Your notes

GCSE Engineering: revision notes

The impact of modern technologies

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Automation and robotics

- **Automation** uses machines and computer control to carry out tasks with little human input. Robots weld, paint and assemble cars.
- Advantages: consistent quality, working 24 hours a day, doing dangerous or repetitive tasks, and lower labour costs over time.
- Disadvantages: high set-up costs, some jobs lost, and the need for skilled technicians and programmers.
- Industry 4.0 links machines through the internet (the **internet of things**) so data can improve production.

New and smart materials

- **Smart materials** change properties in response to a stimulus. **Shape memory alloys** (such as nitinol) return to shape when heated. Thermochromic pigments change colour with temperature. Photochromic materials change with light.
- Piezoelectric materials produce a voltage when squeezed. Quantum tunnelling composite (QTC) conducts more as it is compressed.
- Modern materials include carbon fibre composites and graphene (very strong and conductive).

Sustainability and the environment

- A **life cycle assessment** looks at a product's environmental impact from extraction, manufacture and transport to use and disposal.
- The 6Rs: reduce, reuse, recycle, rethink, refuse and repair.
- Engineers reduce impact by using recycled materials, designing for disassembly, making products more efficient and choosing renewable energy.

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- Lean manufacturing reduces waste; **just-in-time** (JIT) production orders parts only when needed, reducing storage costs.

Impact on society

- Modern technologies bring new products (such as electric vehicles), new jobs and better safety, but also job losses in some industries, e-waste and **planned obsolescence** (products designed to have a short life).

Key terms

Automation	Using machines and computer control to do tasks with little human input.
Smart material	A material that changes properties in response to a stimulus.
Shape memory alloy	A metal that returns to its original shape when heated.
Life cycle assessment	Measuring a product's environmental impact from extraction to disposal.
Just-in-time	Ordering parts only when they are needed.
Planned obsolescence	Designing products to have a short life.
Internet of things	Everyday devices and machines connected through the internet.

Quick questions

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

1. What is a smart material?
2. Which material returns to its shape when heated?
3. What does a thermochromic pigment respond to?
4. What is a benefit of robots in car factories?
5. What is a life cycle assessment?
6. What is just-in-time production?
7. What is planned obsolescence?
8. What does a piezoelectric material do?

Answers

1. A material that changes properties in response to a stimulus
2. A shape memory alloy
3. Temperature
4. Consistent quality and working 24 hours a day
5. Measuring a product's environmental impact from extraction to disposal
6. Ordering parts only when they are needed
7. Designing products to have a short life
8. Produces a voltage when squeezed

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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