

Design & Technology

AQA GCSE

Tools, equipment 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 process is an example of wastage?

- A** Brazing
- B** Die cutting
- C** Vacuum forming

Q2. What is the main purpose of perforation?

- A** To join two metals together
- B** To create a line of small holes for tearing or bending
- C** To melt and reshape plastic

Q3. Which of these is an addition process?

- A** Turning
- B** 3D printing
- C** Milling

Q4. What does soldering typically involve?

- A** Cutting sheet metal with a laser
- B** Joining metals using a filler metal with a lower melting point
- C** Stretching plastic over a mould

Q5. Which process is used to shape metal by removing material in a lathe?

- A** Turning
- B** Blow moulding
- C** Lamination

Q6. What is the key advantage of 3D printing?

- A** It always produces the strongest possible parts
- B** It allows complex shapes to be built layer by layer with minimal waste
- C** It is the fastest manufacturing method for mass production

Q7. Which process is used to bend sheet metal accurately?

- A** Injection moulding
- B** Pressing
- C** Drilling

Q8. What is the main purpose of vacuum forming?

- A** To join two pieces of wood together
- B** To shape thermoplastic sheets over a mould using heat and suction
- C** To cut intricate patterns in paper

Q9. The table below shows specific processes used to remove different materials and make sure materials are cut to a tolerance. Choose one process from the table and, using notes and/or sketches, describe the process in detail **(5 marks)**

Turning	Die cutting	Laser cutting	Cutting by shearing
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Q10. The table below shows examples of manufacturing processes.

Offset lithography	Turning	Casting	Injection moulding	Weaving	Flow soldering
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Choose one of the manufacturing processes from the table. Use notes and/or sketches to describe how your chosen process is used to make products **(6 marks)**

Q11. Choose one of the addition processes in the table below.

Lamination	Printing	Sewing	Soldering	Welding
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Use notes and sketches to describe your chosen process. Identify the equipment used in your chosen process. **(6 marks)**

Answers

Q1. B

Q2. B

Q3. B

Q4. B

Q5. A

Q6. B

Q7. B

Q8. B

Q9.

Turning	Responses may consider wood, metal or polymers on a centre lathe or wood lathe. Expect reference to jigs, and templates to cut a profile on a wood lathe. On a centre lathe use of compound slide and cross slide using incremental measurements on turning handles. Appropriate speed selection, feed rates (coolant with metals) to ensure acceptable tolerance in finish is correct.
Die cutting	Use of papers and cardboards to produce 'nets' or developments suitable for folding and assembly into boxes etc. For tolerance expect reference to shape and profile of creasing rule to avoid cutting, but sufficient profile with creasing channels to allow paper or card to be bent. Even force applied to pressure plates by rolling or pressing to ensure uniform cuts, perforations, creases etc. Ridged cutting blades to form easy tear perforations rather than a complete cut may be considered in response. Reference to crop marks
Laser cutting	Used on woods, metals, polymers, fabrics and paper and card. A data file will need to be created eg 2D design and uploaded to the laser cutter Different colours of line in the Cad drawing assigned to different tasks eg red to cut, black to score Expect tolerance references to be made to focusing the laser (key tool), speed of the laser and pulses of laser light emitted per 25 mm/inch (PPI). Extractor on, lid shut to ensure it works
Cutting by shearing	Opportunities to demonstrate cutting by shearing in woods, metals, textiles and paper and card. NO MARKS FOR ANYTHING TO DO WITH SHEARING SHEEP! Tolerance references may consider use of effective marking out including material removed by a saw cut or guillotine. Use of templates drawn round producing a line to follow. Textiles response 1. Iron fabric to

	remove creases which could affect accuracy. 2. Pin template/pattern securely to fabric, ensuring grain lines match. 3. Ensure sharp fabric scissors are used. 4. Cut as near to the template edge as possible. 5. Crop marks
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Q10.

Offset lithography	<ul style="list-style-type: none"> • A printing process used in the mass production of very long print runs. • Prints in a combination of black, cyan, magenta and yellow inks to produce a product. • Make use of an aluminium plate exposed to a laser image. • Ink and water are applied to rollers from the plate roller. Water keeps the rollers wet to avoid inks sticking. • Image from plate cylinder is transferred to rubber offset cylinder (mirror image of final print) before transferred to final material. • Process is repeated for each of the four colours
Turning	<ul style="list-style-type: none"> • A wastage process typically done using woods or metals. • Expect responses detail use of a wood lathe or three or four jaw chucks on metal centre lathes. • Wood is turned in a rotating chuck and the tool is stationary being moved into the path of the work piece. • Speed of the work piece rotation is altered to reflect work piece diameter and the material being turned. • Long pieces of work need additional support and hence are turned between centre. • Lathes can produce bowls and spindles in wood, bore holes, turn threads and allow for drilling operations to be accommodated in all materials.
Casting	<ul style="list-style-type: none"> • Heating of a material (metal, wax or a polymer/resin) then pouring it into a cavity to cool and solidify. • Complex and intricate one-piece products can be manufactured reducing assembly operations.

	<ul style="list-style-type: none"> • The mould, (allows replication), needs to be slightly bigger than required to allow for shrinkage under cooling. • Expect reference to lost wax casting, sand casting, gravity and pressure die casting. • Left over material can be recycled as can defective products manufactured which are of low quality. • Cast components can be machined, but can also be left as finished.
Injection moulding	<ul style="list-style-type: none"> • Allows for complex polymer shapes/products to be made rapidly in one piece, eg bottle lids. • Injection moulding uses granulated polymer granules fed from a hopper into a heating chamber to become liquid. • Molten polymer is fed under pressure via a ram or Archimedes screw into the steel mould. • Water cooling of the mould further speeds up the manufacturing process. • Left over material can be easily recycled and reused adding to further manufacturing efficiency. • Components are self-coloured and can have surface features, eg grip surfaces added in one go.
Weaving	<ul style="list-style-type: none"> • A shuttle loom is used to produce a plain weave. • A jacquard loom is used to produce fabrics with complicated patterns. Weaving involves two yarns being woven at 90 degrees to each other. Weft horizontally and warp vertically to loom. • Large scale manufacture completed on highly automated looms. • Set up times can be long but once done large amounts of consistent quality fabric can be produced. • Automated manufacture allows for unique fabric designs to be produced rapidly. • Use of specialist CAD software allows for simulations to be completed before a full production run reducing waste and lost time. • Main stages are shedding, picking, beating, let off and take off.

Flow soldering	<ul style="list-style-type: none"> • Used commercially for surface mounted components which does not involve drilling holes. • Surface mount components are positioned on pre-solder pasted pads. • A PCB circuit board is first heated. • One of three ways – reflow oven, infrared lamp or hot air pencil. • Care needs to be taken controlling heat applied to avoid damage to components being joined. • Highly suited to mass production of circuit boards as minimal human involvement.
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Q11.

Lamination	Expect reference to lamination of paper, plastics, textiles or wood. Looking for reference to use in order to improve strength, stability, flexibility and possibly aesthetics, Possible consideration of laminating machine with polymer pouches to stiffen and water proof card. Gluing layers of veneer under pressure (clamps) with adhesive using formers. Fabric interfacing to stiffen collars and caps on clothing.
Printing/3D printing	Expect reference to application on paper, card and textiles. Do not forget developing technologies using PLA polymer with 3D printing machines to manufacture parts/components etc. Specific additional printing techniques include screen printing, digital printing, offset lithography printing, flexography, dye sublimation printing, direct printing, mordant printing, discharge printing and resist printing e.g. batik.
Sewing	Expect reference to hand or machine. Candidates may share understanding of specific sewing techniques making a seam or adding decorative stitching/embroidery e.g. running, back, chain or blanket stitching or machine stitching like zig zag or overlocking stitch
Soldering	Expect reference to use in electronics, hard (brazing) soldering and soft soldering. Soldering irons e.g. electronic component soldering or commercial electronic soldering like wave or flow soldering. Soft soldering using a gas torch used

	in for example by a silversmith may be considered. Use of flux to allow solder to flow.
Welding	Expect reference to welding metals or polymers. Metals are welded using gas e.g. oxyacetylene using a very hot flame or MIG and TIG welding using a large electrical current to create heat and fuse metals together. Polymers can be fused using either heat or chemicals. Chemical welding e.g. Tensol and solvent cement are common in school environments. Heat welding involves using a hot air gun and polymer filler rod of a range of thermoforming plastics e.g. HDPE.