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Design & Technology
Eduqas GCSE

Polymers: 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 but the lowest unit cost?

A One-off

B Batch

C Continuous

Q2. Which process is used to make hollow plastic drinks bottles?

A Blow moulding

B Vacuum forming

C Compression moulding

Q3. In blow moulding, what is the extruded hollow tube of plastic called?

A A slug

B A parison

C A platen

Q4. Which process is used to make thermosetting products such as urea formaldehyde plugs?

A Vacuum forming

B Blow moulding

C Compression moulding

Q5. Why do vacuum forming moulds have draft angles and no undercuts?

A To make the plastic thicker

B So the mould can be removed from the formed plastic

C To speed up the heating

Q6. Which of these is a disadvantage of high volume production?

A It is inflexible and cannot respond quickly to market trends

B It has very low unit costs

C Quality control ensures identical products

Q7. Explain the difference between one-off and continuous production. Give an example product made using each method. **(4 marks)**

Q8. Production aids are used in the manufacture of products. Explain how or why each of the following production aids is used.

Q8a. Jigs **(2 marks)**

Q8b. Templates **(2 marks)**

Q9. The adjustable support arm of a desk lamp is held in a jig while holes are drilled in it. Explain one advantage of using a jig when drilling the holes in the support arm. **(3 marks)**

Q10. This question is about CAD/CAM.

Q10a. Give two benefits of using CAD/CAM in batch production. **(2 marks)**

Q10b. Give two drawbacks of using CAD/CAM for one-off production. **(2 marks)**

Q11. A plastic toy is mass produced. Describe two features that make the toy suitable for mass production. **(4 marks)**

Q12. Plastic drinks bottles are made in very high volumes. Name a commercial manufacturing process used to make the bottles and, using notes and/or sketches, describe the process. **(4 marks)**

Q13. A prototype of a plastic bowl is to be made in a school workshop. Using words and sketches, show how the prototype bowl is vacuum formed. **(5 marks)**

Q14. Products are made in different volumes using prototype/one-off, batch, mass and continuous production. Discuss the advantages and disadvantages of manufacturing in quantity compared to producing a one-off item. Refer to these production methods and give examples in your answer. **(8 marks)**

Answers

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

Q7. (4 marks)

One mark for each identified difference (2 marks max) and one mark for an appropriate example product for each method (2 marks max). For example:

- Scale: one-off makes a single unique product; continuous makes many identical products
- Workforce: one-off uses one highly skilled person doing several tasks (labour intensive); continuous uses fewer, less skilled workers
- Timescale: continuous runs 24/7 with no planned end to production
- Automation: one-off uses hand fabrication and simple tools; continuous is highly automated with production lines
- One-off examples: wedding dress, unique artwork, a custom acrylic sign
- Continuous examples: disposable cups, kitchen roll, generic packaging containers, drinks bottles. Do not accept bread

Q8a.

Up to 2 marks. For example: jigs help with repetition and consistency (1); they give accuracy, e.g. drilling a series of holes in exact places (1); they avoid measuring and marking out lots of identical parts and save time in batch production (1); they are reusable, so parts can be made again at different times (1).

Q8b.

Up to 2 marks. For example: templates improve the accuracy of repetitive marking out (1); they are a marking out tool, drawn round to mark the same outline many times (1); they help with nesting shapes to reduce waste (1).

Q9.

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

- The arm is held firmly in place (1), so it will not move when being drilled (1), therefore there are fewer errors and it is safer (1)
- The jig holds the arm in the correct place (1), so all the holes are drilled in the right place (1), therefore no marking out is needed (1)
- When making a batch of arms (1), the jig makes the process more efficient (1), speeding up manufacture (1)

Q10a.

Any two (1 mark each): accuracy; repeatability and reduced waste; quick change to a different item, greater productivity; fast transfer of data to the machine; reduced workforce or 24/7 production. Allow any valid benefit.

Q10b.

Any two (1 mark each): expensive machinery; longer setting up time; skilled workforce needed to set up the machines; skilled workforce needed to produce the drawings. Allow any valid drawback.

Q11. (4 marks)

For each feature: 2 marks for a complete description of how it makes the toy suitable for mass production; 1 mark for a simple description. For example:

- It is injection moulded, which is easy to repeat and reduces cost when mass produced
- The polymer can be bought in granule form, ready to feed into the injection moulding machine
- Injection moulding can make complex shapes in one piece, reducing assembly after production
- Pigments are added to the polymer before moulding, so no colour or finish has to be applied afterwards
- Moulded ribs and internal struts strengthen the product without extra parts

Q12. (4 marks)

1 mark for naming blow moulding. Up to 3 marks for the description: 1 mark for a simple point, more for a detailed description with several creditworthy points. For example:

- Plastic granules are fed through a hopper and melted along an Archimedes screw
- The polymer is extruded as a hollow tube (parison), which is clamped in a metal mould and the end sealed
- Air is blown in, forcing the polymer out against the mould to make a hollow shape
- The mould is cooled, and the bottle is ejected and trimmed

Q13. (5 marks)

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:

- The mould is made from MDF, expanded polystyrene or another suitable material (1)
- The mould is placed into the vacuum former (1)
- A sheet of material such as HIPS is placed above the mould and clamped down (1)
- The heater is turned on to warm and soften the sheet (1)
- When the sheet is flexible, the mould is raised up into the plastic (1)
- The pump removes the air from under the plastic, sucking it over the mould (1)
- The formed bowl is removed and trimmed, e.g. with a gerbil (1)

Credit understanding of mould requirements: sloped sides so the mould can be removed, curved edges to prevent stretching, and air holes to pull the plastic into internal parts of the mould.

Q14. (8 marks)

Marks	Descriptor
7 to 8	A detailed consideration of the advantages and disadvantages of manufacturing in quantity over a one-off item. Different scales of production are clear, with where and why they would be used, and relevant examples.
5 to 6	A good consideration of advantages and disadvantages, with good evidence of different scales of production and some examples.
3 to 4	A basic consideration of some advantages and disadvantages, with limited evidence of different scales and very limited or no examples. No attempt to evaluate.
1 to 2	One or two limited advantage or disadvantage points given. No examples.
0	No response or nothing worthy of credit.

Prototype/one-off

- Used to test a concept, or for a unique, personalised product made to the customer's exact needs, e.g. a 3D printed prototype
- Very labour intensive, using highly skilled people

Batch

- A set number of identical products, e.g. vacuum formed trays; jigs and templates allow more to be made later
- Small changes between batches are possible, e.g. the colour of phone cases

Mass

- High initial start-up costs in machinery are recouped through large production runs, reducing unit cost
- Automation and robots speed up production, minimise waste and increase efficiency; little change in the design

Continuous

- Simple products always in demand, e.g. bottles, screws, switches; production lines run 24/7
- Very high automation, low skilled staff, costs kept as low as possible, very limited product range