DTBase©

Design & Technology
Eduqas GCSE

Metals: scales of production

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 scale of production has the highest set-up cost?

A One-off

B Batch

C Continuous

Q2. A bespoke piece of jewellery made to a customer's requirements is an example of:

A One-off production

B Batch production

C Mass production

Q3. Which device is drawn round to mark out the same outline many times?

A Jig

B Template

C Depth stop

Q4. Which of these is a disadvantage of batch production?

A It cannot be made to exact personal specifications

B It has the highest unit cost

C Down time between batches

Q5. On a production line, workers doing one specialised, repetitive task each is called:

A Just in time

B Division of labour

C Bulk buying

Q6. What welds car body shells on a car production line?

A Robot welders

B CNC lathes

C Laser cutters

Q7. Aluminium fizzy drinks cans are commercially produced. Over two billion cans are manufactured every year.

Q7a. State the method of manufacture used for the cans: one-off production, batch production or mass production. **(1 mark)**

Q7b. The manufacture of the cans relies on automated production. Outline two advantages of using automated machinery to manufacture the drinks cans. **(2 marks)**

Q8. A mild steel toolbox is made from panels joined with rivets. Five holes need to be drilled along each edge of the panels for the rivets. Use notes and sketches to design a suitable drilling jig. **(4 marks)**

Q9. A template is used to mark out the mild steel front panel of a bicycle chain cover. Explain two advantages of using a template to mark out the front panel when manufacturing in large quantities. **(4 marks)**

Q10. The rear wheels of a metal toy are cut from brass sheet using computer-aided manufacturing (CAM). Each wheel has a small hole in the centre for the axle. Explain two advantages of using CAM to manufacture the rear wheels of the toy. **(4 marks)**

Q11. A flat-packed metal shelving unit is manufactured in batches. Explain two reasons for manufacturing the flat-packed shelving unit in batches. **(6 marks)**

Q12. A stainless steel holder for salt and pepper pots is subjected to quality control checks during manufacture. Explain one advantage of carrying out a quality control check on the holders during manufacture. **(3 marks)**

Q13. A manufacturer who laser cuts a metal light shade owns 25 laser cutting machines. Each light shade takes 5 minutes to laser cut. Calculate how many light shades the manufacturer makes in an 8-hour shift using all 25 laser cutters. Show all workings. **(5 marks)**

Q14. In commercial manufacture, metal chess pieces can be CNC machined. Analyse the advantages and disadvantages of CNC machining the chess pieces. **(5 marks)**

Q15. Aluminium fizzy drinks cans are made in a factory that uses a continuous flow production system. Evaluate the benefits of this method of production. **(6 marks)**

Answers

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

Q7a.

Mass production (1).

Q7b.

Any two (1 mark each):

- It speeds up production, so it takes less time
- It can handle very large quantities of the same product in a continuous flow
- It is quicker than a human and can do repetitive jobs without error
- It makes sure the shaping of the can and cutting of the top are accurate
- Fewer employees are needed, reducing labour costs, so the cans can be made at a lower cost
- It can also package the cans ready for transport

Q8.

Up to 4 marks for a design with both sketches and notes or labels. Any realistic jig that could be used for drilling gets credit. For example, a jig that:

- Has the five hole positions (centres and hole edges) marked or drilled in it, so the holes can be checked and scribed
- Has a stop to line up the end of the mild steel panel, so every panel is located in the same place
- Can be lined up on the centre of the base, then flipped over to mark out the other side
- Can also be used on the ends of the toolbox, which have five holes on each edge

Q9.

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

- They can be quickly drawn or traced around (1), saving time and speeding up production (1)
- Each one will be identical (1), so every part will line up with the others (1)
- The template can also mark out extra features such as holes or cut outs (1), so all the other parts fit correctly into place (1)
- They need little skill to use (1), so they can be used by workers with limited skill or technical knowledge (1)

Q10.

Two advantages (1 mark each), each with a linked justification (1 mark each). Do not accept answers about 24/7 manufacture or comparisons with making by hand. For example:

- The centre hole will be accurately placed in the centre (1), so the axle will be concentric with the outside edge (1)
- The wheel will be perfectly round with a clean, smooth cut edge (1), so it rolls without any deviation (1)
- All the wheels will be identical (1), so the toy sits at the right height on its axles (1)
- The wheels can be nested or lay planned in the CAD software (1), making the most efficient use of the brass and minimising waste (1)
- Cutting speed and feed rates can be set for a perfect finish (1), so less secondary finishing is needed (1)

Q11.

For each of two reasons: the reason (1) plus two linked justifications (1) + (1). For example:

- Once the batch is made, the production line can be changed (1), so other products can be made (1), keeping staff employed, machinery in use and profits coming in (1)
- Specific orders from retailers can be met (1), so manufacturers do not have to hold lots of stock (1), so they do not have lots of money tied up in stock (1)

- Batch production can respond quickly to customer demand (1), so new orders can be turned around quickly (1), so supplies reach the retailers when ordered (1)

Q12.

An advantage (1) plus two linked justifications (1) + (1). For example:

- The holder can be checked for dimensional accuracy (1), so tooling can be checked or changed if it is the wrong size (1), reducing waste and rejects (1)
- The edges can be checked for burrs (1), so they can be hand finished or polished (1), reducing the risk of injury to users and customer complaints or returns (1)
- The depth of the holes can be checked and the tooling adjusted (1)(1), reducing the chance of the pots falling out if the holes are not deep enough (1)

Q13.

1 hour = 60 minutes (1). 8 × 60 = 480 minutes (1). 480 ÷ 5 = 96 light shades per machine (1). 96 × 25 (1) = 2400 light shades in 8 hours (1). Credit any other appropriate method.

Q14. (5 marks)

Answers must include both advantages and disadvantages to get the full 5 marks.

Advantages

- Improved accuracy, so every chess piece of each type is identical; precision of about ±0.1 mm guarantees quality
- Different coloured pieces can be made by changing the material on the machine
- Each set can be made more quickly; operations can be sequenced and programmed to avoid tool changes
- Multiple parts can be made from the bar held in the chuck, reducing waste and cost
- Needs little manpower; speeds and feeds are easily set and varied using CAM
- Safe: the CNC lathe stops if the guard is opened mid cycle

- The pieces have a better finish, so less extra finishing is needed

Disadvantages

- The size of the pieces is limited by the size of the lathe
- Waste material is produced when machining
- Expensive to buy, install, service, maintain and repair the lathe and software
- Settings are different for each material and profile; wrong settings can damage the material or lathe, causing waste or a safety hazard
- Training is needed, as it is a skilled job; it should not be left unattended

Band	Marks	Descriptor
3	4 to 5	A coherent answer with detailed, relevant knowledge and understanding of the advantages and disadvantages of CNC machining the metal chess pieces. Relevant examples and a well-developed, logical chain of reasoning, sustained throughout.
2	2 to 3	Some coherence, with partial knowledge and understanding. Mostly relevant examples and a logical chain of reasoning that may not be sustained throughout.
1	1	Basic knowledge and understanding. Limited relevant examples or logical chain of reasoning.
0	0	Incorrect or irrelevant answers.

Q15. (6 marks)

Indicative content (not all needed):

- Production runs 24/7 and does not stop
- Identical products are made quickly
- Production is automated, reducing labour costs; the workforce works shifts to run the line day and night
- There is a high investment in machinery to set up the production line
- A very high number of products roll off the line, at a low cost and high speed
- Economies of scale lower the cost of production
- Materials can be bought in bulk to reduce costs and improve profit margins

Band	Marks	Descriptor
3	5 to 6	A coherent answer with detailed, relevant knowledge and understanding of the benefits of continuous flow production. Relevant examples and well-developed, substantiated judgements in a logically structured response.
2	3 to 4	Some coherence, with partial knowledge and understanding. Mostly relevant examples and partly substantiated judgements in a generally structured response.
1	1 to 2	Basic knowledge and understanding. Limited relevant examples or judgements, with little structure.
0	0	Incorrect or irrelevant answers.