10 Using resources

Resources

•Humans use the Earth's resources to provide **warmth, shelter, food** and **transport**.
•Finite resources from the Earth, oceans and atmosphere are processed to provide **energy and materials.**

Potable water

•For humans, drinking water should have sufficiently **low levels of dissolved salts and microbes**.
•Potable water is not pure water in the chemical sense because it contains dissolved substances.

•In the UK, rain provides water with low levels of dissolved substances (fresh water) that collects in the ground, in lakes and rivers, and most potable water is produced by:
•choosing an appropriate source of fresh water
•passing the water through **filter beds**
•**Sterilising**.
•Sterilising agents used for potable water include **chlorine, ozone or ultra-violet light.**

•If supplies of fresh water are limited, **desalination** of salty water or sea water may be required.
•Desalination can be done by **distillation** or by processes that use membranes such as **reverse osmosis.** These processes require large amounts of **energy**.

Definitions

Finite – A resource that will run out.
Sustainable development - development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.
Potable water– water that is safe to drink.
Pure - is a single element or compound, not mixed with any other substance.

Sewage

Sewage treatment includes:
• screening and grit removal
•sedimentation to produce sewage sludge and effluent
•anaerobic digestion of sewage sludge
•aerobic biological treatment of effluent

Phytomining and bioleaching (HT only)

•**Phytomining** uses **plants** to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds.
• **Bioleaching** uses **bacteria** to produce leachate solutions that contain metal compounds.
• The metal compounds can then be processed to obtain the metal. For example, copper can be obtained from solutions of copper compounds by **displacement** using **scrap iron or by electrolysis.**

Life cycle assessments

Life Cycle Assessments (LCAs) are carried out to assess the environmental impact of products in each of these stages

- **extracting and processing** raw materials
- **manufacturing** and packaging
- **use** and operation during its lifetime
- **disposal** at the end of its useful life, including transport and distribution at each stage.

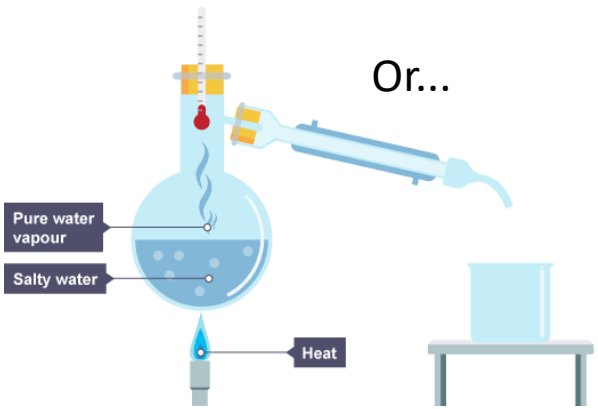
- Its not easy to give values to pollutant effects so people can disagree over life cycle assessments.
- These can be used to evaluate a product but can also be weighted to give an expected outcome for advertising purposes.

- **Reduce reuse recycle** reduces the use of limited resources, energy consumption, waste and environmental impacts.
- We are running out of raw materials.
- Quarrying and mining causes environmental impacts such as loss of habitats.
- Glass , metal and paper can be recycled.

Results

- Pure water boils at exactly 100°C and it's pH is 7
- Salt water contains sodium chloride
- Distillation = Heat the solution, the water evaporates, the salt stays in the container.

Required practical



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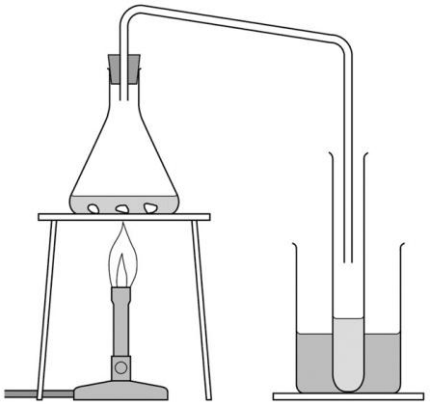


Triple only

Definitions
Corrosion is the destruction of materials by chemical reactions with substances in the environment.
Rusting is an example of corrosion only iron rusts.
Monomer – small molecules that join together to make a polymer.
Polymer - a long chain formed form many repeating units (monomers)
Formulation - a mixture that has been designed as a useful product.

Rusting and corrosion
•Both **air** and **water** are necessary for iron to rust.
•Corrosion can be prevented by applying a **coating** that acts as a barrier, such **as greasing, painting or electroplating**.
•Aluminium has an **oxide** coating that protects the metal from further corrosion.
•Some coatings are reactive and contain a more reactive metal to provide **sacrificial protection**, eg zinc is used to galvanise iron..

Alloys
Most metals in everyday use are alloys.
Bronze is an alloy of copper and tin.
Brass is an alloy of copper and zinc.
Gold used as jewellery is usually an alloy with silver, copper and zinc
Steels are alloys of iron that contain specific amounts of carbon and other metals. High carbon steel is strong but brittle. Low carbon steel is softer and more easily shaped. Steels containing chromium and nickel (stainless steels) are hard and resistant to corrosion.
Aluminium alloys are low density.

Man made materials (triple only)

•Most of the **glass** we use is soda-lime glass, made by heating a mixture of **sand, sodium carbonate and limestone**. Borosilicate glass, made from sand and boron trioxide, melts at higher temperatures than soda-lime glass.

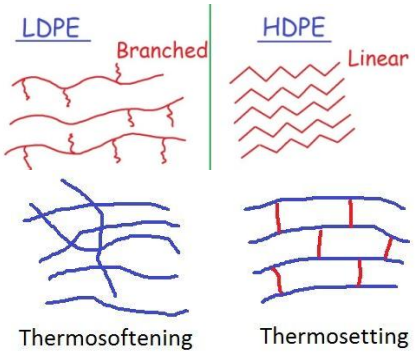
•Clay ceramics, including **pottery and bricks**, are made by shaping wet **clay** and then heating in a furnace.

•The properties **of polymers** depend on what **monomers** they are made from and the conditions under which they are made. For example, low density (LD) and high density (HD) poly(ethene) are produced from ethene.

•**Thermosoftening polymers melt** when they are heated.

•**Thermosetting polymers do not melt** when they are heated.

•Most **composites** are made of two materials, a matrix or binder surrounding and binding together fibres or fragments of the other material, which is called the **reinforcement**.



Haber process and NPK fertilisers (triple only)

•The Haber process is used to manufacture **ammonia**, which can be used to produce nitrogen-based fertilisers.

• The raw materials for the Haber process are **nitrogen and hydrogen**. The Nitrogen comes from **the air**, the hydrogen comes from **methane** gas.

• The purified gases are passed over a **catalyst of iron** at a **high temperature (about 450 °C)** and a **high pressure (about 200 atmospheres)**. Some of the hydrogen and nitrogen reacts to form ammonia. The reaction is reversible so some of the ammonia produced breaks down into nitrogen and hydrogen:

• Nitrogen + Hydrogen ⇌ Ammonia $N_2 + 3H_2 \rightleftharpoons 2NH_3$

•On cooling, the ammonia liquefies and is removed. The remaining hydrogen and nitrogen are **recycled**.

•Compounds of **nitrogen, phosphorus and potassium** are used as fertilisers to improve agricultural productivity. NPK fertilisers contain compounds of all three elements.

•Industrial production of NPK fertilisers can be achieved using a variety of raw materials in several integrated processes. NPK fertilisers are **formulations** of various salts containing appropriate percentages of the elements.

•Ammonia can be used to manufacture **ammonium salts** and **nitric acid**.

•Potassium chloride, potassium sulfate and phosphate rock are obtained by mining, but phosphate rock cannot be used directly as a fertiliser.

•Phosphate rock is treated with **nitric acid or sulfuric acid** to produce soluble salts that can be used as fertilisers.