GCSE
DESIGN AND TECHNOLOGY
8552/W

Unit 1 Written Paper

Mark scheme

June 2025

Version: 1.0 Final

256G8552/W/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Glossary for maths

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

[a, b]	Accept values between a and b inclusive.
For π	Accept values in the range [3.14, 3.142]
Their	Accept an answer from the candidate if it has been inaccurately calculated but is subsequently used in a further stage of the question.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Qu	Part	Marking Guidance	Total marks	AO
01		**B** continuous improvement.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
02		**A** Design for disabilities	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
03		**B** Oil	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
04		**D** melts when heat is applied.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
05		**B** A material produced through a new or improved production technique.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
06		**B** Moves 20 mm to the left	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
07		**C** market pull.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
08		**B** Iron	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
09		**B** culture.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
10		**B** High Impact Polystyrene (HIPS)	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
11		For each material property: 2 marks – Two simple correct points of explanation or one correct point explained in detail possibly using a specific example. 1 mark – One simple correct point of explanation. 0 marks – No response or nothing worthy of credit. **Indicative content** **Hardness** A hard material is one that is: • hard/difficult to **scratch (1)** or **dent (1)** • hard to **cut/ abrade** (1) or wear away (1) • can cut a softer material (1) for example, diamond can cut other materials (1) • withstand an **impact** (1) if something dropped on its surface (1) **Strength** The ability of a material to withstand: • a force (1) without **breaking (1)** • a force (1) without losing **stability (1)** • responses may be linked to strength in **resistance to tensile, compressive, shear torsion and bending forces.** Accept all other valid responses.	4 marks	AO4 1b

Qu	Part	Marking Guidance	Total marks	AO
12		3–4 marks – Detailed reasons clearly linked to opposition to the use of nuclear power for meeting energy demands. 1–2 marks – One or two brief reasons of opposition to nuclear power use or one reason explained in detail. 0 marks – No response or nothing worthy of credit. **Indicative content**	4 marks	AO4 1c

		• Expensive to build a nuclear plant and will cost the taxpayer a lot of money. • Radiation is dangerous to all life if there is a leak. • People are worried about long term exposure to radiation and impact on health and wellbeing. • Potential terrorist target. • Environmental disaster if something goes wrong, e.g. Fukushima and the tsunami. • If there is a leak or disaster it can make large areas uninhabitable for hundreds of years. • Issues dealing with waste. • Decommissioning of nuclear power plants at the end of service. Accept all other valid responses.		

Qu	Part	Marking Guidance	Total marks	AO
13		**2 marks** – Detailed description about stretching **and** return **1 mark** – One correct simple point about stretching **or** return **0 marks** – No response or nothing worthy of credit. **Indicative content** **NB Not looking for an example** • A material with elastic properties can stretch (1) • change shape under force (1) • Return to its original shape or length (1) • A material with elastic properties can stretch under force, but when the force is removed it returns to its original shape /length (2) • Material deforms and returns to original shape (2) • Accept all other valid responses.	2 marks	AO4 1b

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>14</td><td>1</td><td>
<table>
<tr><td>1 mark</td><td>Any one correctly named standard component.</td></tr>
<tr><td>0 marks</td><td>No response or incorrect response.</td></tr>
</table>
Indicative content
<table>
<tr><td>Papers and boards</td><td>• Drawing pins
• Split pins
• Paper fasteners
• Binding bars
• Paper clips</td></tr>
<tr><td>Timber based materials</td><td>• Screws inc. wood screws
• Nail (s)
• Hinges
• KD fittings including scan fittings, dowel, cam lock and corner bloc</td></tr>
<tr><td>Metal based materials</td><td>• Rivets including pop rivets
• Screws inc. machine screws
• Nut
• Bolts
• Washers</td></tr>
<tr><td>Polymer based materials</td><td>• Nuts and bolts
• Hinges
• Screws
• Washers
• Wall plugs</td></tr>
<tr><td>Textile base materials</td><td>• Buttons
• Zips
• Press studs
• Poppers
• Hooks and eyes
• Velcro</td></tr>
<tr><td>Electronic and mechanical systems</td><td>• Resistors
• Capacitors
• Switches
• Battery
• Bulb
• LED
• LDR
• Integrated circuits/microcontroller
• Springs
• Gear(s)
• Phone screen/monitor screen</td></tr>
</table>
Accept all other valid responses.
</td><td>1 mark</td><td>AO4 1a</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>14</td><td>2</td><td>
<table>
<tr><td>3–4 marks</td><td>Two correct simple points of description or one point explained in detail.</td></tr>
<tr><td>1–2 marks</td><td>One correct simple point of description.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

• Standard components can be used across a range of different products reducing the number of different components the manufacturer needs to buy.
• The manufacturer does not have to set up their own equipment to manufacture a wide variety of components to assemble their products.
• Increase speed of production
• Buying in standard components from another manufacturer can be more cost effective, e.g. economies of scale/buying in bulk.
• The manufacturer knows that when buying from a reputable source the components are made by a specialist producer and quality assured before arrival in their factory.
• A standard component can be easily replaced with another if it is broken.
• The use of standard components allows the manufacturer to sell their products flat packed/KD assembly to save them money and allow them to sell their products more cheaply as the customer will carry out the assembly process.

Accept all other valid responses.
</td><td>4 marks</td><td>AO4 1b</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>15</td><td></td><td>
<table>
<tr><td>1 mark</td><td>Maximum and reduced production rates as a fraction/decimal

4500/22 000 or 9/44 or 0.2045...</td></tr>
<tr><td>1 mark</td><td>Reduced production as a percentage

their 0.2045 × 100 or 20.45%</td></tr>
<tr><td>1 mark</td><td>Production has decreased by:

100 – their 20.45 or their 79.55%</td></tr>
<tr><td>1 mark</td><td>Production decreases to nearest whole percent (round up)

80%</td></tr>
</table>
Alternative method:
<table>
<tr><td>1 mark</td><td>Difference in production rates

22 000 – 4500 or 17 500</td></tr>
<tr><td>1 mark</td><td>Reduced production rates as a fraction/decimal

their 17 500/22 000 or 35/44 or 0.7954...</td></tr>
<tr><td>1 mark</td><td>Production has decreased by:

their 0.7954... × 100 or their79.54...</td></tr>
<tr><td>1 mark</td><td>Production decreases to nearest whole percent (round up)

80%</td></tr>
</table>
Indicative content

No working is shown but correct answer of 80% is arrived at then award full four marks.
</td><td>4 marks</td><td>AO4 1c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>16</td><td>1</td><td>
<table>
<tr><td>3 marks</td><td>Detailed explanation and aesthetically related example considered in the selection and/or use of a material or component.</td></tr>
<tr><td>2 marks</td><td>Good explanation or basic explanation and aesthetically related example considered in the selection and/or use of a material or component.</td></tr>
<tr><td>1 mark</td><td>Basic explanation or aesthetic example explaining how each factor would be considered in the use of a material or component.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

Aesthetics

NB No mark for a named product without linking to aesthetics

The guidance provided is illustrative and not exhaustive.

• Can a brightly coloured finish be applied to enhance appearance, e.g. stain, paint etc.
• Looking good so that people want to buy it
• Can the material be finished to give high quality surface decoration, e.g. anodising, screen printed, embossing, varnishing etc.
• Where a material may be difficult to finish well, this could be reason enough to reject it, e.g. timber with a marked interlocking grain or knots; steel rusts when placed in an environment with moisture and air.
• Can a finish be applied to enhance looks e.g. can the fabric be dyed
• Can the material be made to look good so that it will encourage customers to buy it in a product.

Accept all other valid responses.
</td><td>3 marks</td><td>AO4 1b
AO4 1c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>16</td><td>2</td><td>
<table>
<tr><td>3 marks</td><td>Detailed considerations and sourcing related example considered in the selection and/or use of a material or component.</td></tr>
<tr><td>2 marks</td><td>Good considerations or basic considerations and sourcing related example considered in the selection and/or use of a material or component.</td></tr>
<tr><td>1 mark</td><td>Basic consideration or sourcing related example considered in the use of a material or component.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

Source

The guidance provided is illustrative and not exhaustive.

• Is the material easy to source? If it is not easy to access it will make production and deadlines difficult to meet.
• Can the material be sourced in sufficient quantity for the scale of production, e.g. possible future challenges to lithium supply for batteries for electric vehicles.
• Does the sourcing of the material have a negative impact on the environment, e.g. pollution, deforestation. Designers may not want to use materials that might not appeal to potential customers.
• If sourcing is expensive due to extraction costs, e.g. mining, designers may look for a cheaper/cost viable alternative material.
• Social responsibility – does material sourcing make use of cheap labour with poor infrastructure to support workers and their families, e.g. underage workers, poor medical health care, long working hours. There have been many instances of such issues being brought to the public attention in the media.
• Consideration of fair-trade materials.
• Ethics-does the material sourcing harm living creature
• Consideration of local supply v global footprint and carbon footprint

Accept all other valid responses.
</td><td>3 marks</td><td>AO4 1b
AO4 1c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>17</td><td></td><td>
<table>
<tr><td>3 marks</td><td>Detailed understanding of waste allowance when making prototypes/products.</td></tr>
<tr><td>2 marks</td><td>Good understanding of waste allowance when making prototypes/products.</td></tr>
<tr><td>1 mark</td><td>Basic point of understanding related to waste allowance when making prototypes/products.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

Prototype development

• Prototypes need extra waste for tweaks and modifications
• Making parts/components a bit bigger/longer so you can cut down and modify if required. You can’t easily add material.
• Measurements might not be exact
• Allows for trial and error at the prototype stage

Cutting out

• All cutting out should be carried out on the waste side of any marked outline/datum or edge to make sure we do not cut the prototype/part too small.
• Some materials have a surface pattern (fabrics) or grain (woods) and cutting out needs to allow for pattern repeat/grain alignment to ensure there is no mismatch.

Allowing for waste

• Where a blade or saw is being used allowance needs to be given to blade thickness.
• Some materials need a greater allowance for waste, e.g. timber-based materials where after cutting additional finishing, e.g. sanding or planing may be required.
• The use of templates and stencils allow material to be used within tolerances to maximise how many parts are cut from a piece of material.
• Seam allowance in textiles/additional material to allow for turns and fabrication, e.g. stitching seams.

Accept all other valid responses.
</td><td>3 marks</td><td>AO4 1b</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
18	1	One mark for any correct specific main material. **Indicative content** Polymer window frame: • UPVC • PVC • rigid PVC • polycarbonate & acrylic in substitute for glass. Solid wood dining furniture: Any named solid wood including: • Mahogany • Meranti. • Pine • Oak • Teak Metal bike hub: • Aluminium • Aluminium alloy • Aluminium/magnesium alloy. • Steel Printed Circuit Board (PCB): • Copper • paper • fibreglass. Fabric pop-up tent: • nylon • polyester • polyester/cotton mix. • polypropylene Paper and board takeaway food packaging: • card • carton board • cardboard • corrugated card • waxed card. **NB Do not accept paper or paper cardboard or board** Accept all other valid responses.	1 mark	AO4 1c

Qu	Part	Marking Guidance	Total marks	AO
18	2	One mark for the name of any correct modification technique. **Indicative content** Polymer window frame: • adding stabiliser • adding fillers • pigments • spray paint Solid wood dining furniture: • Air/natural seasoning • Kiln seasoning. • Laminating • Seasoning • Staining/Wax/Varnish or other suitable finish • Steam bending • Tanalising **NB Do not accept sanding, carving or wood turning** Metal bike hub: • Anodising • Chrome plating • Electroplating • Galvanising • Painting Printed Circuit Board (PCB): • addition of a photosensitive layer – make the surface polymer light sensitive • etching • lamination • varnishing Fabric pop-up tent: • dyeing • flame retardants • stain resistant finish • silicone coating/sunscreen • water proofing surface treatment/waxing. Paper and board takeaway food packaging: • additives to prevent moisture transfer • encapsulation • impregnation of card • lamination/foil lining • printing • waxing Accept all other valid responses.	1 mark	AO4 1c

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>18</td><td>3</td><td>
<table>
<tr><td>2 marks</td><td>Correct point explained in detail possibly using a specific example.</td></tr>
<tr><td>1 mark</td><td>Correct simple point of explanation.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

N.B Response needs to be linked to material identified in 18.1 (possibly 18.2)

Polymer window frame
• Stop the polymer from yellowing and becoming brittle and cracked from UV and IR light.

Solid wood dining furniture
• Stop the wood from twisting and warping as it dries out in a centrally heated home.
• Improve durability for outdoor use e.g. tanalising

Metal bike hub
• Improved aesthetics – to make the aluminium surface of the wheel more attractive (brightly coloured).
• Hardening – to stop rain, salt impurities on the road etching the surface of the wheel axle away.

Printed Circuit Board (PCB)
• To allow a circuit diagram to be developed on the surface of the PCB board.
• Allow unwanted copper between individual PCB tracks can be etched away to isolate different areas of the board
• Varnishing to protect from oxidation
• Tin plate/tinning contact areas for good, soldered joints

Fabric pop-up tent
• To reduce flammability. Also, some synthetic materials give off toxic fumes that may affect breathing and lead to choking in a fire.
• Waterproofing to stop the tent from leaking.
• Silicone/sunscreen coating to stop children getting sunburnt from UV rays.

Paper and board takeaway food packaging
• To stop the food juices from leaking out and staining clothing and/or surfaces.
• Heat retention to keep food warm.

Accept all other valid responses.
</td><td>2 marks</td><td>AO4 1c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>19</td><td></td><td>
<table>
<tr><td>7–8 marks</td><td>Detailed analysis and evaluation of different scales of production available for use by a manufacturer. Relevant correct examples given to clarify response.</td></tr>
<tr><td>5–6 marks</td><td>Good analysis of different scales of production that can be used by a manufacturer. An attempt to evaluate some points raised (offering personal judgement). Some examples to clarify answer.</td></tr>
<tr><td>3–4 marks</td><td>Basic analysis of generic points dealing with some scales of production that can be used by a manufacturer. No evidence of an attempt to evaluate, (offer personal judgement), on each point raised. Possible limited use of generic examples to support answer.</td></tr>
<tr><td>1-2 marks</td><td>One or two limited points showing limited understanding of different scales of production.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

NB
1. A response with no product examples can only be awarded a maximum of six marks.

2. Response with only one production scale does not answer the question. However, a detailed response of one production scale with example may access 3-4 marks band.

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

Candidates should discuss the following scales of production:

• prototype production (accept reference to one off production if used)
• batch production
• mass production
• continuous production.
</td><td>8 marks</td><td>AO3 2a
AO3 2b</td></tr>
</table>

Expect candidates to discuss the positives and negatives of each scale of production (evaluation) and use examples from their own understanding to clarify further.

Prototype/one off production

Key points	Advantages	Disadvantages
• Uses highly skilled workers expecting higher wages. • Hand fabrication techniques extensively used. • Used for prototype products to test out a design or concept at a pre-production stage. • Bespoke production (meet specific client needs and wants), e.g. wedding dress. • Unique products, e.g. artwork, jeweller. NB May find one off /bespoke production exemplified as part of car manufacture where integrated manufacture allows cars to be made to personalised customer choices, e.g. colour, trim etc.	• Does not require high investment in expensive CAD/CAM or automated production systems. • You can use a standard range of hand and machine tools found in most workshops. • End products are usually of high quality.	• Labour intensive so expensive to produce products using this method. • Difficult to replicate exact copies of products. • Time consuming to make.

Batch production

Key points	Advantages	Disadvantages
• A set number of products are made at one time, e.g. rolls of fabric, wallpaper etc.	• A good system for making small quantities of identical products, e.g. F1 car manufacture.	• When machinery is used it will need to be stopped to reconfigure for a new task or

• Perishable goods can be made in batches, e.g. paints, adhesives. • Uses moulds, templates and patterns to speed up production. NB Be aware of references to batches of components being used in mass manufacture of a product.	• Materials can be purchased in larger quantities for economies of scale/bulk discount. • The use of moulds, templates etc can improve consistency and accuracy between products.	activity – downtime. • Another technique employing a degree of highly skilled and hence expensive staff that can add to on-costs.

Mass production

Key points	Advantages	Disadvantages
• Produces large numbers of identical products. • Production broken down into stages. • High productivity. • Workers and machines perform one dedicated task for speed. • Boring and monotonous work. • Low skilled labour may be considered, but increasingly mass production has a few highly skilled workers to keep highly automated production lines running efficiently. • Use assembly lines and automated manufacture, e.g. white goods, TVs and mobile phones.	• Good for manufacturing large quantities over a long time, e.g. vehicles, drinks cans etc. • High productivity leads to large economies of scale buying in materials and components. • Highly automated manufacture requiring lower labour input to increase productivity.	• Initial set up cost for machinery and equipment is time consuming and expensive. • Rigorous QA needed to check consistency of products being made or lots of defective product can be made.

Continuous production

Key points	Advantages	Disadvantages
• Lots and lots of identical products made without stopping, e.g. processing of materials into stock forms. • Production should only stop for maintenance. • Good for simple components continually required, e.g. staples, nuts and bolts, zips, resistors.	• Very limited work force required leading to less time lost for comfort breaks, illness and holidays. • Highly suited to 24/7 production. • Very high productivity.	• Very high equipment costs at initial set up. • Production time lost for initial set up.

Accept all other valid responses.

Qu	Part	Marking Guidance	Total marks	AO
20		Maximum of **two** marks for **each** production aid.	4 marks	AO4 2b

2 marks	A detailed explanation for each production aid
1 mark	A basic explanation for each production aid
0 marks	No response or nothing worthy of credit.

Indicative content

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above. Important note: patterns and templates are essentially the same thing. The word 'pattern' is more likely to be used in textiles.

Jigs:
- help with repetition and consistency
- help with accuracy, e.g. drilling/punching a series of holes in exact places in a piece of material

		• can be used to avoid measuring and marking out lots of identical parts • are used to save time when manufacturing lots of similar parts, e.g. batch production • are reusable so once made they can be used to make parts at different times • a jig is metal device attached to sewing machinery which holds part of a garment, such as a pocket, in place while the machine (CNC) sews it into position. A jig is used to ensure the process can be repeated accurately and to a high quality. Pockets on jeans are a good example. Patterns/templates: • are used to improve repetitive marking out accuracy • are a marking out tool • can help with the 'nesting' and orientation i.e. following the grain line of parts on a piece of material or fabric • can help reduce material waste and ensure it is used more efficiently • patterns are used to trace outlines onto fabric so cutting out prior to sewing can take place • in textiles, patterns can help plan for effective material use where a repeating pattern or design on the fabric needs to be considered • templates are shapes that are drawn around to replicate the same image of drawing multiple times on a piece of material • in textiles patterns are the shapes of pieces of a product which are made from paper or card. The patterns can be pinned to fabric before cutting out and sewing together or drawn around before cutting out and sewing together. Accept all other valid responses.		

Qu	Part	Marking Guidance	Total marks	AO
21	1	**3–4 marks** – Detailed evaluation of how the exercise bike satisfies the needs and wants of the user. **1–2 marks** – Basic analysis of how the exercise bike satisfies the need and wants of the user. Little or no evidence of evaluation of how the bike satisfies the needs and wants of the user. **0 marks** – No response or nothing worthy of credit. **Indicative content** • Safety – stable design with rubber feet that can't slip on a floor. • Improve physical fitness and wellbeing. • Variety of different training options to stop the user from becoming bored, e.g. mountain mode, sprint mode. • Adjustable seat and handlebars for user comfort. • Internet compatible to engage with a 'real' personal trainer.	4 marks	AO3 1a AO3 1b

		• Exercise in the safety of your own home (as in a pandemic). • Interactive options to exercise online. • Ease of assembly – so it can be put together after purchase by the user. Ease of disassembly/folding/collapsing for storage. Accept all other valid responses.		

Qu	Part	Marking Guidance	Total marks	AO
21	2	3–4 marks: Detailed evaluation of anthropometrics and ergonomics used in the exercise bike 1–2 marks: Basic evaluation of anthropometrics **and/or** ergonomics used in the exercise bike 0 marks: No response or nothing worthy of credit. **Indicative content** **Anthropometrics** Look for reference to human sizes (dimensions) not the human body. • To ensure that all features are designed to suit the maximum possible numbers of users, e.g. 5–95th percentile. • Hand grips and pedals that can be adjusted to suit different sized feet. • Appropriate distance of the screen and controls depending on arm length, so they are easy to reach. • Buttons on control panel that can be easily pressed with a finger. **Ergonomics** Look for reference to how the exercise fits and works with the human user. • Adjustable features e.g. seat to suit different users • Display – information is well presented and clearly visible to read. • Padded seat so your bum does not get sore. • Thermoforming polymers (foam) hand grips for comfort so your hands do not slip. • Toe clips so your feet cannot slip off the pedals. Accept all other valid responses.	4 marks	AO3 1a AO3 1b

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>21</td><td>3</td><td>
<table>
<tr><td>3–4 marks</td><td>Detailed evaluation of the innovation in the design of the exercise bike.</td></tr>
<tr><td>1–2 marks</td><td>Limited evaluation of the innovation in the design of the exercise bike.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>

Indicative content

NB Watch for repeats of question stem i.e., internet ready. Do not credit unless clarified.

• Interactive features so you can train with others including compete.
• Interactive features allow user to get advice and encouragement from other users.
• Modern materials like carbon fibre to increase strength and durability without increasing weight of the product. Important if it must be moved around in the home for storing away etc.
• Internet ready – access to different programmes and updates to prevent bike from becoming technological obsolete.
• Additional apps e.g. cardiac monitor to measure heart rate etc.

Candidates may evaluate by suggesting innovative features not present:
• Devices to help cool the user down
• Plays music and links to your phone
• A drinks holder to hold a cup to stay hydrated
• Links to Fitbit
• Watch performance data
Accept all other valid responses.
</td><td>4 marks</td><td>AO3 1a
AO3 1b</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>22</td><td></td><td>
<table>
<tr><th>Marks</th><th>Subtract one area of colour from another</th></tr>
<tr><td>1 mark</td><td>Total panel size is:

120 × 60 = 7200 mm^2 or 12 x 6 = 72cm^2</td></tr>
<tr><td>1 mark</td><td>Area of 1 blue panel area is:

20 × 20 = 400 mm^2 or 2 x 2 = 4 cm^2</td></tr>
<tr><td>1 mark</td><td>Areas of 6 blue panels/total blue panel area is:

Their 400 × 6 = their 2400 mm^2
or
their 4 x 6 = their 24cm^2

NB Some candidates may miss second step and use:

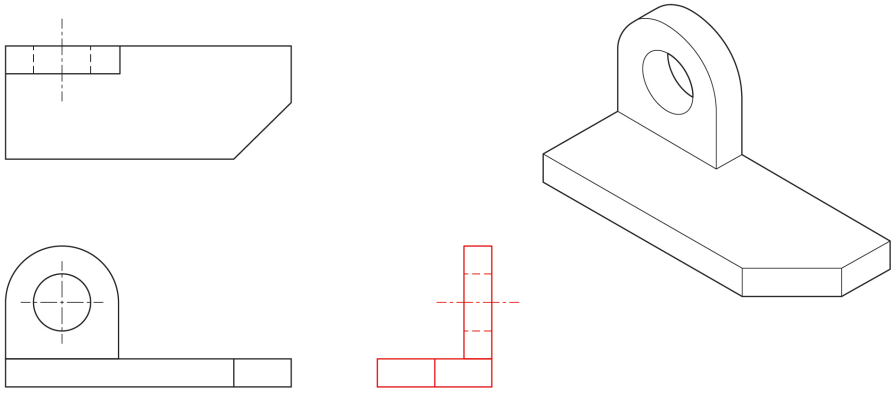
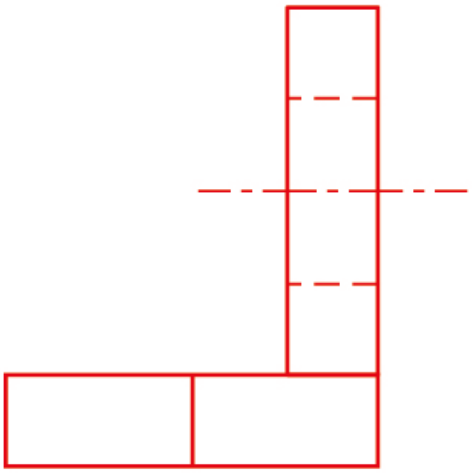
60 × 40 = 2400 mm^2 or 6 x 4 = 24cm^2 (award both marks)</td></tr>
<tr><td>1 mark</td><td>Proportions are:

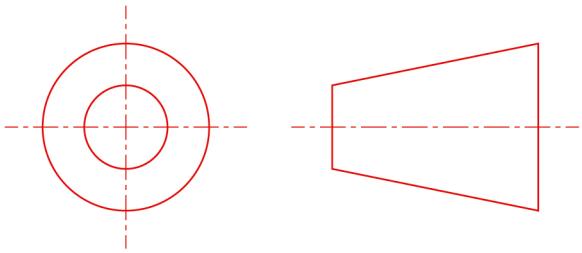
their 7200 – their 2400 = their 4800
or
their 72 – their 24 = their 48

(Total panel size – Total blue panel area)

2400/4800 or</td></tr>
<tr><td>1 mark</td><td>1:4800/2400 or 1:48/24</td></tr>
<tr><td>1 mark</td><td>Ratio is:

1:2 or 2:1</td></tr>
</table>
N.B. If the correct ratio is shown i.e. 1:2 or 2:1 with no working award max marks
</td><td>6 marks</td><td>AO4 2c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>23</td><td>1</td><td>The end elevation generated needs to look like the one in red shown below:
 
Image below is enlarged to illustrate correct hidden detail and centre line conventions
 
Indicative content
<table><tr><td>1 mark</td><td>Basic correct shape – L shape</td></tr><tr><td>1 mark</td><td>L shaped elevation drawn correct way round including solid vertical line indicating angled face</td></tr><tr><td>1 mark</td><td>Two hidden detail lines for the hole not extending outside the L shape.</td></tr><tr><td>1 mark</td><td>Centre line of hole extending outside the drawing</td></tr></table></td><td>4 marks</td><td>AO4 2c</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
23	2	Correct symbol is D 	1 mark	AO4 2c

Qu	Part	Marking Guidance	Total marks	AO
24	1	One mark for each correct step. Award full marks even if no working shown but answer is correct. **NB One mark max for any piece of correct method** 1 mark: Credit **any** calculation from the **2** indicated below: **Total cost of 1 weathervane** (£22 × 4 hours) + £5 = £93 **AND/ OR** **Total cost of 6 weathervanes** their 93 x 6 = their £558 1 mark: Fully correct answer only **£558**	2 marks	AO4 2c

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>24</td><td>2</td><td>Award full marks even if no working shown but answer is correct.

<table>
<tr><td>3 marks</td><td>Credit any 3 calculations from the 4 indicated below:

Time taken to make 6 weathervanes

6 × 0.5 = 3 hours in total

Labour costs to make 6 weathervanes

£22 x 5 x 3 = their £330

Material costs to make 6 weathervanes

£5 x 6 = their £30

Total cost of 6 weathervanes

Their £330 + their £30 = their £360</td></tr>
<tr><td>1 mark</td><td>Fully correct answer only
£360</td></tr>
</table>
</td><td>4 marks</td><td>AO4 2c</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
24	3	One mark for correctly identifying **method 2/ 5 workers/table3.** One mark for any valid explanation point. **Indicative content** **NB Wrong method but correct reason gets 1 mark** • lower total labour costs • increased productivity • reduced production time • workers more productive on specialist task **Do not accept cheaper or quicker unless qualified** Accept all other valid responses.	2 marks	AO4 2b

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>25</td><td></td><td>
<table>
<tr><td>2 marks</td><td>Two correct simple points or one point in more detail as to how the factor may be considered in choosing materials and/or components for use.</td></tr>
<tr><td>1 mark</td><td>One correct simple point as to how the factor may be considered choosing materials and/or components for use.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Maximum of two marks for each factor i.e., 2 x 3 marks

NB Responses MUST be about materials and components NOT a product.

Indicative content

Product function:

• what is the material required to do, e.g. support its own weight or the weight of something else
• what conditions does it have to work under, e.g. withstand any wear and tear
• what specific properties does the material or component need, e.g. light or heavy
• will it be fit for purpose, e.g. simulate or just mock up a non-working product or do something
• will the material be easy to work with to create the prototype
• can the material be finished to the correct quality for the prototype.

Cost:

• if the prototype is a mock up the designer will not want to spend a lot on materials
• if a lot of a material or lots of components are required, can they be bought in bulk to reduce manufacturing costs
• what quality of materials can be used, e.g. high-quality expensive materials are not usually needed for a mock up or a prototype
• are materials easy to work, i.e. there are no additional costs needing expensive tools or equipment to be factored in to make the prototype
• use of recycled or upcycled materials for the prototype would be desirable to get the prototype fabrication costs down.

Availability:

• can the material be easily sourced to quickly make a mock up or prototype
• valuable time can be wasted ordering and waiting for materials/components to arrive to make a prototype or mock up
• are they in stock with a retailer and quick to deliver
</td><td>6 marks</td><td>AO4 2b</td></tr>
</table>

		• are the materials/components available in stock forms and sizes • selecting materials/components that are readily available will fit in with development in the time frames of projects and deadlines. Accept all other valid responses.		

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>26</td><td></td><td>
<table>
<tr><td>3 marks</td><td>A detailed explanation of how increasing carbon dioxide levels in the atmosphere impact on the design and manufacture of products.</td></tr>
<tr><td>2 marks</td><td>A good explanation of how increasing carbon dioxide levels in the atmosphere impact on the design and manufacture of products.</td></tr>
<tr><td>1 mark</td><td>A basic explanation of how increasing carbon dioxide levels in the atmosphere impact on the design and manufacture of products.</td></tr>
</table>
Indicative content
Possible examples are highlighted

By purchasing products using materials from sustainable sources, e.g. FSC timber, supplies can be replenished removing carbon dioxide from the environment (and ecosystems and places people and life on earth inhabit can be preserved for future generations).
Reducing CO2 levels (carbon footprint) by using fewer materials or sourcing materials closer to home
Designing products that can be repaired, upgraded and maintained
Designer and/or manufacturer needs to consider the 6Rs
Designing products consuming less power/energy.
Manufacturing using renewable energy /fewer fossil fuels
Society and consumers as members are increasingly aware of the impact that their choices and demand for products can have on the world in which we live. Consumers may choose to upgrade their mobile phone or car less frequently. They may choose to upcycle clothing. This avoids extreme consumption of resources, particularly primary processing and extraction of raw materials to make new products.

</td><td>3 marks</td><td>AO4 2c</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>27</td><td></td><td>
<table>
<tr><td>5–6 marks</td><td>Detailed explanation as to why designers must research and investigate existing products. Clear comment and understanding of why this is needed before starting to design new products.</td></tr>
<tr><td>3–4 marks</td><td>Good points of explanation. Some linking of how investigation and research can inform the design of new products.</td></tr>
<tr><td>1–2 marks</td><td>Basic explanation with one or two points considering why investigation and research is undertaken by designers. Little or no linking of how existing products can inform the design of new ones.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
Indicative content

You can award full marks for response with a single well-developed response.

• To identify good and bad points in existing designs and avoid ‘building in’ bad points/features.
• To assess the commercial viability of their ideas
• Carry out investigations to identify problems with existing products.
• Research and investigation inform prototypes
• Find out what materials are used to make existing products.
• Find out assembly and construction processes.
• Identify a price for existing products to ensure they and new products are competitively priced.
• To develop an understanding of competitor’s design and consider how function/operation/use etc can be improved.
• Find out what intended users think of existing products and what they would look for in a new and improved product.
• Find out if existing products meet the needs and wants of their intended user(s) and target market.
• To avoid infringement on someone else’s intellectual property.

The use of examples may help to further explain and clarify responses and should be rewarded if relevant.

Accept all other valid responses.
</td><td>6 marks</td><td>AO4 2b</td></tr>
</table>