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Design & Technology
Eduqas GCSE

Metals: surface treatments and finishes

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- 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

- 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. What are the two main reasons for finishing metals?

A To make them magnetic and lighter

B Protection from rust or tarnish, and aesthetics

C To make them easier to cut and bend

Q2. What is used to degrease metal so the finish sticks?

A A solvent such as white spirit

B Emery cloth

C A file

Q3. For plastic dip coating, the metal is heated in an oven to about:

A 80°C

B 800°C

C 230°C

Q4. Enamelling is done by:

A Firing powdered glass onto the metal in a kiln

B Dipping steel in molten zinc

C Burning oil onto hot steel

Q5. What is galvanising?

A Thickening the oxide layer on aluminium

B Dipping steel in molten zinc

C Spraying polymer powder and baking it

Q6. Why is a primer applied before painting metal?

A To give the final colour

B To make the surface shiny

C To stop rust and help the paint stick

Q7. A child's toy car is made from machined aluminium.

Q7a. The toys have different finishes applied. Explain why a finish is used. **(2 marks)**

Q7b. State the name of a piece of equipment used to polish some parts of the toy to a shine. **(1 mark)**

Q8. This question is about choosing finishes.

Q8a. A toolbox has been fabricated from mild steel. State a surface treatment used to create a suitable finish on the toolbox. **(1 mark)**

Q8b. An interior wall lamp has a solid aluminium back. Name one surface finish or surface treatment that could be applied to the aluminium back. **(1 mark)**

Q9. This question is about anodising aluminium.

Q9a. An aluminium product is placed in a tank of sulphuric acid and connected to a power supply, with the product as the anode. Name this process. **(1 mark)**

Q9b. Give one reason, other than an attractive appearance, why a finish would be applied to a product made from metal. **(1 mark)**

Q9c. The 5 mm diameter aluminium rails of a shower room storage unit are anodised. Give two reasons why the aluminium rails should be anodised. **(2 marks)**

Q9d. The metal parts of a children's construction kit are anodised in different colours. Explain one reason for anodising different parts of the construction kit in different colours. **(2 marks)**

Q10. Part of a mild steel workshop tool hook has been dip coated. Use notes and sketches to show how the surface of the tool hook should be prepared and dip coated. **(4 marks)**

Q11. This question is about finishes for steel used outdoors.

Q11a. A range of mild steel bicycle racks has been powder coated. Describe the main function of this finish. **(2 marks)**

Q11b. A watering can is made from 1 mm thick mild steel, with a zinc plated handle and spout. Explain how the choice of material and/or surface finish makes it suitable for an outdoor garden environment. **(2 marks)**

Q12. A bicycle wheel hub is made from metal.

Q12a. Name one modification technique (such as a surface treatment) that could be used on the metal of the bike hub. **(1 mark)**

Q12b. Why does the material need modifying to make a more effective product? **(2 marks)**

Q13. The number wheels of a teaching aid are made from aluminium. Give two different surface finishes or treatments that could be applied to the aluminium number wheels. Explain one advantage of using each surface finish or treatment. **(6 marks)**

Q14. The mild steel bracket of a wall-mounted lamp has been finished with a powder coating. Explain two benefits of using a powder coating to finish the surfaces of the bracket. **(6 marks)**

Answers

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

Q7a.

1 mark each for up to two reasons. For example:

- To protect the body or wheels of the car and extend the life of the product
- To protect against corrosion, as children often spill liquids over toys
- To let the manufacturer offer a range of car bodies in different colours to increase sales
- To add colour to attract the target user

Students may mention ways of colouring or finishing aluminium: spray painting (a primer base coat, then a gloss, satin or matt top coat; the primer helps the top coat stick), colouring after anodising, or polishing with a buffing wheel.

Q7b.

Buffer, buffing wheel, polishing wheel or polisher (1).

Q8a.

Any one (1): polishing, clear lacquer, paint, dip coating. Credit any other appropriate response.

Q8b.

Any one (1): paint; dip coating; electroplating or anodising; powder coating; brushed; polished or buffed; lacquer.

Q9a.

Anodising (1). Also accept electroplating or electrolysis.

Q9b.

Any one (1): to prevent corrosion; to protect it; to make it hard wearing, durable or long lasting.

Q9c.

Any two (1 mark each): it gives a protective layer; greater corrosion resistance; an attractive (coloured) appearance.

Q9d.

A reason (1) and a linked justification (1). For example:

- Anodising creates a durable finish (1), so parts will not be damaged when they are put together and taken apart (1)
- It makes the kit more visually appealing (1), encouraging young children to play with it and more parents to buy it (1)
- Different parts can be recognised by their colour (1), making it easier to find the parts needed (1)
- It adds realism to the kit (1), so more life-like models can be built (1)

Q10.

Cap at 3 marks if there are no sketches, or sketches with no notes. Notes and sketches that include (1 mark each):

- Clean the metal, e.g. with emery cloth, to remove the surface oxide and give a key for the coating (1)
- Hang the hook from wire (1)
- Heat the hook evenly, soaking it for 15 to 20 minutes (1)
- Place the hook in a fluidised bath of plastic particles, with air blown through the plastic to make a fluid bed (1)
- Put the hook back in the oven to let the granules fuse (1)
- Leave it to cool and solidify (1)

Q11a.

Up to 2 marks for answers about the function of the powder coated finish. Answers should cover the reasons for powder coating, e.g.:

- Aesthetics: different colours can be applied, giving the range the manufacturer needs and colour coding the racks
- It is a protective finish that prevents the racks scratching the bicycles locked to them, and makes the racks more durable

Q11b.

The zinc coating on the steel provides resistance against rust (1), protecting the watering can against the weather (1).

Q12a.

Any one (1): anodising; chrome plating; electroplating; galvanising; painting.

Q12b.

Marks	Descriptor
2	A correct point explained in detail, possibly with a specific example.
1	A correct simple point of explanation.
0	No response or nothing worthy of credit.

Indicative content:

- To improve the aesthetics, e.g. making the aluminium surface of the hub more attractive and brightly coloured
- Hardening, to stop rain and salt from the road etching away the surface of the wheel axle

Q13.

For each of two finishes: the finish (1) plus two linked justifications (1) + (1). For example:

- The wheels can be polished or buffed (1), so they rotate and slide over each other (1), so there is less wear and friction between the touching wheels (1)

- The wheels can be lacquered (1), so the surface is better protected against dirty fingers (1), so it looks nicer for longer (1)
- The wheels can be painted or anodised (1), so they can be different colours (1), so the number wheels can be one colour and the sum wheel another, making them stand out (1)

Q14.

For each of two benefits: the benefit (1) plus two linked justifications (1) + (1). Do not accept anything about a smoother surface. For example:

- It gives a waterproof finish (1), so water and rain are repelled from the surface (1), so water cannot reach the steel and corrosion is prevented (1)
- It gives a tough surface finish (1), which protects the steel when it is hung up (1), so the life of the product is longer (1)
- It can be applied in a solid colour (1), giving a more attractive product (1), resulting in greater sales (1)