**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.

**Q14.** State three reasons why Precious Metal Clay (PMC) could be used for a decorative jewellery item. **(3 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)

**Q14.**

* It is malleable and easy to mould and shape into an appropriate form
* It has an attractive aesthetic appearance
* It can be polished once fired
* It is less expensive than using a traditional metal such as gold and silver
* It is able to be hallmarked to provide authenticity
* It will set to become hard and durable when fired

1 mark per bullet point