

**OCR A-Level**

**Composite Materials**  
**(5.2aviii)**

**Materials required for questions**

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- Pencil
- Rubber
- Calculator

**Instructions**

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- 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**

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- 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.** GRP is a combination of which materials?

- A** Glass fibre and resin
- B** Wood fibre and resin
- C** Carbon fibre and resin

**Q2.** What is a suitable composite material for the body of a Formula 1 car?

- A** GRP
- B** GRC
- C** Lightweight ceramic

**Q3.** What is CFRP

- A** Carbon fibre resin polymer
- B** Cement fibre reinforced plastic
- C** Carbon fibre reinforced polymer

**Q4.** Which component in a fibre based composite material is primarily responsible for carrying tensile loads?

- A** The polymer matrix
- B** The fibre reinforcement
- C** The filler material

**Q5. Evaluate the use of carbon fibre in the manufacture of crash helmets. (6 marks)**

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**Q6. Explain one advantage of using carbon fibre rather than polyvinyl chloride (PVC) for the outer shell of the cycle helmet. (3 marks)**

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**Q7.** Give three reasons why a gel coat is used when laminating a glass reinforced plastic (GRP) product. **(3 marks)**

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**Q8.** Explain the meaning of 'composite material' **(2 marks)**

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## Answers

Q1. A

Q2. A

Q3. C

Q4. B

Q5.

Advantages:

- Extremely strong/durable/tough/impact resistant (1)
- Light weight (1)
- Good strength to weight ratio (1)
- Gives good protection for the rider (1)
- Easily mouldable (1)
- A uniform strength can be achieved all over the helmet (1)
- The surface is suitable for the application of various decorative options e.g. decals/paint (1)
- Has good elastic properties deflecting some of the impact (1)
- Doesn't degrade e.g. in sunlight/water (1)
- Aesthetic appeal / range of colours (1)

Disadvantages:

- High cost of material /helmet (1)
- High wastage (1)
- Time consuming/skilled process to manufacture (1)
- Relatively high cost of production method (1)
- Accident/impact means the helmet is no longer serviceable/safe to use (1)

Maximum of 5 marks if advantages or disadvantages only are given

Q6.

Any explanation that includes the identification of an advantage (1) and linked justifications of that advantage (1+1): 1.

- Carbon fibre has higher strength than PVC (1) providing better protection for the wearer of the helmet (1) reducing the chance of serious injury or fatality (1)

- Carbon fibre is tougher/harder/more impact resistant than PVC (1) which increases the durability/life of the helmet (1) providing long term economies (1)
- Carbon fibre provides a marketing opportunity (1) because users may perceive the helmet as high-tech/ cutting edge/ trendy product (1) increasing sales of the helmet/ providing higher profit opportunities (1)
- Woven structure of the fibres (1) provides strength in all directions (1) providing excellent protection for the wearer (1)
- Carbon fibre does not degrade when exposed to sunlight/ UV light (1) providing longer lasting functional protection/ durability (1) making the product cost effective for the user (1)
- Carbon fibre has a unique and distinct appearance (1) that is difficult to replicate (1) giving the perception of a high quality desirable product/ providing increased profit opportunities for the manufacturer (1)

**Q7.**

Give three reasons why a gel coat is used when laminating a glass reinforced plastic (GRP) product.

1 mark for each appropriate reason to a maximum of 3 marks.

Indicative content

Gel coat:

- can be used to provide a pigment to the external surfaces of a GRP product
- may be enhanced with additives such as UV stabilisers to increase the durability of the GRP product
- provides a hard scratch resistant surface to a GRP product
- produces an impermeable coating which protects the GRP product from water damage
- provides a smooth flat surface that is capable of being polished to a high lustre.
- Is the first stage of the moulding process that ensures a smooth outer surface finish and aids the release of the moulding once cured.

This list is not exhaustive. Accept any other valid responses.

**Q8.**

- A mix of two or more materials (1)
- To produce a material with enhanced properties (1)