Your notes

GCSE Chemistry: revision notes

Using resources and potable water

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Using the Earth's resources

- Humans use the Earth's resources for warmth, shelter, food and transport.
- Natural resources, supplemented by agriculture, provide food, timber, clothing and fuels. Finite resources from the Earth, oceans and atmosphere are processed to provide energy and materials.
- **Sustainable development** meets the needs of current generations without compromising the ability of future generations to meet their own needs.

Potable water

- **Potable water** is safe to drink. It is not pure: it contains dissolved substances, but only low levels of salts and microbes.
- In the UK, rain collects in the ground and in lakes and rivers as fresh water. It is treated by choosing a good source, passing it through filter beds, and **sterilising** it with chlorine, ozone or ultraviolet light.
- Where fresh water is scarce, sea water can be desalinated by distillation or reverse osmosis (using membranes). Both need large amounts of energy.
- Required practical: test the pH of a water sample, find the mass of dissolved solids by evaporating a sample, and purify it by distillation.

Waste water

- Waste water from homes, farms and industry must be treated before it is released into the environment.

- Sewage treatment: screening and grit removal; sedimentation to produce sewage sludge and **effluent**; anaerobic digestion of the sludge; aerobic biological treatment of the **effluent**.
- Industrial waste water may also need harmful chemicals removed.

Alternative ways of extracting metals (Higher)

- Metal ores, such as copper ores, are becoming scarce, so low-grade ores are used.
- **Phytomining**: plants absorb metal compounds from the soil; they are harvested and burned, and the ash contains the metal compounds.
- **Bioleaching**: bacteria produce leachate solutions that contain metal compounds.
- Copper can then be obtained from these solutions by displacement using scrap iron, or by electrolysis.

Life cycle assessments

- A **life cycle assessment** (LCA) looks at the environmental impact of a product at each stage: extracting and processing raw materials, manufacturing and packaging, use during its lifetime, and disposal, including transport at each stage.
- Use of water, resources and energy, and the waste produced, can be measured fairly easily, but giving values to pollution needs value judgements. So LCAs are not purely objective, and shortened LCAs can be misused, for example in advertising.

Reduce, reuse, recycle

- Reducing use, reusing and **recycling** materials cuts the use of limited resources and energy, and reduces waste and environmental damage from quarrying and mining.
- Glass bottles can be reused, or crushed and melted to make new glass. Metals can be recycled by melting and recasting.
- Some scrap steel can be added to iron from a blast furnace, reducing the iron that must be extracted from ore.

Corrosion and alloys (separate sciences)

- Rusting of iron needs both air (oxygen) and water.
- **Corrosion** can be prevented by barriers (greasing, painting or electroplating) or **sacrificial protection**, where a more reactive metal such as zinc corrodes instead (galvanising).
- Alloys: bronze (copper and tin), brass (copper and zinc), high-carbon steel (strong but brittle), low-carbon steel (softer, easily shaped) and stainless steel (with chromium and nickel, hard and **corrosion**-resistant). Aluminium alloys have low density.

Your notes

Materials (separate sciences)

- Soda-lime glass is made by heating sand, sodium carbonate and limestone. Borosilicate glass (sand and boron trioxide) melts at a higher temperature.
- Clay ceramics, such as pottery and bricks, are made by shaping wet clay and heating it in a furnace.
- Thermosoftening polymers melt when heated because their chains are held together only by weak intermolecular forces; thermosetting polymers don't melt, because strong cross-links join their chains.
- Composites are made of a reinforcement, such as fibres, in a matrix or binder, for example fibreglass and concrete.

The Haber process and fertilisers (separate sciences)

- The Haber process makes ammonia: $N_2 + 3H_2 \rightleftharpoons 2NH_3$. Nitrogen comes from the air and hydrogen from natural gas.
- Conditions: about 450 °C, about 200 atmospheres pressure and an iron catalyst. Unreacted gases are recycled.
- NPK fertilisers contain nitrogen, phosphorus and potassium compounds to improve crop growth. Ammonia is used to make ammonium salts and nitric acid.

Key terms

Sustainable development	Meeting today's needs without compromising the ability of future generations to meet theirs.
Potable water	Water that is safe to drink.
Desalination	Removing salt from sea water, by distillation or reverse osmosis.
Sterilising	Killing microbes, for example with chlorine, ozone or ultraviolet light.
Effluent	The liquid part of sewage after sedimentation.
Phytomining	Using plants to absorb metal compounds from soil.
Bioleaching	Using bacteria to produce solutions containing metal compounds.
Life cycle assessment	An assessment of a product's environmental impact from raw materials to disposal.
Recycling	Processing used materials so they can be used again.
Corrosion	The destruction of materials by chemical reactions with substances in the environment.
Sacrificial protection	Protecting iron by attaching a more reactive metal that corrodes instead.

Your notes

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is potable water?
2. Which of these is used to sterilise drinking water?
3. Why is desalination not widely used in the UK?
4. What happens to sewage sludge?
5. What is phytomining? (Higher)
6. What is bioleaching? (Higher)
7. Which stage is NOT part of a life cycle assessment?
8. Why are LCAs not completely objective?

Answers

1. Water that is safe to drink
2. Chlorine
3. It needs large amounts of energy
4. It is digested anaerobically
5. Using plants to absorb metal compounds from soil
6. Using bacteria to produce solutions containing metal compounds
7. Choosing the product's advertising colours
8. Giving values to pollution effects needs value judgements

What to do next

Practise 12 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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