AQA

AS
DESIGN AND TECHNOLOGY: PRODUCT DESIGN
7551/W

Paper 1 Written Paper

Mark scheme

June 2020

Version: 1.0 Final

206A7551/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.

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.

Section A

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>1</td><td></td><td>Which of the following materials is most appropriate for a cereal box?
A Cartridge paper
B Corrugated card
C Duplex card
D Laminated card

Answer: C Duplex card</td><td>1 mark</td><td>AO41a</td></tr>
<tr><td>2</td><td></td><td>Complete Table 1 to show the appropriate classification for each of the four processes by ticking (✓) the correct box.

Only one tick per process is allowed.

Table 1
<table><tr><th></th><th>Wasting</th><th>Fabrication</th><th>Redistribution</th></tr><tr><td>Brazing</td><td></td><td>✓</td><td></td></tr><tr><td>Drilling</td><td>✓</td><td></td><td></td></tr><tr><td>Extrusion</td><td></td><td></td><td>✓</td></tr><tr><td>Spinning</td><td></td><td></td><td>✓</td></tr></table></td><td>4 marks</td><td>AO41a</td></tr>
<tr><td>3</td><td></td><td>Give two reasons why phosphorescent pigments are used in signs.

1 mark for each correct response.

Indicative content:
• Phosphorescent pigments glow in the dark and can show exit routes or fire extinguisher locations in emergency situations.
• Phosphorescent pigments do not require a power supply so they will continue to glow even if there is a power outage.
• The pigments can be mixed with traditional inks used in printing processes to allow the signs to be printed using existing equipment.
• Phosphorescent pigments are far safer than the radioactive materials that used to be used to create glow-in-the-dark materials.

This list is not exhaustive.

Accept any other valid responses.</td><td>2 marks</td><td>AO41a</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>4</td><td></td><td>Compare and evaluate the suitability of screen printing and digital printing for a point-of-sale display.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>5–6 marks</td><td>A detailed comparison of how the stated processes are suitable for printing a point-of-sale display. Points made are largely accurate and offer detailed evaluation of the advantages each printing process offers over the other and describes why one process may be chosen over the other.</td></tr>
<tr><td>2</td><td>3–4 marks</td><td>A good comparison of how the stated processes are suitable for printing a point-of-sale display. Points made are mostly correct (although there may be some inaccuracies), making some reference to the differences between each process and include some evaluation of why this makes each suitable (or otherwise) for printing a point-of-sale display.</td></tr>
<tr><td>1</td><td>1–2 marks</td><td>Response is basic and may only cover a single printing process, showing limited understanding or evaluation of the benefits or drawbacks in using this process for a point-of-sale display.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit</td></tr>
</table>

Indicative content:

Screen printing:

• Screen printing can be suitable for small print runs which would match the quantities required for a point-of-sale display.
• Screen printing may not be suitable for the larger volumes necessary for national advertising campaigns as it could take too long to manually produce the quantities required.
• The set-up costs of screen printing are low and would allow manufacturers to make a reasonable profit when producing point-of-sale displays that required small print runs.
• Screen printing can produce more vibrant colours if used on dark materials than can be achieved when using digital printing. This may make it more suitable for some designs of point-of-sale display.
• Screen printing requires each colour to be applied separately and this can make it difficult to produce point-of-sale displays that require a large number of colours in a cost-effective manner due to the large number of colour applications that would be required.
• Screen printing may take a long time to complete as each colour may need to be allowed to dry before the next colour can be applied over the top.</td><td>6 marks</td><td>AO3 2a
AO3 2b</td></tr>
</table>

		Digital printing: • Digital printing allows artwork from a CAD design to be printed directly on to the material for the point-of-sale display. This allows designs to be printed much more quickly than using screen printing. • Digital printing only applies a thin layer of ink, so it is difficult to achieve a good level of colour vibrancy if printing on to dark materials. • Digital printing uses CMYK colour mixing so there is no need to wait for individual colours like in screen printing. • Digital printing allows more detailed images to be printed on to a point-of-sale display than can be achieved using screen printing. • Set up costs of digital printing can be quite high due to the need for an expensive printer and a good quality computer, but this can be offset by allowing print runs as low as one to be run effectively. • Due to the speed of printing and drying, digital printing can be a viable option for high volume productions of point-of-sale displays that may not be able to be achieved efficiently using screen printing. **This list is not exhaustive.** **Accept any other valid responses.**		

Qu	Part	Marking Guidance	Total marks	AO

5 — 4 marks — AO41c

A carbon fibre reinforced plastic (CFRP) part has a mass of 0.8 kg. The ratios of materials required to make this part are shown in **Table 2**.

Table 2

Ratio CFRP matting : resin and hardener	2:15
Ratio resin : hardener	2:1

Calculate the mass of resin used to make this part.

Method to calculate the mass of resin & hardener out of the total mass of the part of 0.8 kg	$\frac{800}{(15+2)} \times 15$	1 mark
Correct value for the total mass of resin & hardener (award 2 marks if this value obtained with or without method)	705.882…. (g)	1 mark
Method to calculate the mass of resin out of the total of 705.882… (or what they got for 705.882…)	$\frac{705.882...}{3} \times 2$	1 mark
Correct final answer for mass of resin	470.59…g (or 471g)	1 mark
Mass Where no working out is shown but final answer is accurate. (Note: The correct answer is full marks.)	470.59…g (or 471g)	4 marks

Alternative method:

Convert 2nd ratio	15 ÷ (2+1) = 5	1 mark
Ratio of CFRP : resin : hardener	2 x 5 = 10 1 x 5 = 5 Ratio CFRP: resin: hardener = 2:10:5	1 mark
Ratio factor	2 + 10 + 5 = 17	1 mark
Calculate mass	(10/17) x 0.8 = 0.471kg	1 mark
Mass Where no working out is shown but final answer is accurate.	= 0.471kg	4 marks

Accept responses given in either grams (g) or kilogrammes (kg)

Qu	Part	Marking Guidance	Total marks	AO
6		**Figure 1** shows a polymer detergent bottle. The bottle can be manufactured either from high density polyethylene (HDPE) or a biodegradable polymer. Compare and evaluate the suitability of **both** materials for this detergent bottle.	6 marks	AO3 2a AO3 2b

Level	Mark	Description
3	5–6 marks	A detailed evaluation of the suitability of both materials for the bottle shown. Points made are largely accurate, considering the benefits and drawbacks of both materials, including reference to the ability of the materials to be moulded and impact of disposal. A conclusion may be drawn about which material is the most suitable.
2	3–4 marks	A good evaluation of the suitability of both materials for the bottle shown. Some consideration is given to the benefits of one material over the other, with some reference made to environmental impact or manufacturing details. Information is mostly correct although there may be some inaccuracies or misunderstandings.
1	1–2 marks	A basic evaluation of the suitability of one or both materials. The points made lack detail. The response may only consider functional details and show little understanding of the benefits of one material over the other.
	0 marks	No response worthy of credit

Indicative content:

HDPE:

- HDPE is a thermoplastic material with a low softening point that allows it to be blow moulded in to the shape of the bottle.
- HDPE is a very durable material that will not degrade quickly. This will mean that it will remain in the environment for hundreds of years if disposed of via landfill.
- HDPE can have pigments added to allow the bottle to be formed in the colour shown.
- HDPE does not degrade in sunlight or when wet, so the bottle will have a guaranteed quality for a long period of time.
- HDPE can be recycled and recovered if sorted correctly when the bottle is disposed of.

		Biodegradable polymer: • Like thermoplastics such as HDPE, biodegradable polymers have low softening points that allow them to be formed in to the shape of the bottle using the blow moulding process. • Biodegradable polymers can be designed to break down using a range of processes, such as composting, degradation under UV light, or degradation through water absorption. This allows the container to have a sufficiently long life span to fulfil its purpose and still degrade quickly, possibly in a matter of days or weeks. • Bottles made from biodegradable polymers may need to be stored under strict conditions to prevent early degradation. This could put some companies off of using them due to the risk of containers in stock beginning to break down sooner than desired. • Some biodegradable polymers produce methane gas when degrading in landfill. This is a greenhouse gas which contributes to global warming, so an increased use in these materials could be detrimental to the environment. • Biodegradable polymers can cause issues in recycling if they are not sorted correctly and end up being mixed together with alternatives such as HDPE. **This list is not exhaustive.** **Accept any 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>7</td><td></td><td>Explain why carbon fibre reinforced plastic (CFRP) would be chosen to manufacture a hockey stick instead of using a traditional wooden material.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>5–6 marks</td><td>A detailed understanding of why CFRP would be used to make a hockey stick instead of wood. Information is largely accurate and shows detailed understanding of the better material properties offered by CFRP with detailed comparison to the properties which would have been offered by a wooden alternative.</td></tr>
<tr><td>2</td><td>3–4 marks</td><td>A good understanding of why CFRP would be used to make a hockey stick, with some comparison to traditional wooden construction. Information is mostly correct although there may be some inaccuracies or misunderstandings.</td></tr>
<tr><td>1</td><td>1–2 marks</td><td>A basic understanding of why CFRP would be used to make a hockey stick, with little or no comparison to a wooden alternative. There is a lack of detail in the response and few relevant points provided.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit</td></tr>
</table>

Indicative content:
• CFRP provides greater compressive strength and stiffness compared to wooden alternatives. This allows greater power to be generated when striking a hockey ball.
• CFRP provides a lighter weight than wooden alternatives. This reduces fatigue when carrying the hockey stick throughout the match and allows the stick to be swung at the ball more vigorously.
• CFRP has allowed hockey sticks to be far more consistent in their weight, stiffness and power, reducing variation between one hockey stick and another.
• Aftercare of CFRP hockey sticks is reduced compared to wooden alternatives, allowing less time to be spent maintaining equipment and increasing the longevity of each hockey stick
• CFRP hockey sticks do not absorb moisture like wooden alternatives and this reduced risk of breakage or loss of accuracy.
• Using CFRP allows the hockey stick to be made with a hollow construction. This reduces weight which allows the stick to be used with greater force and less fatigue.
• The use pigments during the manufacture of CFRP has allowed colour to be added without the need to paint the hockey stick. This prevents the finish from wearing away and helps maintain a good appearance.
• CFRP allows reinforcement of specific sections of the hockey stick to improve functionality and durability.

This list is not exhaustive. Accept any other valid responses.</td><td>6 marks</td><td>AO41b</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>8</td><td></td><td>The triangular part shown in Figure 2 will be cut from a sheet of stainless steel using a laser cutter. It takes 30 seconds to cut out the part in a single cut.

Calculate the machining speed in metres per second (m/s).

<table>
<tr><td>Set out equation (Pythagoras Theorem)</td><td>Hypotenuse^2 = opposite^2 + adjacent^2

or

$c^2 = a^2 + b^2$</td><td>1 mark</td></tr>
<tr><td>Rearrange equation and insert data</td><td>$1.3^2 – 0.5^2 = a^2$</td><td>1 mark</td></tr>
<tr><td>Calculate length of missing side</td><td>$\sqrt{1.44}$ = 1.2m</td><td>1 mark</td></tr>
<tr><td>Calculate machining speed</td><td>Speed = Total distance ÷ time
= (1.2+1.3+0.5) ÷ 30
= 3 ÷ 30
= 0.1m/s</td><td>1 mark</td></tr>
<tr><td>Machining speed
<u>Where no working out is shown but final answer is accurate</u>.</td><td>= 0.1m/s</td><td>4 marks</td></tr>
</table>
</td><td>4 marks</td><td>AO41c</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>9</td><td></td><td>Explain the changes that may be required for a manufacturer to increase production from 50 to 5000 units.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>5–6 marks</td><td>A detailed understanding of the implications for a manufacturer when changing the scale of production from 50 to 5 000 items. Information is largely correct and a variety of examples are made.</td></tr>
<tr><td>2</td><td>3–4 marks</td><td>A good understanding of the implications for a manufacturer when changing the scale of production from 50 to 5 000 items. Information is mostly correct (although there may be some inaccuracies) and some relevant examples are made.</td></tr>
<tr><td>1</td><td>1–2 marks</td><td>A basic understanding of the implications for a manufacturer when changing the scale of production from 50 to 5 000 items. The response will be narrow or superficial, lacking in detail.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit.</td></tr>
</table>

Indicative content:

• Additional storage space may be required to allow the greater volumes of products made to be stored on site.
• Production in larger volumes may use techniques that require less skilled workers than smaller scales of production. This change could result in a skilled workforce getting bored.
• Jigs and fixtures may be required to speed up manufacture and repetitive tasks.
• Permanent joining methods will generally be replaced with temporary fixings.
• Use of flexible CNC manufacture to replace manual production techniques.
• CNC manufactured components allow for interchangeability/replacement to reduce waste.
• Increased volume of production may allow for bulk purchasing of materials at discounted costs.
• Designs may need to be developed to make use of bought-in/standardised components.

This list is not exhaustive.

Accept any other valid responses.</td><td>6 marks</td><td>AO41b</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>10</td><td></td><td>Discuss the advantages and disadvantages of using computer-aided design (CAD) when designing a TV remote control compared to using hand-drawn methods.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>5–6 marks</td><td>A detailed understanding of both the advantages and disadvantages of using CAD compared to hand-drawn methods, directly related to designing a TV remote control. A variety of points are made that are largely accurate and explained in detail.</td></tr>
<tr><td>2</td><td>3–4 marks</td><td>A good understanding of the advantages of using CAD over hand-drawn methods, with some recognition of disadvantages. Points made are mostly correct (although there may be some inaccuracies) and make some reference to the TV remote control context.</td></tr>
<tr><td>1</td><td>1–2 marks</td><td>A basic understanding of the advantages of CAD, with minimal or no recognition of disadvantages. Responses may be generic, narrow and superficial, lacking in detail, with little or no reference to the context of a TV remote control.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit</td></tr>
</table>

Indicative content:
• Different materials or colour schemes can be applied to the TV remote control quickly when using CAD; using a manual alternative would take far longer to achieve similar results.
• Errors can be changed easily when using CAD. Errors made using a hand-drawn method may risk the design of the TV remote control needing to be restarted.
• Databases of components such as on/off buttons can be used in CAD software and imported without needing to be redrawn. If using a hand-drawn method, they would need to be drawn or traced every time.
• CAD designs can be attached to an email and received instantly by clients anywhere in the world for design of the TV remote control to be reviewed. Hand-drawing designs would need to be scanned, faxed or physically posted, all of which will take longer.
• CAD designs can be produced with greater accuracy than using hand-drawn methods.
• If there is a power outage, the hardware required to use CAD software may not work and this could result in deadlines being missed.
• Some CAD renderings require high specification computers to implement which are vastly more expensive than being completed using hand-drawn methods.
• CAD software can crash during use and this can result in work being lost or corrupted. This would not occur using a hand-drawn method.</td><td>6 marks</td><td>AO41c</td></tr>
</table>

		• CAD software is updated regularly. This means staff/CAD users need to stay up to date through training which can be expensive. • If using CAD, figures and numbers can be applied to the design of the TV remote control to label buttons and features. This level of detail is hard to achieve using hand-drawn methods. **This list is not exhaustive.** **Accept any other valid responses.**		

Section B

Qu	Part	Marking Guidance	Total marks	AO

11 **Table 3** shows selected anthropometric data for UK adults.

	Percentile / Sex	5th	10th	30th	50th	70th	90th	95th
Eye height, standing (mm)	Male	1528	1551	1598	1632	1667	1713	1743
	Female	1415	1437	1482	1515	1548	1598	1621

11 1 Plot the graph to represent the data for UK **female** adults**.** — 2 marks — AO4 2c

Axes labelled and scaled correctly	1 mark
Points plotted accurately.	1 mark

11 2 Use your graph from **Question 11.1** to estimate the 80th percentile for Eye Height Standing for UK **female** adults. — 2 marks — AO4 2c

Line drawn at 80th percentile to line or curve		1 mark
Missing value correctly read off from graph	= [1564,1572]	1 mark

Note for markers:
Follow through their increasing graph – full marks can be awarded in 11.2 even if their graph in 11.1 is wrong as long as it is increasing

If it is outside the range it still needs to be checked to see if it is correct for their graph.

If their graph is inaccurate it will have lost marks in 11.1.

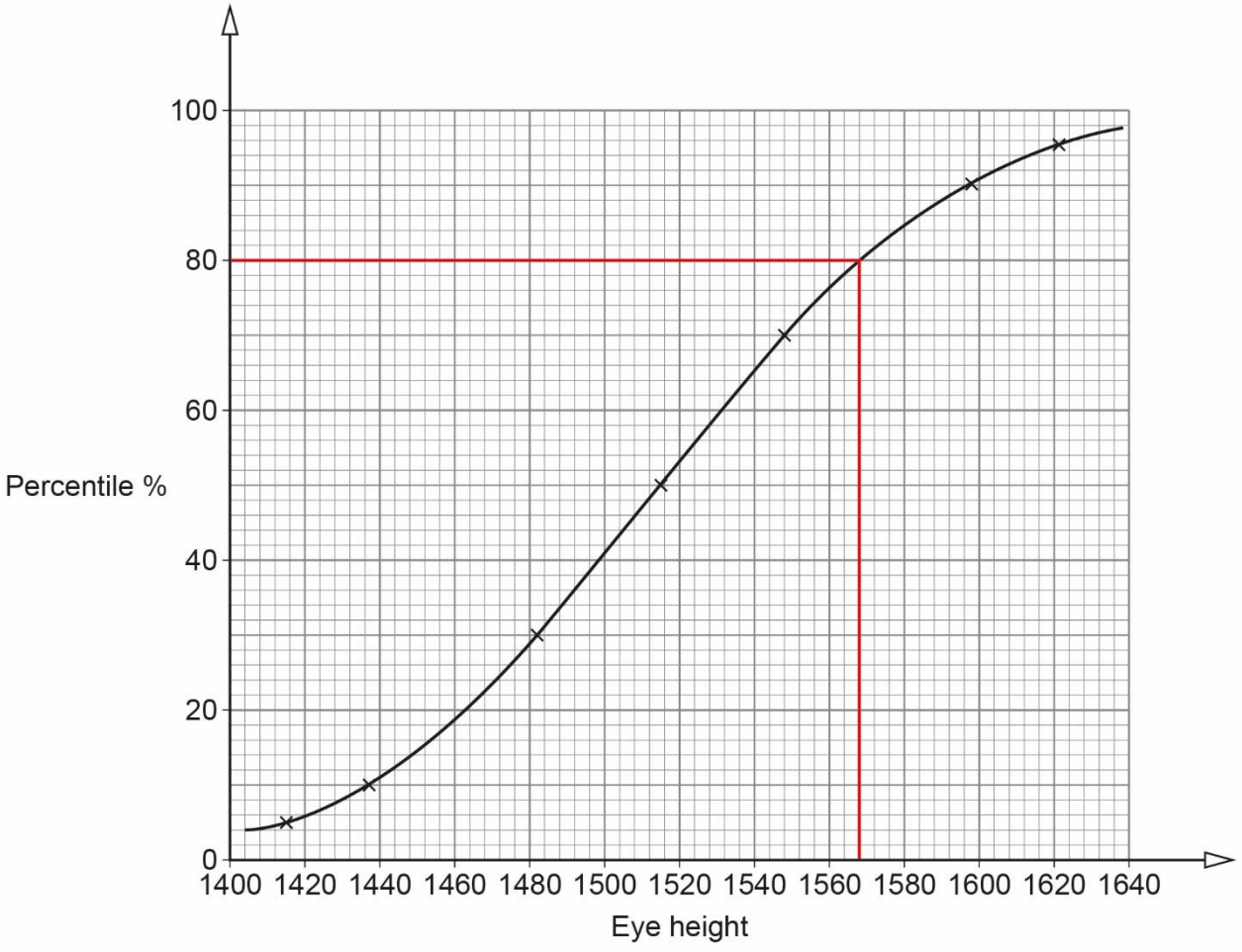
Check their value is read correctly (to within half a small square) in 11.2 for the marks (as long as graph increasing (as above)).

See graph x 2 below

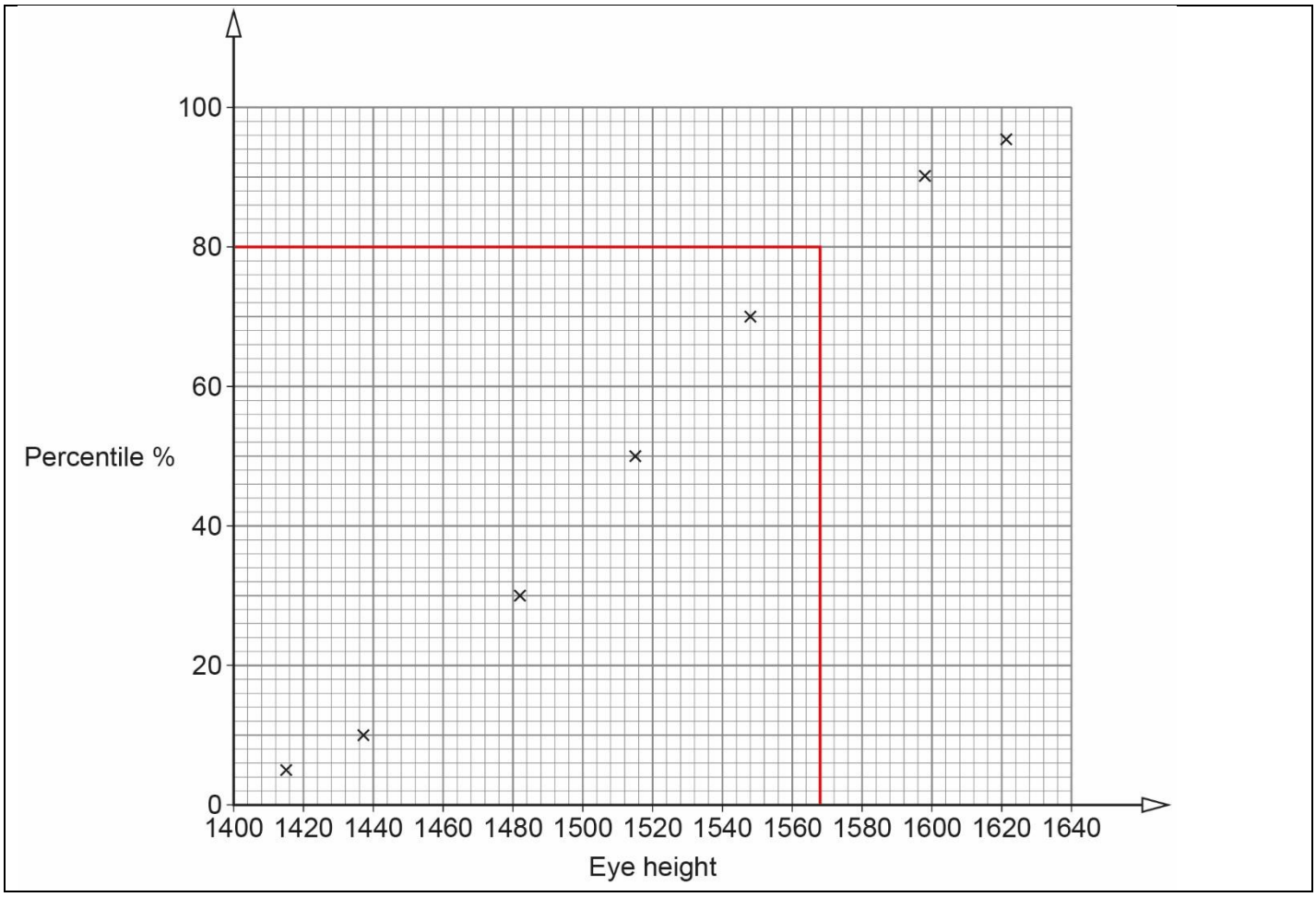
Note for markers:
The graph is also correct with straight lines between the plotted points.

Ignore line or curve drawn prior to (1415, 5)

Accept



Or accept


Percentile %
100
80
60
40
20
0
1400 1420 1440 1460 1480 1500 1520 1540 1560 1580 1600 1620 1640
Eye height

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>12</td><td></td><td>Analyse and evaluate the impact that Fairtrade initiatives have had on manufacturers and consumers.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>5–6 marks</td><td>A detailed analysis and evaluation of the impact Fairtrade initiatives on both manufacturers and consumers. A variety of points are made that are largely accurate and explained in detail.</td></tr>
<tr><td>2</td><td>3–4 marks</td><td>A good analysis and evaluation of the impact Fairtrade initiatives have had manufacturers or consumers. Some relevant points are given that are mostly correct, although there may be some inaccuracies and misunderstandings.</td></tr>
<tr><td>1</td><td>1–2 marks</td><td>A basic analysis and evaluation of the impact of Fairtrade initiatives. The response will be narrow and superficial or simply be a description of what Fairtrade is, rather than an analysis and evaluation of its impact.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit</td></tr>
</table>

Indicative content:
• Workers in developing countries receive a fair wage if working for a Fairtrade employer. This has increased costs for manufacturers.
• Equal rights are implemented in countries where this may not previously have been the case. Some consumers are willing to pay more for products that they know are ethically sourced in this manner.
• Healthcare is provided for people in developing countries working for a Fairtrade employer.
• Better education and training is provided for people in developing countries working for a Fairtrade employer. This provision will have had knock on costs for both manufacturers and consumers that may increase prices.
• Farming and manufacture has become more sustainable, giving workers regular employment and a reliable income. This also provides manufacturers with more reliable sources of materials to use in their products.
• Demand for Fairtrade products has increased as consumers have come to better understand the benefits to people in developing countries that are provided by Fairtrade.
• Consumers are more confident that the products they buy are ethically sourced if they carry the Fairtrade logo.
• Prices in supermarkets have become fairer and do not risk being so low that they put farmers or producers in to poverty,
• Fairtrade has improved access to agricultural services such as organic farming and premium markets; this has given farmers greater incentives to farm better and sell more, leading to better supply chains for manufacturers.</td><td>6 marks</td><td>AO3 1a
AO3 1b</td></tr>
</table>

		• **Fairtrade has improved local cooperatives in developing countries, increasing their ability to demand better prices for the materials they farm / produce**. • **Toxic pesticides used in farming have been reduced through the education and training that farmers working for Fairtrade companies have received. This in turn is helping promote greater biodiversity** and makes consumers more confident in buying Fairtrade products as they know their environmental impact should be minimal. **This list is not exhaustive.** **Accept any other valid responses.**		

Qu	Part	Marking Guidance	Total marks	AO
13		**Figure 3** and **Figure 4** both show rocking horses.	6 marks	AO31a AO31b

	LDPE rocking horse	Pine rocking horse
Seat height	300 mm	300 mm
Construction	Hollow single piece LDPE (moulded)	Solid pine (jointed)
Mass	1.8 kg	5.2 kg
Maximum user weight	19 kg	55 kg

Compare both rocking horses.

In your answer you should refer to:

- material properties
- product safety

Level	Mark	Description
3	5–6 marks	A detailed comparison of both rocking horses referring to both material properties and product safety. A variety of points are made that are largely accurate, offering perceptive judgements relating to the design of both rocking horses.
2	3–4 marks	A good comparison of both rocking horses, referring to both material properties and product safety. Information given is mostly correct (although there may be some inaccuracies) with relevant points that make reference to the main differences between each rocking horse.
1	1–2 marks	A basic comparison of both rocking horses that is largely descriptive and makes reference to at least one of the bullet points. Responses may be narrow and superficial, lacking in detail and giving few accurate or relevant points.
	0 marks	No response worthy of credit

Indicative content:

LDPE rocking horse:

- LDPE can be rotationally moulded to make the rocking horse hollow. This will make the rocking horse lightweight and easier for a young child to move around than the pine rocking horse.
- LDPE has good chemical resistance so it will be able to be cleaned with detergents to keep the surfaces hygienic.
- LDPE is a non-toxic material so if a young child bites or chews any parts they will not be at risk of poisoning.

		• The LDPE rocking horse has sufficient compressive strength to take the weight of a young child so that it can be used correctly. However, there is a risk of the rocking horse collapsing if an adult tries to use it, which is less likely to be an issue with the pine rocking horse. • LDPE can be pigmented during manufacture to allow a wide of colours to be available. **Pine rocking horse:** • Pine is a relatively lightweight timber when compared to alternatives such as oak. However, it is not as lightweight as LDPE which could lead to minor injuries if it falls on to a young child. • Over time, the surface of the pine rocking may start to degrade and lead to the risk of splinters forming which could injure a young child using it. • The pine rocking horse is likely to have an applied finish, such as polyurethane varnish. Over time, this finish may start to flake off and risk being ingested by a young child. • The rockers are very long which means this rocking horse is less likely to topple over in use than the LDPE rocking horse. • Pine has good compressive strength and should be able to take the weight of either its intended users or adults. • Pine is fast growing softwood with a wide grain pattern. This leads to the risk of the timber snapping along the grain if used roughly which could lead to sharp edges being formed. **This list is not exhaustive.** **Accept any 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>14</td><td></td><td>State two quality control checks that would be used on a sheet of medium density fibreboard (MDF).

1 mark for each correct response.

Indicative content:
• Visual inspection to look for defects or water damage.
• Dimensional checks, such as checking that the sheet of MDF is the correct thickness.
• Weight checks can be used to check that the sheet is the correct density.
• Ultrasonic testing to ensure no internal defects within the sheet.

This list is not exhaustive.

Accept any other valid responses.</td><td>2 marks</td><td>AO4 2a</td></tr>
<tr><td>15</td><td></td><td>Explain how different research methods are used in a user-centred design process.

<table>
<tr><th>Level</th><th>Mark</th><th>Description</th></tr>
<tr><td>3</td><td>7-9 marks</td><td>A detailed description of how both primary and secondary research methods are used in a user centred design process. Points made are largely accurate, defining specific research methods that are used for explicit reasons, directly related to meeting user needs.</td></tr>
<tr><td>2</td><td>4-6 marks</td><td>A good description of how primary and secondary research methods are used in a user centred design process. Points made are mostly correct (although there may be some inaccuracies) and clearly explain how different research tasks can be undertaken to find/meet user needs.</td></tr>
<tr><td>1</td><td>1-3 marks</td><td>A basic description of some primary or secondary research methods, with little or no reference to a user centred design process. Responses may be narrow and superficial, lacking in detail and giving few accurate or relevant points.</td></tr>
<tr><td></td><td>0 marks</td><td>No response worthy of credit</td></tr>
</table>

Indicative content:
• Users can be interviewed to find out their needs or wants with regards to new products.
• Focus groups can be used that are representative of the target market. These can be used to find opinions about existing products or feedback on prototypes.
• Questionnaires can be used to find out market data such as income levels, age ranges, hobbies and interests. This data can be used to</td><td>9 marks</td><td>AO42b</td></tr>
</table>

		help identify user needs and wants which will help designers to make more informed decisions when developing products. • Anthropometric data can be taken from databases or from directly measuring volunteers in a test group. This data can be used to ensure that the products being developed are an appropriate size for a large percentage of the intended user group. • Ergonomic issues can be considered through direct observation of potential users interacting with prototypes. This allows strengths of the prototype to be identified and allows potential improvements to be considered that will make the product better suit user needs. • Immersive research, such as designers being blindfolded to simulate being blind, helps designers to better understand the issues faced by different user groups. • Sales figures for existing products can be analysed to identify popular products that are already available. This information can then be used to help design products that will be desirable in current market trends. • During the design process, user feedback regarding design ideas can be sought to ensure that the product being designed is appealing to the target market. • Existing products can be analysed to identify common features which should be desirable for the target market. This can be achieved via product disassembly or through researching existing products on the internet or in catalogues. **This list is not exhaustive.** **Accept any other valid responses.**		

16		State **four** ways that manufacturers can reduce the amount of waste material created during the manufacture of a product. 1 mark per relevant point (maximum 4 marks) **Indicative content:** • Tessellation of designs to maximise the number of parts that can be cut from a single sheet/piece of material. • Ordering material sizes that best match the size of the product being manufactured. • Recycling materials back in to the production process rather than allowing them to go to waste. • Only ordering in the amount of material required to manufacture orders that have been received. • Implementing regular quality checks on tooling to ensure parts made remain within tolerance. • Temporary fixings can be used so components can be separated and reused. **This list is not exhaustive.** **Accept any other valid responses.**	4 marks	AO4 2a

Qu	Part	Marking Guidance	Total marks	AO
17		State **four** benefits of making electrical products easier to repair. 1 mark per relevant point (maximum 4 marks) **Indicative content:** • Less electrical waste will end up in landfill as faulty electrical products will be repaired instead of thrown away. • Jobs will be created for people to repair electrical products which will increase employment opportunities. • Products will last for longer if they can be repaired and allow people to spend savings on additional products rather than replacements for unrepairable electronic devices. • Manufacturers of electrical products that can be repaired will gain a positive reputation for being proactive in making their products 'greener' for the environment as they won't need to be thrown out so often. • Finite materials required in electrical devices (such as copper or gold) will last for longer as less products may need to be produced. • If consumers can fix products at home easily, their confidence in repairs will improve allowing them to fix more items instead of needing to replace them. **This list is not exhaustive.** **Accept any other valid responses.**	4 marks	AO4 2c