

Design & Technology (Product Design)

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OCR A-Level

Modern Materials (5.2aix)

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don't spend too much time on one question

Good luck!

Q1. What is not a disadvantage of using an LCD screen over traditional screens?

- A** LCD is more expensive
- B** LCDs are very fragile
- C** LCDs have a shorter lifespan

Q2. Which modern material would be most suitable for the turbine blades in a jet engine?

- A** E-textiles
- B** Super-alloys (e.g., Inconel)
- C** Bioplastics

Q3. A "smart" bandage that monitors wound pH and releases antibiotics accordingly would likely incorporate:

- A** Super-alloys
- B** Nanosensors and responsive nanomaterials
- C** Woven graphene sheets

Q4. A key challenge in the widespread adoption of graphene is:

- A** Its high toxicity and environmental hazard
- B** The difficulty and cost of producing high-quality sheets on an industrial scale
- C** Its poor performance in electronic applications

Q5. The image below shows a plastic cup.



Q5a. Since the reduction of the use of polymers in single-use packaging, designers and manufacturers have had to seek alternative modern materials.

Identify a suitable modern material for the cup shown in the image. Justify your answer **(2 marks)**

Q5b. Explain one disadvantage of using the modern material identified in Q5a for the cup. **(2 marks)**

Q6. The image below shows a walkie talkie.



Identify one modern material that could be used in the design of the walkie-talkie. Justify how this smart or modern material would improve the design. **(2 marks)**

Q7. Evaluate the use of liquid crystal display (LCD) technology in mobile phone screens **(6 marks)**

Answers

Q1. C

Q2. B

Q3. B

Q4. B

Q5a.

Possible modern materials may include:

- PLA (1). Suitable for disposal packaging as it is fully biodegradable/ compostable (1).
- Starch-based or plant-based biopolymers (1). This modern material is renewable/sustainable and therefore will reduce carbon footprint (1).
- Any other valid suggestion.

Q5b.

Possible disadvantages may include:

- Biopolymers will not biodegrade in a landfill (1) and need to be in the right conditions to decompose (1).
- Contamination of recycling schemes (1) makes the material less likely to be recycled/ the process more difficult/available e.g. terracycling (1)
- Encourages people to litter as they believe the cup will decompose in nature (1) and do not understand this will take time (1).
- Biopolymers made from plants and the planting and harvesting (1) of these could affect or displace wildlife or natural habitats (1)
- Any other valid suggestion.

Q6.

Possible modern materials may include:

- Bio-polymers (1) could be used in the casing of the walkie-talkie so that at the end of life it can degrade/will create less environmental impact (1).
- LED/OLED screen (1) could be used as it is then backlit and easy to read the numbers on the screen in the dark (1).
- Any other valid suggestion.

Q7.

Advantages

- Low energy requirement/efficient (1)
- Extends battery life (1)

- Lightweight units (1)
- Thin / small / compact unit / minimal space required (1)
- Increased portability (1)
- Produce a wide range / 256 colours (1)
- Vivid / bright / clear display (1)
- Small pixel size allows detailed/ sharp/ high quality / high-definition images (1)
- Sufficiently robust /tough /can take some impacts / knocks (1)
- Reliable/ durable / long-lasting (1)
- Can be mass produced cheaply / quickly (1)
- They do not get hot (1)
- Light is instant/no warm-up time (1)
- Reduced eye strain (1)
- Powered by small batteries (1)

Disadvantages

- Can be broken from a direct impact / relatively easily (1)
- Limited viewing angle (1)
- Expensive to replace / high maintenance cost / difficult to fix (1)
- Can suffer from image persistence / retention (1)
- A small, damaged area can affect the whole screen (1)