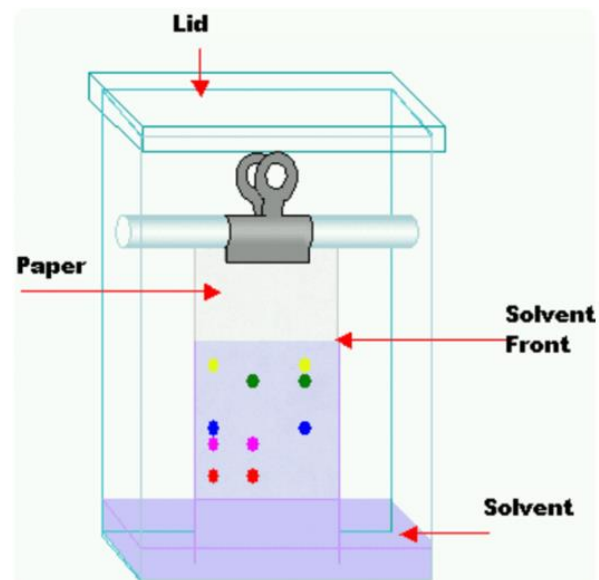
Mixtures can be separated by processes such as filtration, distillation, crystallisation and chromatography.



Paper chromatography can be used to separate mixtures and can give information to help identify substances.

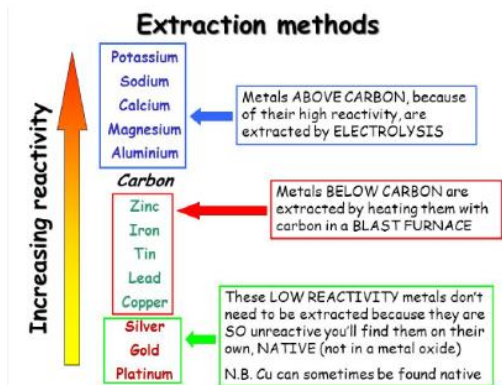


In paper chromatography a solvent moves through the paper carrying different compounds different distances.



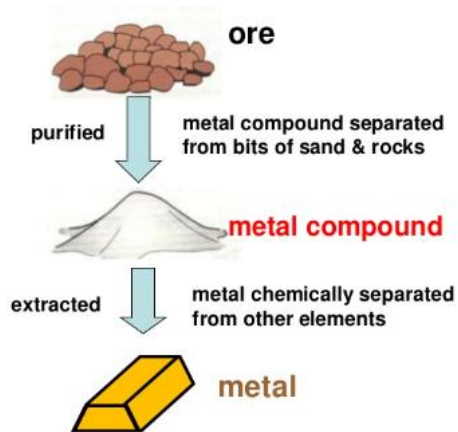
Metals and Alloys

Unreactive metals, such as gold, are found in the Earth as the metal itself, but most metals are found as compounds that require chemical reactions to extract the metal.



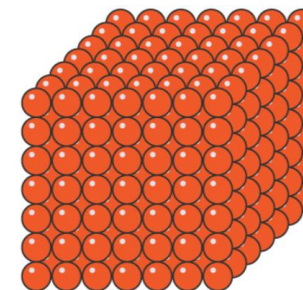
Metals less reactive than carbon can be produced by heating the metal compounds in the ore with carbon.

Ores contain enough metal to make it economic to extract the metal. Large amounts of rock need to be quarried or mined to get metal ores.



We should recycle metals to save resources and limit environmental impacts

Metals have giant structures of atoms with strong bonds between the atoms and so most metals have high melting points.



Copper has properties that make it useful for electrical wiring and plumbing.

Aluminium is a useful metal because of its low density and resistance to corrosion.

Most metals in everyday use are alloys. Pure iron, gold and aluminium are too soft for many uses and so are mixed with small amounts of other elements to make alloys, which are harder for everyday use.

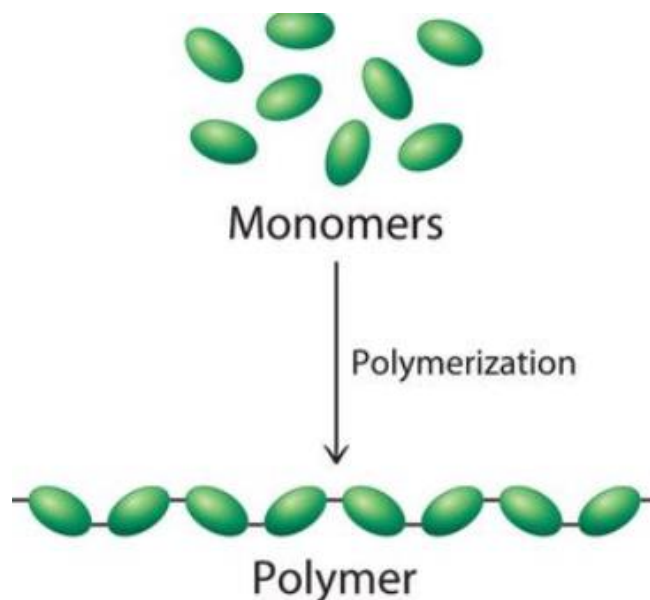
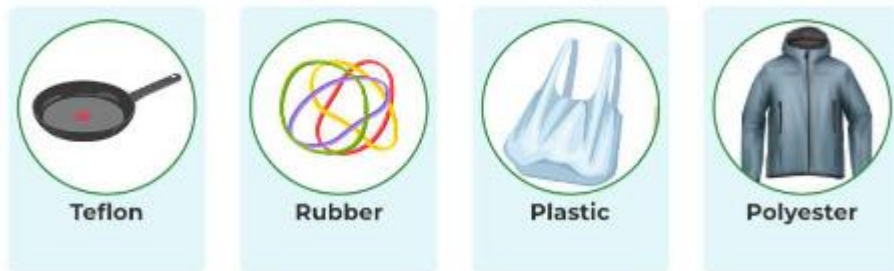


Most iron is converted into steels. Steels are alloys since they are mixtures of iron with carbon and other metals.

Polymers

Polymers such as poly(ethene), poly(propene) polystyrene and PVC are made from small compounds called monomers that join together to form very long chains.

Examples of Polymers



Polymers are waterproof, resistant to chemicals, and can be moulded, so they have many useful applications as packaging materials, pipes and containers.

Polyethylene is used to make plastic sandwich bags



Compact Discs are made from synthetic polymers such as polycarbonate



Polystyrene is used to make Styrofoam cups and cd cases



Milk jugs are made from the synthetic polymer polyethylene (HDPE)



Soda bottles are made from polyethylene terephthalate (PETE)



Synthetic polymers are used to make specialty athletic clothing such as Polyester, Nylon, Lycra or spandex



Many polymers are not biodegradable, so they are not broken down by microbes. This can lead to problems with waste disposal.

