GCSE Science – Aspects of Year 10 Work Tested In The Final Exam (Chemistry)

From Module 5 (the first Chemistry Module)

Metals

More than three-quarters of the elements are metals. In the periodic table metals are mainly found:

- in the two left hand columns (Group 1 and Group 2)
- in the central block (transition elements).

The elements in Group 1 of the periodic table (known as the **alkali metals**):

- are metals with low density (the first three in the Group are less dense than water and so float on it);
- react with non-metals to form ionic compounds. The compounds are white solids which dissolve in water to form colourless solutions;
- react with water releasing hydrogen; and
- form hydroxides which dissolve in water to give alkaline solutions.

In the centre of the periodic table is a block of metallic elements. These elements, which include iron and copper, are known as **transition metals**. Like other metals, transition metals are good conductors of heat and electricity and can easily be bent or hammered into shape. Compared to alkali metals:

- they have high melting points (except for mercury, which is a liquid at room temperature);
- they are hard, tough and strong;
- they are much less reactive and so do not react (corrode) so quickly with oxygen and/or water.

These properties make transition metals very useful as structural materials (e.g. iron, usually in the form of steel) and for making things which must allow heat or electricity to pass through them easily (e.g. copper for electrical cables). Most transition metals form coloured compounds. These can be seen:

- in pottery glazes of various colours;
- in weathered copper (green).

Many transition metals, including iron and platinum, are used as catalysts.

Reactivity Series

The reactivity series lists metals in order of their reactivity, with the most reactive metal at the top of the list and the least reactive at the bottom (the Data Sheet has a reactivity series of metals).

A more reactive metal can **displace** a less reactive metal from its compounds. How a metal is extracted from its ore depends on how reactive it is (e.g. gold needs no chemical treatment, iron needs a blast furnace, but aluminium needs electrolysis).

Chemical properties of metal and non-metal compounds

Compounds of alkali metals called salts can be made by reacting solutions of their hydroxides which are alkaline with acids. In these neutralisation reactions:

acid + alkaline hydroxide solution → a neutral salt solution + water

The particular salt produced in any reaction between an alkali and an acid depends on the metal in the alkali, and the acid used.

From Module 6 (the second Chemistry Module)

Note: Material tested only at Higher Tier is shown with a vertical line next to it.

Fossil fuels

Most of the compounds in crude oil consist of molecules made up of hydrogen and carbon atoms only (**hydrocarbons**). The many hydrocarbons in crude oil may be separated into fractions, each of which contains molecules with a similar number of carbon atoms, by evaporating the oil and allowing it to condense at a number of different temperatures. This process is **fractional distillation**.

The hydrocarbon molecules in crude oil vary in size. The larger the molecules (the greater the number of carbon atoms) in a hydrocarbon:

- the higher its boiling point; and
- the less volatile it is.

Large hydrocarbon molecules can be broken down (cracked) to produce smaller more useful molecules. This process involves heating the hydrocarbons to vaporise them and passing the vapours over a hot catalyst. A thermal decomposition reaction then occurs. Some of the products of cracking are useful as fuels. Other products of cracking can be used to make plastics (polymers) such as poly(ethene) and poly(propene).

The cracked hydrocarbon molecules have carbon carbon double covalent bonds (they are unsaturated) and are known as alkenes. These unsaturated hydrocarbons are reactive and so are useful for making many other substances including polymers. Polymers have very large molecules, and are formed when many small molecules, of substances called monomers, join together. This process is called polymerisation.

Most fuels contain carbon and/or hydrogen and may also contain some sulphur. The gases released into the atmosphere when a fuel burns may include:

- carbon dioxide;
- water (vapour), which is an oxide of hydrogen; and
- sulphur dioxide.

Rocks

At the surface of the Earth younger sedimentary rocks usually lie on top of older rocks. Sediments contain evidence for how they were deposited (e.g. layers formed by discontinuous deposition, ripple marks formed by currents or waves. Sedimentary rock layers are often found tilted, folded, fractured (faulted) and sometimes even turned upside down. This shows that the Earth's crust is unstable and has been subjected to very large forces.

The Atmosphere

The release of carbon dioxide by burning the carbon locked up over hundreds of millions of years in fossil fuels increases the level of carbon dioxide in the atmosphere.

Carbon dioxide reacts with substances in sea-water to make insoluble carbonates. These are mainly calcium carbonate, which is deposited as sediment. The reactions also make soluble hydrogencarbonates, which are mainly calcium hydrogencarbonate and magnesium hydrogencarbonate. These reactions increase as the level of carbon dioxide in the atmosphere goes up, but they do not completely absorb the extra carbon dioxide released into the atmosphere.