Design & Technology

Modern materials

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try to 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
- Don’t spend too much time on one question

Good luck!

Q1. What is not a use for thermo-ceramics?

A Turbine blades

B Metal cutting tools

C F1 car break discs

Q2. 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

Q3. Having smartphone screens that repel greasy fingerprints is achieved using which of the following?

A Polymorph

B Nanomaterials

C LCDs

Q4. Kevlar is a material that has which of these properties?

A Strong and resistant to impact

B Soft and resistant to spills and stains

C Conductive and resistant to fire

Q5. What material is used to make dental braces?

A Nitinol

B Zinc

C Aluminium

Q6. Which of the statements about Graphene are false?

A Graphene is a nonmetal

B Graphene has low resistance to flow of electricity

C Graphene has high resistance to flow of electricity

Q7. Which of the following statements about nanomaterials is true?

A They have excellent thermal capacity

B Used in construction industry because of their resistance to corrosion

C A single particle has an average size of 1-100nm

Q8. Which of these properties of glulam is false?

A Cheap material

B Easy to form and shape

C Good strength-to-weight ratio

Q9. What is a modern material **(1 marks)**

Q10. Name a product manufactured from Kevlar and explain why it is suitable for its production **(4 marks)**

Product:

Reasons:

Q11. Evaluate the use of liquid crystal display (LCD) technology in mobile phone screens **(6 marks)**

Q12. Explain how Kevlar fibres are processed and arranged to give this material its unique properties **(2 marks)**

Q13. Turbine blades in jet engines and brake discs in high performance cars are often made from thermo-ceramics.

Explain three advantages of thermo-ceramics that make them appropriate in these situations **(6 marks)**

1.

2.

3.

Answers

Q1. B
Q2. C
Q3. B
Q4. A
Q5. A
Q6. C
Q7. C
Q8. A

Q9.

- A modern material is a material that has been engineered to have improved properties (1)

Q10.

Bullet proofing/protective equiptment (vest/armour) (1)

- Material is extremely strong (1)
- Lightweight (1)
- High tensile strength to weight ratio (1)
- Non flammable (1)

Car fuel tanks (1)

- Non flammable (1)
- Difficult to puncture (1)
- Flexible (1)

Bike tyres (1)

- Reduces puncture rates (1)
- Material is strong (1)
- Lightweight (1)
- Flexible (1)

Boat hulls, aerospace framework (1)

- Lightweight (1)
- Can withstand force, tensile stress (1)
- Impact resistant (1)

Q11.

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)

Q12.

- Arranged as a mat (non woven) (1)
- Arranged in layers (1)
- Woven (1)
- Spun into ropes (1)
- Can be treated with chemicals (1)
- Woven for strength as a net/mat (2)
- Woven to create a net like structure resistant to penetration, e.g. knife attack (2)
- Chemical treatment to make fibres more flexible, e.g. easier to move wearing them as clothing (2)

Q13.

- Strength (1) in order to withstand high forces without breaking / deforming (1)
- Heat resistant (1) so they do not soften / weaken when in situ (1)
- Stable (1) so that they do not excessively expand with heat causing malfunction (1)
- Hard (1) so that they do not wear away /scratch when in use (1)
- Lightweight (1) increasing efficiency (e.g., fuel saving) (1)