OCR B GCSE Chemistry

Topic 4: Material choices

How is data used to choose a material for a particular use?

Notes

1. Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals, including melting point, softening temperature (for polymers), electrical conductivity, strength (in tension or compression), stiffness, flexibility, brittleness, hardness, density, ease of reshaping

- glass ceramics: transparent, hard, brittle, poor heat and electrical conductors
    - uses: windows, bottles
- clay ceramics: opaque, hard, brittle, poor heat and electrical conductors
    - uses: bricks and porcelain
- polymers: can be made transparent/translucent/opaque, poor heat and electrical conductors, can be tough or ductile
    - uses: plastic bags, bottles
- metals: shiny, good heat and electrical conductors, hard, tough
    - uses: cars, bridges, electrical cables

2. Explain how the properties of materials are related to their uses and select appropriate materials given details of the usage required

- see above

3. Describe the composition of some important alloys in relation to their properties and uses, including steel (separate science only)

- Most metals in everyday uses are alloys.
- Pure copper, gold, iron and aluminium are all too soft for everyday uses and so are mixed with small amounts of similar metals to make them harder for everyday use.
- this works because in a pure metal, all the + metal ions are the same size and in a regular arrangement, allowing the layers to slide over each other relatively easily, making the metal soft and malleable. In an alloy, you have + ions of different metals, which have different sized ions. This disrupts the regular structure and prevents the ions being able to slide as easily, leaving a much harder, stronger metal.

- Steels are alloys since they used mixtures of carbon and iron
    - Some steels contain other metals. Alloys can be designed to specific uses.
    - Low-carbon steels are easily shaped - used for sheeting (malleable)
    - High carbon steels are hard - used for cutting tools
    - Stainless steels (containing chromium and nickel) are resistant to corrosion - used for cutlery

- uses of other alloys:
    - aluminium: low density, used for aircraft
    - copper: good conductor, used in electrical cables
    - gold: good resistance to corrosion, used in jewelry
    - magnalium (aluminum + magnesium): low density, used in cars and planes
    - brass (copper + zinc): hard, resistant to corrosion, used in coins