

Design & Technology

Metals

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 makes a metal a ferrous metal?

- A** It must contain carbon
- B** It must contain iron
- C** It must contain rust

Q2. The carbon content in ferrous metals usually ranges between what?

- A** 0.15 and 1.4%
- B** 98.3 and 100%
- C** 23.3 and 42%

Q3. What is a disadvantage of Cast iron?

- A** It is ductile
- B** It is soft
- C** It is brittle

Q4. Aluminium is ideal for aircraft due to what property?

- A** Its malleable
- B** Its lightweight
- C** Its corrosion resistant

Q5. What is an alloy?

- A** A mixture of two or more materials
- B** A mixture of two or more metals
- C** A mixture of a two or more polymers

Q6. Copper is used for wiring because of what property?

- A** It is ductile
- B** It is soft
- C** It is brittle

Q7. Why is brass used in gears?

- A** It casts well
- B** It is easy to machine
- C** It has a low coefficient of friction

Q8. What might stainless steel be used to make?

- A** Kitchen utensils
- B** Ship propellers
- C** Magnets

Q9. A kitchen sink has been manufactured from stainless steel.

Provide **two physical** and **two mechanical** characteristics of the metal chosen for the kitchen sink, along with an explanation for why each property is appropriate for this product **(8 marks)**

Q10. Die-casting is a common process used for making metal products.

Explain **one** specific characteristic of zinc that justifies its usage as a material for die-casting **(2 marks)**

Q11. Casting is a common process used for making metal products such as brass paperweights.

Explain **one** specific characteristic of zinc that justifies its usage as a material for casting **(2 marks)**

Q12. Explain **three** distinct mechanical properties of copper that render it appropriate for usage as electrical wire. **(6 marks)**

Q13. Explain **two** reasons why carbon steel is used for the blade of a chisel. **(4 marks)**

Answers

Q1. B

Q2. A

Q3. C

Q4. B

Q5. B

Q6. A

Q7. C

Q8. A

Q9.

Mechanical Properties

- Due to its hardness (1) since its surface resists scratches from cutlery, dishes, washing, etc (1)
- Toughness (1) prevents it from breaking if a pan is dropped on it (1)
- Malleability (1) means it is press-formable into the sink's shape (1)

Physical properties

- Corrosion resistance (1) won't rust or deteriorate when in contact with water (1)
- Chemical resistance (1) prevents detergent degradation (1)

Q10.

- When molten, zinc has good fluidity (1), so it will flow easily into the die (1)
- Zinc uses less energy to melt (1) because of its low melting point (1)

Q11.

- When molten, brass has good fluidity (1), so it will flow easily into the die (1)
- Brass uses less energy to melt (1) because of its low melting point (1)

Q12.

- Enough durability (1) to withstand breaking (1)
- Flexibility (1) allows the wire to flex without snapping (1)
- Ductility (1) to enable wire drawing (1)
- Fatigue strength (1), which enables repeated bends without fracture (1)
- Being soft (1) makes it simple to cut (1)
- Creep resistant (1), preventing deformation from repeated pressures (1)

Q13.

- Carbon steel is hard (1) so the cutting edge will remain sharp / will not easily damage / be durable / require less frequent sharpening (1)
- Carbon steel has high strength (1) meaning that the chisel will not deform / remain rigid / it will retain its desired shape (1)
- Carbon steel can have different carbon contents (1) allowing the properties to be tailored to the requirements of the blade(1)