AQA GCSE Chemistry: Topic 10

"Grade 7" Examiner Cheat Sheet — Using Resources

Section 1: Sustainability & Earth's Resources

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

- **Finite:** Resources that are used faster than they can be replaced (e.g., Fossil fuels, metals).
- **Renewable:** Resources that can be replaced as quickly as they are used (e.g., Timber, food).

Role of Chemistry: Finding alternatives to finite resources (e.g., synthetic polymers instead of rubber) and developing processes that use less energy.

Section 2: Potable Water Algorithm

Definition: Potable water is water that is **safe to drink**. It is NOT chemically pure as it contains dissolved salts.
Treatment Algorithm (Fresh Water):

1. **Source:** Choose a suitable source (e.g., river, lake, or groundwater).
2. **Filter:** Pass through filter beds to remove **insoluble solids**.
3. **Sterilise:** Kill microbes using **Chlorine**, **Ozone**, or **UV light**.

Desalination (Salty Water): If fresh water is scarce, salty water must be treated via **distillation** or **reverse osmosis**. *Drawback:* Requires extremely high amounts of energy (expensive).

Section 3: Waste Water Treatment Matrix

Treatment Steps (Sequential Order):

1. **Screening:** Removes large debris like grit and plastic.
2. **Sedimentation:** Heavy solids sink to form **sludge**; lighter liquid stays above (**effluent**).
3. **Aerobic Digestion:** Bacteria break down organic matter in effluent (uses air).
4. **Anaerobic Digestion:** Bacteria break down sludge (no air). Produces **biogas** (fuel).

Section 4: Life Cycle Assessments (LCAs)

Goal: To assess the environmental impact of a product at every stage of its "cradle to grave" life.
The 4 Stages of LCA:

1. **Extracting Raw Materials:** Energy used in mining; habitat destruction.
2. **Manufacturing & Packaging:** Energy for processing; chemical by-products.
3. **Use During Lifetime:** Energy used (e.g., fuel) and pollution produced.
4. **Disposal:** Landfill space, recycling energy, or incineration emissions.

Section 5: LCA Comparison (Plastic vs. Paper)

Stage	Plastic Bag	Paper Bag
Raw Material	Crude Oil (Finite)	Timber (Renewable)
Process	High energy; waste.	Massive water/energy use.
Use	Highly reusable.	Often used only once.
Disposal	Not biodegradable.	Biodegradable; recyclable.

HT Critical Point: LCAs are not purely objective. While energy can be measured, assigning values to "aesthetic pollution" is subjective and can lead to **bias**.

Section 6: Reducing Resource Use

Strategies: Reduce, Reuse, Recycle.

- **Metals:** Recycled by melting. Saves energy compared to extraction from ores.
- **Glass:** Crushed and remelted to make new objects. Some bottles are **reused**.
- **Impact:** Conserves finite raw materials and reduces environmental footprints.

Section 7: Bio-Extraction (Copper Ores)

Used for **low-grade ores** that are not economical to mine traditionally.
1. Phytomining:

- Plants are grown on copper-rich soil and absorb metal ions into their tissues.
- Plants are **harvested and burned** to produce **ash**.
- Ash contains copper compounds which are extracted using acid or electrolysis.

2. Bioleaching:

- Bacteria break down copper compounds in the ore.
- This produces a solution called a **leachate**.
- Copper is then extracted using **displacement** (with scrap iron) or **electrolysis**.

Section 8: Corrosion & Rust Prevention

Rusting: Specific to **Iron**. Requires both **Oxygen** and **Water**.
Prevention Algorithm:

1. **Barrier Methods:** Painting, greasing, or electroplating. (Stops air/water contact).
2. **Sacrificial Protection:** Attaching a **more reactive** metal (e.g., Zinc). It reacts *instead* of the iron.
3. **Galvanising:** Coating in Zinc (both a barrier and sacrificial protection).

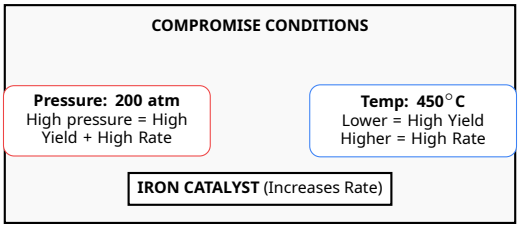
Section 9: Alloy Masterlist

Definition: Mixtures of metals to change properties (usually to make them harder).

- **Bronze:** Copper + Tin (Statues).
- **Brass:** Copper + Zinc (Taps/Instruments).
- **Steel:** Iron + Carbon. (High Carbon = Strong/Brittle; Low Carbon = Soft/Malleable).
- **Aluminium Alloys:** Low density (Aeroplanes).

Section 10: The Haber Process (Ammonia)

Equation: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (Exothermic forward) **Sources:** Nitrogen (Air); Hydrogen (Natural gas).



Logic Checklist:

- **Temperature:** Forward is exothermic. Low temp gives high yield but is too **slow**. 450°C is the **compromise**.
- **Pressure:** Fewer moles on the right. High pressure gives high yield AND high rate, but >200 atm is **dangerous/expensive**.

Section 11: NPK Fertilisers

Elements: Nitrogen (N), Phosphorus (P), Potassium (K).

- **Formulations:** Mixed salts to improve agricultural productivity.
- **Ammonium Nitrate:** $NH_3 + HNO_3 \rightarrow NH_4NO_3$. (Main source of Nitrogen).
- **Industrial vs. Lab:** Industry uses higher concentrations and higher temperatures (Exothermic energy is reused).

Section 12: Advanced Materials

- **Ceramics:** Glass (Soda-lime or Borosilicate) and clay. Hard, brittle insulators.
- **Polymers:** Thermosoftening (melt when heated) vs. Thermosetting (strong cross-links; do not melt).
- **Composites:** A reinforcement material embedded in a binder (matrix). Examples: Carbon fiber, reinforced concrete.

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