Your notes

GCSE Engineering: revision notes

Engineering materials and their properties

Contents

1. Metals
2. Polymers and composites
3. Mechanical properties
4. Physical properties
5. Key terms
6. Quick questions
7. What to do next

Metals

- **Ferrous metals** contain iron and most will rust. Mild steel (low carbon) is tough and easy to work; high carbon steel is harder, for tools; cast iron is hard but brittle; stainless steel contains chromium and resists corrosion.
- **Non-ferrous metals** contain no iron: aluminium (light, corrosion resistant), copper (excellent electrical conductor) and zinc (used to coat steel).
- **Alloys** are mixtures of a metal with other elements to improve properties. Brass is copper and zinc; bronze is copper and tin.

Polymers and composites

- **Thermoplastics** soften when heated and can be reshaped and recycled, such as acrylic, ABS, nylon, PVC and polypropylene.
- **Thermosetting polymers** set permanently when first heated and can't be reshaped, such as epoxy resin, polyester resin and urea formaldehyde (used in electrical fittings).
- **Composites** combine materials to get better properties: carbon fibre reinforced polymer (strong and light), glass-reinforced plastic (GRP) and reinforced concrete.

Mechanical properties

- Strength: resisting a force without breaking (tensile strength for pulling, compressive strength for squashing).
- Hardness: resisting scratching, wear and indentation. **Toughness**: absorbing energy without breaking (the opposite of brittleness).
- **Ductility**: being drawn out into wire. **Malleability**: being hammered or pressed into shape without cracking.

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- Elasticity: returning to the original shape after a force is removed. Plasticity: staying permanently deformed.

Physical properties

- Density = mass ÷ volume. Aluminium is about 2.7 g/cm³; steel is about 7.8 g/cm³.
- Electrical and thermal conductivity, melting point, and resistance to corrosion.

Key terms

Ferrous metal	A metal that contains iron.
Non-ferrous metal	A metal that contains no iron.
Alloy	A metal mixed with other elements to improve its properties.
Thermoplastic	A polymer that can be reheated and reshaped.
Thermosetting polymer	A polymer that sets permanently and can't be reshaped.
Composite	A material made by combining two or more materials.
Toughness	The ability to absorb energy without breaking.
Ductility	The ability to be drawn out into a wire.
Malleability	The ability to be hammered or pressed into shape without cracking.

Quick questions

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

1. Which metal is ferrous?
2. What is brass an alloy of?
3. What is a thermoplastic?
4. Which is a thermosetting polymer?
5. What is toughness?
6. What is ductility?
7. Why is stainless steel used for cutlery?
8. A block has mass 540 g and volume 200 cm³. What is its density?

Answers

1. Mild steel
2. Copper and zinc
3. A polymer that can be reheated and reshaped
4. Epoxy resin
5. The ability to absorb energy without breaking
6. The ability to be drawn out into a wire
7. It resists corrosion
8. 2.7 g/cm³

Your notes

What to do next

Practise 10 questions on this topic

Try 3 exam questions, with mark schemes

Read the lesson, one step at a time

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