The big picture
The Earth's structure
The Earth's crust
Igneous rocks
Sedimentary and metamorphic rocks
Weathering and erosion

Key ideas and terms

Finite and renewable




Humans use the Earth's resources to provide warmth, shelter, food and transport.
Natural resources are supplemented by agriculture. Finite resources are processed for energy and materials.

Finite resource: one being used up faster than it can be replaced.

Chemistry improves agricultural and industrial processes to provide new products and sustainable development.

Natural resource	Useful product	Synthetic version
Wool (sheep)	Clothing	Polymers
Rubber (trees)	Car tyres	Polymers

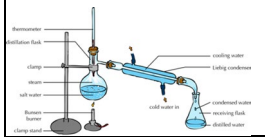
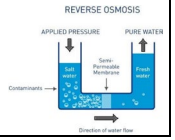
Sustainable development: development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.

Potable water

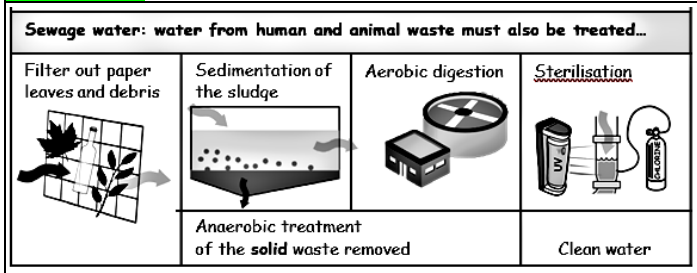
Drinking (potable) water should have sufficiently low levels of dissolved salts and microbes. Potable water is not pure water in the chemical sense because it contains dissolved substances.
In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in lakes and rivers. Method:

- choosing an appropriate source of fresh water
- passing the water through filter beds
- sterilising.

Sterilising agents used for potable water include chlorine, ozone or ultraviolet light.
In other countries, desalination of salt water is used.
Step 1: filter out large objects.
Step 2: **desalinate** (remove salt) by either high temperature **distillation** or high pressure **reverse osmosis**.

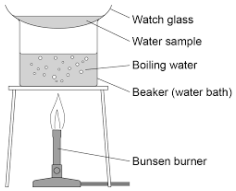



Waste water



Required practical

Reproducibility and accurate results are essential. So if asked for "a fair test on a 100 cm^3 sample of water" you must:
Divide the sample into smaller volumes so you can do repeats to see if your results are reproducible.
Record the mass of crucibles **before and after** to find the difference in mass and therefore the mass of the residue from the water.



Always use clean, dry equipment.
Type of analysis: pH (3-6) means acid rain, or distilled water. pH (8- 10) means minerals dissolved in water. A boiling point of 100 °C means pure water, impurities raise the boiling point. A freezing point of 0 °C means pure water, impurities lower the freezing point.

Phytomining

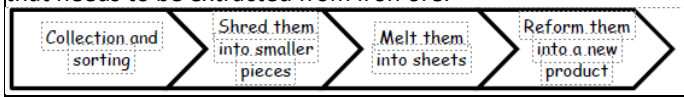
Copper ores are becoming scarce and new ways of extracting copper from low-grade ores are needed instead of mining. Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds. The copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis.

Bioleaching

Bioleaching is another way to extract copper from low grade ores. It uses bacteria to produce leachate solutions. The copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis.

The 3 Rs

The reduction in use, reuse and recycling of materials by end users reduces the use of limited resources, use of energy sources, waste and environmental impacts.
Metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. Much of the energy for the processes comes from limited resources.
Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.
Some products, such as glass bottles, can be reused. Glass bottles can be crushed and melted to make different glass products. Other products cannot be reused and so are recycled for a different use.
Metals can be recycled by melting and recasting or reforming into different products. The amount of separation required for recycling depends on the material and the properties required of the final product. For example, some scrap steel can be added to iron from a blast furnace to reduce the amount of iron that needs to be extracted from iron ore.



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.

Use of water, resources, energy sources and production of some wastes can be fairly easily quantified. Allocating numerical values to pollutant effects is less straightforward and requires value judgements.
Selective or abbreviated LCAs can be devised to evaluate a product but these can be misused to reach pre-determined conclusions, eg in support of claims for advertising purposes.

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The Earth's Resources