DTBase©

Design & Technology
Eduqas GCSE

Metals: specialist techniques and processes

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. Which tool marks the centre of a hole so the drill does not wander?

A Centre punch

B Scriber

C Dividers

Q2. Which type of hole is slightly bigger than the bolt, so the bolt passes straight through?

A Pilot hole

B Tapping hole

C Clearance hole

Q3. Which of these is a temporary method of joining metals?

A Brazing

B Nuts and bolts

C Riveting

Q4. What is the rod used for brazing made from?

A Silver

B Brass

C Tin

Q5. Which machine cuts thick steel plate quickly using ionised gas?

A Laser cutter

B CNC press brake

C Plasma cutter

Q6. On the lathe, which operation makes the end of the bar flat?

A Facing

B Knurling

C Parting off

Q7. A jig for marking out dowel positions is made from 1 mm thick mild steel sheet. Its development (net) is marked out on the sheet, with two Ø2 mm holes, then cut out and bent into a U shape that fits neatly over the end of a 40 × 20 mm wooden rail.

Q7a. Name two marking out tools that could be used to mark out the development (net). **(2 marks)**

Q7b. Give one reason why a centre punch would be used before drilling the holes in the mild steel sheet. **(1 mark)**

Q7c. Use sketches and notes to show how the development (net) could be cut out. Name all the tools and equipment used. **(3 marks)**

Q7d. Use sketches and notes to show how the cut out development (net) could be bent to shape. Name all the tools and equipment used. **(4 marks)**

Q8. The number wheels of a teaching aid are made from round aluminium bar measuring 100 mm diameter × 15 mm thick. Use notes and sketches to show how a 10 mm hole would be drilled through the centre of one of the number wheels using a pillar drilling machine. **(4 marks)**

Q9. The wheels of a child's toy car are machined from aluminium round bar.

Q9a. State the name of a machine used to create the axle holes in the wheels. **(1 mark)**

Q9b. Describe how to manufacture the wheels of the toy. **(4 marks)**

Q10. A holder for salt and pepper pots is made from 8 mm stainless steel plate. It has holes 9 mm deep for the pots to sit in. Explain two reasons for using a milling machine to manufacture the holders. **(4 marks)**

Q11. A mild steel toolbox is constructed using rivets. Explain why rivets are used in the construction of the toolbox. **(2 marks)**

Q12. The mild steel handle of a candle holder passes through a hole in its lid. Use notes and sketches to show how the handle and the lid are joined by brazing. **(4 marks)**

Q13. Three different methods are used to join metals in a structure: a nut and bolt, a countersunk rivet and a welded joint. Give one different reason for using each method. **(3 marks)**

Q14. The hollow sections of a bicycle frame are joined together by welding. Use words and sketches to show how to weld a section of the bicycle frame. **(5 marks)**

Q15. A stamped copper name plate is to be joined to the flat mild steel front panel of a desk tidy. Give two different methods of assembly that could be used to join the copper name plate to the front panel. Explain one reason for using each method of assembly. **(6 marks)**

Answers

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

Q7a.

Any two (1 mark each): scriber, try square, steel rule, metre rule, ruler, odd leg callipers, engineer's (marking) blue. Do not accept centre punch.

Q7b.

Any one (1): to guide the tip of the drill; to stop the tip of the drill wandering; to give an accurately positioned hole.

Q7c.

- Use of tin snips or a hacksaw shown (1)
- Tin snips or hacksaw named (1)
- Work held in a vice or clamped (1)

Also accept a guillotine or a notcher.

Q7d.

- Use of a former the same shape as the section of the rail (1)
- Use of a vice or clamps (1)
- Use of a mallet or hammer (1)
- Technical accuracy (1)

Q8.

Notes and/or sketches that include (1 mark each, up to 4):

- Mark or centre punch the centre of the piece of metal (1)
- Clamp the wheel to the machine table (e.g. with G clamps) or hold it in a vice, so it cannot move while being drilled (1)

- Put the 10 mm drill bit into the chuck (1)
- Wear PPE to protect your eyes (1)
- Turn the machine on and lower the drill bit into the metal (1)

Q9a.

Pillar drill or lathe (1). Hand or electric drill also accepted.

Q9b.

Up to 4 marks for a clear understanding of the stages. For example:

- Using a centre lathe, turn the aluminium bar down to the diameter of the wheel (1)
- Turn grooves into the bar for the tyre tread (1)
- Centre drill the hole in the centre of the wheel on the lathe, using the tailstock (1)
- Shape the axle of the wheel on the lathe (1)
- Part off the wheel ready to use (1)
- Surface finish the wheel, e.g. polish or buff it, before fitting it to the car body (1)

Q10.

Two reasons (1 mark each), each with a linked justification (1 mark each). For example:

- It can be used with a tracer (1), so it can follow a template and make identical copies of the holder (1)
- It can cut to different depths (1), so it can cut out the recesses, holes, profile or shape (1)
- Different sized or profiled cutters can be used (1), so shaped edges and rounded corners can be made and sharp edges removed (1)
- It can be computer controlled (CNC) (1), so the holder can be cut unaided, 24/7, faster than by manual methods (1)

Q11.

1 mark for each correct reason, up to 2. For example:

- Pop rivets give a permanent join for the mild steel sheet

- They give a neat finish, avoiding the discolouration a heat process would cause
- Heat processes may distort the shape of the toolbox, so they are less suitable
- The holes are made on the folds of the material, so the rivets join each section together
- They give an industrial look
- They are a quick and simple joint

Q12.

Cap at 3 marks if there are no sketches, or sketches with no notes. Notes and sketches that include:

- Cleaning the surfaces between the two parts (1)
- Applying flux to help the brazing rod flow (1)
- Using wire to hold the parts together during brazing, or putting the handle through the hole (1)
- Applying heat with a brazing torch to melt the brazing rod (1)
- Applying the brazing rod (filler) to the joint (1)

Q13.

One mark for each method. For example:

- Nut and bolt: a temporary fastening that can be removed or adjusted if needed (1)
- Countersunk rivet: a permanent method that keeps the surfaces clean and flush (1)
- Welded joint: a permanent, strong joint that resists compression, tension and torsion, gives a flush surface and needs no extra materials (1)

Q14.

Up to 5 marks for words and sketches showing a clear understanding of the stages. A maximum of 3 marks if only words or only sketches are given. For example:

- Position the parts of the frame together and clamp them in position (1)
- Heat the two sections to be joined with a welding torch (1)

- Melt the welding rod along the join of each section to make the joint (1)
- Leave it to cool down (1)
- Health and safety, e.g. gloves and goggles to protect the eyes and hands from heat and sparks, and a leather apron (1)

Credit quality control checks, e.g. clamping together or using a welding jig.

Q15.

For each of two methods: the method (1) plus two linked justifications (1) + (1). For example:

- Rivets (1): they hold the name plate in place by compression (1), as the rivet passes through holes in both parts and is compressed to form a second head on the inside face (1)
- Pop rivets (1): they only need access from the front of the desk tidy (1), which suits joining thin sheets together (1)
- Adhesive or glue (1): it forms a bond between the two different metals (1), as layers are applied and pressure is applied until the name plate is secure (1)
- Tape (1): it can be applied quickly with no drying time (1), as the parts are just pushed together and need no clamping (1)
- Mechanical fixings such as machine screws, nuts and washers (1): tightening the nut compresses the two parts together (1), giving a firm connection (1)