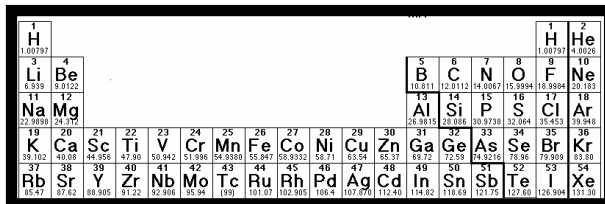


Science Revision Notes

Atoms, Elements and Compounds

Atoms have a nucleus surrounded by electrons. **Elements** in the same vertical columns (**groups**) of the Periodic Table have similar **chemical properties**. Potassium, Sodium, and Lithium and very reactive group 1 metals and Calcium and Magnesium are less reactive metals in group 2. Copper and Iron are **transition metals** because they lie between groups 2 and 3. Carbon and Oxygen are **non-metals** because they are on the right of the Periodic Table and Fluorine is an element in group 7.

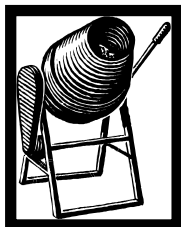


The atoms in molecules are represented by **symbols**. Ca is the **formula** for an element, O₂ and Cl₂ are formulae for **molecules** of an element. Magnesium oxide is heavier than magnesium before it is burned because it is a **compound**. MgCO₃ is Magnesium carbonate, carbon dioxide is CO₂, water is H₂O, CuCO₃ is Copper Carbonate and Calcium Carbonate is CaCO₃. They are all compounds because they are made from at least two elements in **fixed proportions**. Atoms in molecules are held together by **chemical bonds**. In dot cross diagrams the dot is the nucleus and the crosses are electrons.

Rocks and Building

The main metal in **Limestone** is Calcium. **Quicklime** is made by thermal decomposition of Limestone in a kiln to give off Carbon Dioxide. The formula for quicklime is CaO and its chemical name is **Calcium Oxide**.

Slaked lime is made by reacting quicklime with spots of water. The chemical name for slaked lime is **Calcium Hydroxide**. When a little Slaked lime is dissolved in water it makes **limewater**. Blowing Carbon Dioxide through limewater creates Calcium Carbonate (limestone) again.



Limestone is important in the manufacture of **cement**. It is made by heating limestone with clay. A mixture of sand, stones cement and water makes **concrete**. Dropping hard steel balls onto concrete is a test for its hardness. Slaked lime can be mixed with sand and water to make **mortar**. This is used to stick bricks together.

Heating limestone, sand and sodium carbonate makes **glass**.

One argument for allowing limestone **quarrying** in National Parks is that it provides **jobs** for local people and one argument against allowing the quarrying is that they make unsightly scars on the landscape. Transporting limestone by lorry causes **pollution** and **damage** to buildings. This could be reduced by transporting it by rail.

Rocks and Metals

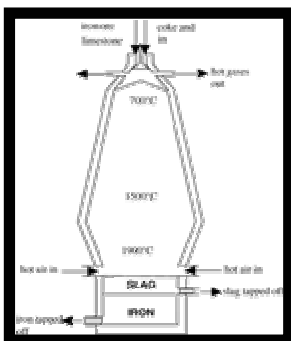
Ingots of **Gold** occur in rock because it is an unreactive metal found native in the earth. It is used to make jewellery.

Rocks from which metals can be extracted economically are called **ores**. Oxygen is often combined with metals in ores. The method used to extract a metal from its ore depends on its **reactivity**. Zinc is more reactive than Iron and both can be extracted from their ores by reacting with carbon.

When copper carbonate is heated, the gas given off is Carbon Dioxide and the black powder left from heating it is Copper Oxide. Copper is used to make electrical cables and water pipes. Good **conductors** let heat and electricity pass through easily. Metals with high melting points are solid until they reach a high temperature.



A mixture of metals is known as an **alloy**. Bronze is an alloy of Copper and other metals like Tin.



A **blast furnace** operates continuously for several years because it is expensive to heat it up. Iron Oxide is turned into **pig-Iron** by heating with coke. It takes less energy to make iron if scrap iron is used because the furnace does not need to reduce the iron oxide in the scrap. Pig-Iron is an alloy of **Iron and Carbon** which can be changed into pure Iron by removing all the carbon. Pure Iron is soft and easily shaped because the atoms can slide over each other. **Brittle** metals shatter when hit with a hammer, but **tough** ones do not. Pig-Iron is not used for making cars because it is too brittle. Iron is better than Aluminium for making bridges because it is stronger.

Pure iron is changed into **Low-alloy steels** by adding up to 5% other metals. 12-15% Chromium can be mixed with iron to make **high alloy steels**.

Aluminium is extracted from Aluminium Oxide by **electrolysis**. It is expensive because it takes a lot of electricity. It is important to recycle Aluminium because it is expensive to extract and it destroys the local environment. Aluminium is very reactive but less reactive than Sodium. The oxide layer stops oxygen reaching the rest of the metal so it prevents **corrosion** travelling through the bar. Aluminium is better than iron for making cans for fizzy drinks because its oxide is not **toxic**. There is at least 250 years supply of Aluminium ore left at our present rate of usage.

Aluminium and Titanium are more expensive than iron because they need a lot of energy to extract them. Aluminium and Titanium are used in aircraft because they have a **low density** (Titanium is also strong). Other metals can be mixed with Titanium to make it **harder**.

Crude Oil

Crude oil can be separated into **fractions** because it is a **mixture** of compounds

Crude oil is heated before it goes into the fractionating column to change it to a **vapour**. Crude oil fractions are collected at different levels because they **condense** at different **temperatures**. The temperatures **reduce** as the vapours pass up the column.

Oil fractions are all hydrocarbons called **Alkanes**. The **larger** the alkane molecule the **higher** the boiling point. The formula for the alkane with 2 Carbon atoms is C_2H_6 which is collected near the top of the fractionating column. C_3H_8 has a lower boiling point than C_8H_{18} , which is lower than $C_{12}H_{26}$, and $C_{16}H_{34}$ has a high boiling point. C_3H_8 will also **catch fire** more easily than $C_{12}H_{26}$

Kerosene has a higher boiling point than petrol. Petrol is a **thinner** liquid than diesel as its molecules are longer than petrol molecules

Burning a pure alkane always produces water vapour, and in plenty of air produces **Carbon Dioxide** which causes **global warming**. Burning fossil fuels in a limited supply of air produces Carbon monoxide which causes **human poisoning**. Burning fossil fuels can produce **particles** in the air which are thought to cause **global dimming**. Burning a pure alkane never produces sulphur dioxide but Coal does produce **Sulfur Dioxide** which combines with water in the air and falls as **acid rain**.

Ethanol is a **clean** fuel producing only Carbon Dioxide and water.

