DTBase©

Design & Technology
Eduqas GCSE

Using specialist techniques

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. Vacuum forming is an example of which type of technique?

A Wastage

B Addition

C Reforming

Q2. What does wastage mean?

A Removing material to shape it

B Joining materials together

C Using heat to change the state of a material

Q3. Steam bending and laminating are examples of:

A Wastage

B Deforming

C Addition

Q4. Welding a steel frame or sewing a bag is an example of which term?

A Fabricate

B Shape

C Reform

Q5. Which of these is an addition process?

A Milling

B Turning

C 3D printing

Q6. Fitting a PCB and switches into a case is an example of which term?

A Shape

B Assemble

C Deform

Q7. Name one process used to remove waste material to make different parts of a prototype. Describe the process you have chosen. **(3 marks)**

Q8. Choose one of these processes used to remove material and make sure materials are cut to a tolerance: turning, die cutting, laser cutting, or cutting by shearing. Using notes and/or sketches, describe the process in detail. **(5 marks)**

Q9. Materials frequently have to be deformed and reformed. Choose one of these products: metal toy car, birthday card, polymer toothbrush, cotton skirt or plywood chair.

Q9a. Name a specific deforming or reforming process used in the manufacture of your chosen product. **(1 mark)**

Q9b. Explain why this process is used in the manufacture of your chosen product. **(2 marks)**

Q9c. What safety issues need to be considered when using the process given in your answer to Q9a? **(2 marks)**

Q10. Describe how materials can be formed when making a prototype. **(3 marks)**

Q11. Choose one of these manufacturing processes: turning, casting, injection moulding or flow soldering. Use notes and/or sketches to describe how your chosen process is used to make products. **(6 marks)**

Q12. Quality control is used when making products.

Q12a. Explain the purpose of 'quality control'. **(2 marks)**

Q12b. Describe one method of 'quality control' that is used when making prototype products. **(2 marks)**

Q13. The handle of a sweet dispenser is made from two discs, each Ø40 mm and cut from 10 mm thick MDF sheet. One disc has a Ø5 mm hole drilled through it. The second disc has a Ø5 mm blind hole 8 mm deep. Use sketches and notes to show how the two discs, including the holes, could be produced from 10 mm thick MDF sheet. Name all the tools and equipment used. **(5 marks)**

Answers

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

Q7.

1 mark for a named process, e.g. die cutting; perforation and punching; turning; sawing; milling or routing; drilling; cutting (including laser cutting); shearing; abrasive removal such as sanding or filing. Recycling and waste management is incorrect.

2 marks for describing a correct situation of use (1 mark for a simple point, 2 for a detailed response with two creditworthy points). For example:

- Laser cutting: a file from software such as 2D Design instructs the laser to cut precisely, avoiding human error, often in acrylic, plywood and card; settings include focus, speed, power and extraction
- Die cutting: removes a net or several nets from card in one operation using knives, creasing bars and perforation blades, e.g. card packaging
- Turning: a wood or metal lathe removes material from a rotating work piece to give a round profile, e.g. spindles, bowls, metal cylinders
- Sawing: hand saws suited to the material or cut (hacksaw for metal, dovetail saw for wood, coping saw for curves) or machine saws such as a band saw to remove material quickly
- Milling: vertical milling cuts slots and holes in materials such as aluminium; horizontal milling machines large flat surfaces
- Drilling: makes a through or blind hole with a twist drill, using a hand drill, cordless drill or pillar drill
- Shearing: shears or tailor's shears cut fabric; pinking shears give a zig zag edge to stop fraying; a guillotine shears paper, card and sheet metal

Q8. (5 marks)

Marks	Descriptor
5	Fully coherent response using detailed notes and/or sketches, with clear understanding of how the chosen process is used correctly to cut to a tolerance.
4	Clear notes and/or sketches correctly explain the process of removing material, with a simple attempt to consider how a tolerance might be used.
3	Notes and/or sketches correctly explain the process, with an implied reference to a tolerance.
2	Simple notes or sketches showing a very basic understanding of removing material by one of the processes.
1	A simple sketch or note about removing material by one of the processes.
0	No response or nothing worthy of credit.

Indicative content:

- Turning: wood, metal or polymers on a centre lathe or wood lathe; templates to check a profile on a wood lathe; on a centre lathe, compound slide and cross slide with incremental measurements on the handles; suitable speed and feed rate (coolant with metals) for an accurate finish
- Die cutting: produces nets from paper and card for folding into boxes; the creasing rule is shaped so it creases without cutting; even pressure gives uniform cuts, perforations and creases
- Laser cutting: used on woods, metals, polymers, fabrics, paper and card; a CAD file (e.g. 2D Design) is uploaded; line colours set tasks (e.g. red to cut, black to score); tolerance comes from focusing the laser, its speed and pulses per inch (PPI); extractor on and lid shut
- Cutting by shearing: accurate marking out allowing for material removed by the cut; templates drawn round to give a line to follow; for fabric: iron out creases, pin the pattern with grain lines matching, use sharp fabric scissors and cut close to the template edge

Q9a.

Any correctly named process for the chosen product (1). For example:

- Metal toy car: die casting, gravity casting
- Birthday card: creasing, scoring, embossing, die cutting (for creasing and perforation)

- Polymer toothbrush: injection moulding, over moulding
- Cotton skirt: pressing or ironing, folding, pleating, creasing (not gathering)
- Plywood chair: lamination (former or vacuum bag), steam bending, bending

Q9b.

2 marks for two correct reasons or one reason qualified; 1 mark for one brief point. For example:

- Casting: makes a one-piece form with fine detail and a smooth finish that takes paint well
- Embossing: a raised or depressed relief pattern adds texture; scoring and creasing let card fold at a precise point without tearing the fibres
- Injection moulding: an ergonomic shape; bristles are held in so they cannot fall out; quick for mass production. Over moulding gives a soft touch grip
- Pressing or ironing creases fabric and keeps folds in place for pinning and stitching; pleating adds decoration and fullness
- Laminating: veneers are bonded under pressure in a former or vacuum bag to make a unique profile once the glue cures; steam bending softens fibres so wood bends without splitting

Q9c.

2 marks: two safety issues in brief, or one in detail. 1 mark: one issue in brief. The issue must suit the process. For example:

- PPE, e.g. goggles, heat-protective gloves
- Safe use of equipment, e.g. securing heavy items so they cannot fall on feet; finger traps with clamps; risk of burns where heat is used
- Precautions when using heat or an iron

Q10.

3 marks: thorough understanding of forming and how it is used in prototype construction. 2 marks: basic understanding. 1 mark: very limited

understanding, e.g. naming a forming process or an example. Forming changes a material's shape without adding or removing material. For example:

- Timber: strips steamed to soften the fibres and bent; thin strips laminated with adhesive on a former under pressure
- Metals: bars and tubes bent round a former; annealed to make bending easier; forged red hot on an anvil; cast into a mould; pressed, e.g. car body panels
- Papers and boards: creasing and scoring for accurate folds; perforations for tearing
- Polymers: line bending; vacuum forming over a former; plug and yoke forming; injection moulding
- Textiles: drape forming felt hats; gathering; pleating

Q11. (6 marks)

Marks	Descriptor
5 to 6	A detailed description making several correct points about the process, using notes and/or sketches. Specific, correct stages clearly linked to making products.
3 to 4	A description showing some understanding of the process, using notes and/or sketches. Basic reference to some stages, but lacking links to product manufacture.
1 to 2	Simple notes or a sketch showing limited understanding of the process.
0	No response or nothing worthy of credit.

Turning

- A wastage process for woods or metals, on a wood lathe or a three or four jaw chuck on a metal centre lathe
- The work rotates and the tool is moved into its path; speed is changed to suit the diameter and material
- Long work is supported between centres; lathes make bowls and spindles, bore holes, cut threads and drill

Casting

- Metal, wax or polymer/resin is heated and poured into a cavity to cool and solidify
- Complex one-piece products reduce assembly; the mould is slightly oversize to allow for shrinkage

- Lost wax, sand, gravity and pressure die casting; leftover material and defects can be recycled; castings can be machined or left as finished

Injection moulding

- Polymer granules are fed from a hopper into a heating chamber and melted
- Molten polymer is forced by a ram or Archimedes screw into a steel mould; water cooling speeds up the process
- Complex shapes made rapidly in one piece, e.g. bottle lids; self-coloured, with features such as grips added in one go; waste can be recycled

Flow soldering

- Used commercially for surface mount components, with no drilled holes
- Components are placed on pads pre-coated with solder paste; the PCB is heated by a reflow oven, infrared lamp or hot air pencil
- Heat must be controlled to avoid damaging components; suited to mass production with little human involvement

Q12a.

One mark for each point, up to 2: to check or test; to make sure a product meets a specific standard or agreed specification; to guarantee the accuracy of a part; to make sure it is made to an agreed tolerance; fit for purpose; good enough to sell. Do not accept “to prevent mistakes”.

Q12b.

1 mark for a simple point, 2 marks for a well explained specific method. For example:

- 1 mark: visual check; use a ruler or multimeter; use a jig, fixture, template or go/no-go jig; test against the specification; check within tolerances; test that it works; check seams
- 2 marks: dimensional accuracy, e.g. using a micrometer or vernier callipers; jigs and fixtures such as go/no-go jigs and depth stops; registration marks; alignment of interlocking parts; surface inspection for defects; checking PCB tracks with a multimeter; safety checks for loose parts or sharp edges; checking zips and fastenings work

Q13.

One mark for each:

- Mark out a 40 mm × 40 mm piece of MDF (1)
- Cut to a disc shape, leaving a small amount of waste to remove (1)
- File or sand to the finished shape (1)
- Holes drilled correctly (1)
- Tools and equipment correctly named (1)

Alternatively, accept use of a hole saw: hole saw named (1); hole saw drawn (1); centres marked on a 40 mm × 40 mm piece of MDF (1); description of use (up to 2).