DTBase©

Design & Technology
Eduqas GCSE

Marking out

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 is a tolerance?

A The acceptable variation in a dimension

B The thickness of a saw blade

C The total cost of a material

Q2. What is the kerf?

A A mark showing where to drill

B The material lost through the width of the blade

C The face side of a piece of timber

Q3. How is acrylic sheet usually marked out?

A With a marking knife on the bare surface

B With tailor's chalk

C With a felt tip or chinagraph pencil on the protective film

Q4. What does a jig do?

A Guides a tool into the same place every time

B Measures the diameter of a hole

C Produces a mould for casting

Q5. Which of these checks whether a part is within tolerance quickly?

A Sliding bevel

B Go/no-go gauge

C Tracing wheel

Q6. Where should parts be cut from on a sheet to reduce waste?

A The middle of the sheet

B Anywhere, as long as it is quick

C The edge of the sheet, so the rest can be used

Q7. Templates are used when marking out parts.

Q7a. Explain the purpose of a template. **(2 marks)**

Q7b. A manufacturer needs to produce a template in the shape of a regular hexagon. The distance between opposite corners A and B needs to be 90 mm. Work out the length of one side of the hexagon. **(1 mark)**

Q7c. Calculate the interior angle at each corner of the hexagon. **(2 marks)**

Q8. Datum points and datum faces are used when marking out.

Q8a. Define the term ‘datum point’. **(1 mark)**

Q8b. Explain why datum points are used during manufacturing. **(2 marks)**

Q8c. A line is measured and marked out on a hardwood block 100 mm from the datum face. Describe the purpose of the datum face. **(2 marks)**

Q9. Tolerances are used when making and checking components.

Q9a. Explain what is meant by the term ‘tolerance’ when measuring a component. **(2 marks)**

Q9b. Describe how tolerances are used as part of quality control. Give examples in your answer. **(4 marks)**

Q9c. Holes are to be drilled 7 mm in diameter with a tolerance of ±0.5 mm. State the maximum and minimum acceptable diameters of the holes. **(1 mark)**

Q10. During manufacture it is important to use materials efficiently and minimise waste. Explain how each of the following improves material management: (i) nesting of shapes and parts/lay planning; (ii) cutting techniques. (3 marks each) **(6 marks)**

Q11. Explain why we need to allow for waste when making prototypes. **(3 marks)**

Q12. The two ends and the centre piece of a desk organiser are marked out on a length of hardwood using a template, with 5 mm of waste marked out between each shape.

Q12a. State one benefit of using a template to mark out the shapes of the ends and centre piece. **(1 mark)**

Q12b. State one reason why 5 mm of waste has been marked out between each shape. **(1 mark)**

Answers

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

Q7a.

2 marks: a clear explanation with more than one point, possibly with an example of its use. 1 mark: one valid point. For example:

- Templates save time when marking out
- You can draw round a template to produce multiple copies of a part or design
- They allow repetition and improve accuracy between identical parts
- They are reusable, so identical parts do not have to be redrawn each time

Q7b.

45 mm (1). (A regular hexagon is made of six equilateral triangles, so each side is half the distance between opposite corners: 90 ÷ 2 = 45 mm.)

Q7c.

120° (2 marks). 60° seen in working (1 mark).

Q8a.

Any one (1): a starting point from which all measurements are taken; marks put on the material as a starting point, e.g. face side and face edge marks; a reference origin; matching starting points on fabric so pattern repeats are correct; alignment of wood grain to keep a pattern.

Q8b.

2 marks: a detailed explanation. 1 mark: one brief point. For example:

- Improves accuracy and reduces measurement errors

- CNC machines (e.g. a laser cutter) use a datum point to calculate movement and travel to complete a job
- Reduces material waste by allowing accurate tessellation and alignment of parts
- Aligns patterns and parts, e.g. pattern repeats on fabric or wood grain

Q8c.

The datum face provides a perfectly flat surface (1) from which to measure, so measurements are accurate (1).

Q9a.

2 marks: a detailed explanation, or one point clarified in detail. 1 mark: a basic explanation. For example:

- A tolerance is concerned with accuracy
- It is the variation that can be accepted above or below a specified length, weight, etc.
- It can be shown as a percentage, e.g. ±5% for resistor values, or as a number, e.g. ±2 mm for how much longer or shorter a part can be and still be used

Q9b.

3 to 4 marks: a detailed description, with example(s), of how tolerances are used to make sure of quality and accuracy in quality control. 1 to 2 marks: a basic description and/or an example. Answers must say how tolerances are used, not just define a tolerance. For example:

- Go/no-go gauges and templates with preset tolerances let parts be checked quickly
- Maximum and minimum measurements mean parts are not thrown away just for not being precisely the right size
- Tolerances make sure parts and components will work and be fit for purpose
- Sampling, e.g. checking every 10th product
- Resistors have a tolerance, e.g. a gold band means ±5%, so the actual value can vary between an upper and lower limit
- Tolerances can also cover things like temperature ranges or how much a part can flex or bend

Q9c.

Maximum 7.5 mm and minimum 6.5 mm (1). Both must be correct for the mark.

Q10. (6 marks)

For each technique: 3 marks for two or more correct points explained clearly and in detail; 2 marks for two or more simple points, or one point in detail; 1 mark for one simple correct point.

Nesting of shapes and parts/lay planning

- Planning the best way to use the material and minimise waste
- Placing similar shapes and parts next to each other, as close together as possible
- Looking for patterns, e.g. inverting triangular shapes to save material
- Tessellation: parts placed together in interlocking, repeating patterns
- Using standard forms and sizes of material so it is bought in the most cost-efficient form

Cutting techniques

- Allow for the width of saw cuts, e.g. 2 mm with a dovetail saw, so parts are not cut too small
- Ignoring material lost to saw cuts makes parts too small (out of tolerance), so they are rejected and material is wasted
- Seam allowances so fabric edges can be joined effectively
- Different coloured lines for cut and score/crease lines on paper and board, so fold and glue flaps are created
- Red lines for cut and black lines for engrave on a laser cutter, to avoid errors

Q11.

3 marks: detailed understanding of waste allowance. 2 marks: good understanding. 1 mark: a basic point. For example:

- Prototypes need extra material for tweaks and modifications; parts can be made a bit bigger and cut down, as you cannot easily add material
- Measurements might not be exact; it allows for trial and error
- Cut on the waste side of the marked line so the part is not too small

- Allow for the pattern repeat on fabric or grain alignment on wood
- Allow for the thickness of the blade or saw
- Some materials need more allowance, e.g. timber that will be sanded or planed after cutting
- Templates and stencils help fit as many parts as possible into a piece of material
- Seam allowance in textiles for joining and turning

Q12a.

Speed, or repeated accuracy (1).

Q12b.

To allow for the thickness of the saw cut (kerf) (1). Do not accept “room for error”.