Materials: Ceramics, Polymers and Composites

Calculator allowed · about 35 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Choose the material group that includes a clay mug: ceramic, polymer or composite.

(1)

---

2 Fibreglass contains glass fibres in a plastic. State the job of the glass fibres and the job of the plastic.

(2)

---

3 A builder needs a beam that is strong but not too heavy. A composite beam has mass 3 kg and can safely hold 90 kg. Calculate the supported mass per kilogram of beam.

(2)

---

4 A ceramic tile and a polymer sheet are tested for water absorption. The tile gains 0.2 g and the sheet gains 0.0 g. Each started at 20.0 g. Calculate the percentage mass increase for each.

(4)

© Revision Library | revisionlibrary.co.uk

5 A class compares three materials for an outdoor sign. The results are: ceramic tile, hard, waterproof, brittle; polymer sheet, light, waterproof, flexible; plywood composite, stiff, strong, absorbs water at its edges. Which would you choose for a light sign that may be knocked? Explain using two properties.

(3)

6 A designer wants a material for an oven dish. It must keep its shape when hot and be easy to clean. Choose ceramic or a soft polymer and give a reason for each requirement.

(3)

7 A bridge designer compares steel alone with a composite of strong fibres in a light polymer. Explain one advantage and one possible limitation of the composite for a bridge part.

(3)

8 State one property of ceramics that makes them useful for floor tiles.

(1)

9 A glass window lets light pass through and does not absorb much water. Name these two properties.

(2)

© Revision Library | revisionlibrary.co.uk

10 A ceramic plate is hard but breaks when dropped. State the property that describes breaking easily.

(1)

---

11 A saucepan handle is made from a polymer. State one reason this can be safer to hold than a metal handle when the pan is hot.

(2)

---

12 A drinks bottle is made from a polymer. Give two useful properties of this material for the bottle.

(2)

---

13 A plastic ruler bends slightly when pressed and returns to its shape when released. State the property shown.

(1)

© Revision Library | revisionlibrary.co.uk

14 A school wants a material for a transparent, shatter-resistant safety visor. Choose the better option: ordinary glass or a tough clear polymer. Give one reason.

(2)

15 A composite is made by combining materials so that the parts work together. State what a composite is and give one example.

(2)

© Revision Library | revisionlibrary.co.uk

Mark scheme · Materials: Ceramics, Polymers and Composites

Question 1

Ceramic. **B1**

Answer: **Ceramic.**

Question 2

Glass fibres make it strong or stiff. **B1**

Plastic holds the fibres together. Accept that it forms or maintains the shape, supports the fibres, or protects them; any one valid role earns this mark. **B1**

Answer: **Fibres add strength; plastic binds them and forms the shape.**

Question 3

Uses 90 / 3. **M1**

30 kg of supported mass per kg of beam. **A1**

Answer: **30 kg per kg.**

Question 4

Tile: (0.2 / 20.0) x 100. **M1**

Tile: 1%. **A1**

Sheet: (0.0 / 20.0) x 100. **M1**

Sheet: 0%. **A1**

Answer: **Tile: 1%; polymer sheet: 0%.**

Question 5

Chooses polymer sheet. **B1**

It is light. **B1**

It is flexible, so it is less likely to break when knocked (or another supported link). **B1**

Answer: **Choose polymer sheet: it is light and can flex when knocked instead of breaking.**

Question 6

Chooses ceramic. **B1**

Ceramic can withstand high temperatures without softening like many polymers. **B1**

Its hard, smooth surface can be cleaned. **B1**

Answer: **Ceramic: it stays hard at oven temperatures and its smooth surface is easy to clean.**

Question 7

One valid advantage, for example high strength for its mass. Accept another scientifically valid advantage of the stated composite compared with steel. **B1**

Explains how the stated advantage helps the bridge part: for example, a strong, light part can support the required load while adding less load to the bridge supports. Credit a valid consequence linked to the advantage, not a repetition of it. **B1**

One possible limitation linked to its effect, for example damaged fibres reduce strength, heat may soften the polymer, or joined materials can be difficult to separate for repair or recycling. Accept another scientifically valid limitation with its effect on use or disposal. **B1**

Answer: **The composite can be strong for its mass, so it can support the required load while adding less load to the bridge supports. Damaged fibres could reduce its strength.**

Question 8

Any one useful property, for example hard, resistant to scratching, durable, or waterproof/easy to clean when glazed. Accept another suitable property for floor tiles. **B1**

Answer: **Ceramics are hard.**

Question 9

Transparent. **B1**

Waterproof, or does not absorb water. **B1**

Answer: **Transparent and waterproof.**

Question 10

Brittle. **B1**

Answer: **Brittle.**

Question 11

Polymers are poor conductors of heat, or thermal insulators. **B1**

Less heat reaches the hand, so the hand is less likely to be burned. **B1**

Answer: **The polymer is a poor conductor of heat, so less heat travels to the hand.**

Question 12

One useful property: lightweight, waterproof, tough, or can be moulded into shape. Accept another suitable property. **B1**

A second distinct useful property: lightweight, waterproof, tough, or can be moulded into shape. Accept another suitable property; do not credit the same property twice. **B1**

Answer: **Any two distinct useful properties, for example waterproof and tough.**

Question 13

Elastic, because it returns to its original shape when released. **B1**

Answer: **Elastic.**

© Revision Library | revisionlibrary.co.uk

Question 14

Tough clear polymer. **B1**

It resists shattering or breaking when hit, so protects the wearer. Accept that it is tough or less brittle than ordinary glass. Transparency is not also required for this mark. **B1**

Answer: **Tough clear polymer, because it lets light through and is less likely to shatter.**

Question 15

A material made by combining two or more different materials. **B1**

Example: reinforced concrete, fibreglass, or plywood. **B1**

Answer: **A composite combines different materials; reinforced concrete is one example.**

© Revision Library | revisionlibrary.co.uk