Your notes

GCSE Design and Technology: revision notes

Modern, smart and composite materials

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Modern materials

- **Graphene**: a single layer of carbon atoms. Very strong, light and an excellent conductor. Possible uses include flexible screens and batteries.
- Metal foams: metals with gas bubbles inside, making them light but strong. Used for crash protection and lightweight panels.
- Titanium: strong, light and corrosion resistant. Used in aircraft, bike frames and medical implants.
- Liquid crystal displays (LCDs): thin screens that use liquid crystals to show images, used in phones and TVs.
- Nanomaterials: materials engineered at a tiny scale, such as self-cleaning glass or antibacterial coatings.

Smart materials

- **Smart materials** change their properties in response to a change in their surroundings, then change back.
- **Shape memory alloys** (such as nitinol) return to their original shape when heated. Used in glasses frames and stents.
- **Thermochromic pigments** change colour with temperature. Used in kettles, baby spoons and mugs.
- **Photochromic pigments** change colour with light. Used in sunglasses lenses that darken in sunlight.

Composites and technical textiles

- A **composite** combines two or more materials to get better properties. Glass-reinforced plastic (GRP) is used for boat hulls; carbon-fibre reinforced plastic (CRP) is used for racing bikes and sports cars.

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- Technical textiles are made for performance: conductive fabrics carry electricity (in wearable tech), fire-resistant fabrics protect firefighters, **Kevlar** is strong enough for body armour, and microfibres can hold micro-encapsulated scents or medicines.

Your notes

Key terms

Smart material	A material that changes its properties in response to a change in its surroundings.
Shape memory alloy	A metal that returns to its original shape when heated.
Thermochromic pigment	A pigment that changes colour with temperature.
Photochromic pigment	A pigment that changes colour with light.
Composite	A material made by combining two or more materials.
Graphene	A strong, light layer of carbon one atom thick.
Kevlar	A very strong synthetic fibre used in body armour.

Quick questions

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

1. What is a smart material?
2. What does a thermochromic pigment respond to?
3. What does a photochromic pigment respond to?
4. What is special about a shape memory alloy?
5. Which is a composite material?
6. What is graphene?
7. Why is titanium used for medical implants?
8. What is Kevlar used for?

Answers

1. A material that changes its properties in response to its surroundings
2. Temperature
3. Light
4. It returns to its original shape when heated
5. Glass-reinforced plastic
6. A single layer of carbon atoms
7. It is strong, light and doesn't corrode
8. Body armour

What to do next

Practise 11 questions on this topic

Try 5 exam questions, with mark schemes

Read the lesson, one step at a time

Your notes