



A-level DESIGN AND TECHNOLOGY: PRODUCT DESIGN 7552/1

Paper 1 Technical Principles

Mark scheme

June 2025

Version: 1.0 Final



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](https://www.aqa.org.uk)

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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	1	Identify the specific material classification of nylon. 1 mark for the correct response provided. Indicative content • Thermoplastic. • Polyamide. • Man made or synthetic fibre. • Thermoforming polymer.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
01	2	State two specific properties of nylon. 1 mark per correct response provided. Indicative content • Corrosion resistant. • Chemical resistant. • Low coefficient of friction. • Hard and resistant to abrasion. • Tough. • Flexible. • Low density. • High tensile strength. • Elastic This list is not exhaustive. Accept any other valid responses.	2 marks	AO4 1a

Qu	Part	Marking Guidance			Total marks	AO
02		Use the information in Figure 1 to calculate the length of the cutter path shown.			3 marks	AO4 1c
		Calculating the total circumference of the cutter path	$C = 2 \pi r$ $C = (2 \times \pi \times 40)$ $= [251.20, 251.33 \text{ mm}]$ or $= 80 \pi$	1 mark (M1)		
		Calculate the length of the cutter path	(their 251.33) $\div 360 \times 240$ or (their 80π) $\times (360 - 120) \div 360$ or (their 251.33) - (their 80π) $\times 120 \div 360$ or (their 251.33) - (their 80π) $\times \frac{1}{3}$ $= [167.46, 167.60 \text{ mm}]$	1 mark (M1) 1 mark (A1)		
		Calculate the length of the cutter path Where no working has been shown but final answer is accurate.	$= [167.46, 167.60 \text{ mm}]$	3 marks		

Qu	Part	Marking Guidance	Total marks	AO										
03		Explain why natural rubber is an appropriate material for the body of the hot water bottle shown in Figure 2. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response includes a detailed understanding of why natural rubber would be a suitable material for the body of the hot water bottle. Response should refer to a range of properties of rubber and be specifically related to the hot water bottle context. Not all indicative content needs to be referenced to access full marks.</td></tr><tr><td>3–4 marks</td><td>The response includes a good understanding of why natural rubber would be a suitable material for the body of the hot water bottle. Response may refer to a range of properties of natural rubber and its suitability for the hot water bottle context. There may be some irrelevant points made or a lack of clarity, but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic explanation of the material properties of natural rubber with limited reference to the hot water bottle context. At the lower end of the mark band statements will be largely generic.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content: • Natural rubber is flexible so its shape can change as it is filled with hot water. • Natural rubber is tough and can withstand extended use without becoming damaged. • Natural rubber is elastic so that it can expand without becoming damaged when filled with hot water. • Natural rubber is soft so it is comfortable to touch with your feet when used. • Natural rubber is impermeable to liquid so prevents the hot liquid leaking and causing injury. • Natural rubber is a thermal insulator which prevents the water from cooling too quickly. • The insulative property also limits the transfer of heat so although it provides warmth, it doesn't burn the user. • Natural rubber can be pigmented to match a brand identity or give consumer aesthetic choice. • Natural rubber can be easily cleaned or sanitised maintaining hygiene. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response includes a detailed understanding of why natural rubber would be a suitable material for the body of the hot water bottle. Response should refer to a range of properties of rubber and be specifically related to the hot water bottle context. Not all indicative content needs to be referenced to access full marks.	3–4 marks	The response includes a good understanding of why natural rubber would be a suitable material for the body of the hot water bottle. Response may refer to a range of properties of natural rubber and its suitability for the hot water bottle context. There may be some irrelevant points made or a lack of clarity, but this will not detract from the overall quality of the response.	1–2 marks	The response offers a basic explanation of the material properties of natural rubber with limited reference to the hot water bottle context. At the lower end of the mark band statements will be largely generic.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1c
Marks	Description													
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0 marks	No response or nothing worthy of credit.													

Qu	Part	Marking Guidance	Total marks	AO
04		State two requirements of the Sale of Goods Act (1979). 1 mark per correct response provided. Indicative content • Goods that are sold must be as described. • Goods that are sold must be fit for purpose / durable. • Goods that are sold must be of appropriate quality. • Goods that are sold must be safe. • Goods that are sold must be free from minor defects. • Goods that are sold must match any sample or product displayed. • Under the sale of goods act, a supplier must replace or repair faulty goods within a reasonable time frame. This list is not exhaustive. Accept any other valid responses.	2 marks	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO										
05		Analyse and evaluate the suitability of using moulded paper pulp for the takeaway cup holder shown in Figure 3. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response includes detailed analysis and evaluation of the suitability of the material for the context. The response evaluates how appropriate the use of the material is with reference to properties and the intended use of the product and will likely refer to both positive and negative points. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.</td></tr><tr><td>3–4 marks</td><td>The response includes good analysis and evaluation of the material used. The response provides evaluation of the properties of the material with some reference intended use of the product and may refer to both positive and negative points. There may be lack of clarity, but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response includes basic analysis and tends to be descriptive rather than evaluative and may not fully understand the intended use of the takeaway cup holder. At the lower end of the mark band statements will be largely generic.</td></tr><tr><td>0 marks</td><td>No response worthy of credit.</td></tr></table> Indicative content • Moulded paper pulp is biodegradable meaning that it will break down naturally over time once disposed of, reducing the environmental impact of the product. • Moulded paper pulp can be made from recycled paper and board and has a beige colouration. The product does not need an aesthetic finish, which makes moulded paper pulp suitable for the cup holder. • Moulded paper pulp is biodegradable, making it an appropriate material for use in a product that has a short life span and is intended to be disposed of. • The use of moulded paper pulp can help address the sustainability considerations for the food and beverage industry. • Moulded paper pulp is a thermal insulator which protects the user from burning their hands when using the product. • Moulded paper pulp has limited rigidity, meaning that the holder can often twist or bend. • Moulded paper pulp quickly loses its structural integrity when it becomes moist meaning that the holder may break.	Marks	Description	5–6 marks	The response includes detailed analysis and evaluation of the suitability of the material for the context. The response evaluates how appropriate the use of the material is with reference to properties and the intended use of the product and will likely refer to both positive and negative points. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.	3–4 marks	The response includes good analysis and evaluation of the material used. The response provides evaluation of the properties of the material with some reference intended use of the product and may refer to both positive and negative points. There may be lack of clarity, but this will not detract from the overall quality of the response.	1–2 marks	The response includes basic analysis and tends to be descriptive rather than evaluative and may not fully understand the intended use of the takeaway cup holder. At the lower end of the mark band statements will be largely generic.	0 marks	No response worthy of credit.	6 marks	AO3 2a AO3 2b
Marks	Description													
5–6 marks	The response includes detailed analysis and evaluation of the suitability of the material for the context. The response evaluates how appropriate the use of the material is with reference to properties and the intended use of the product and will likely refer to both positive and negative points. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.													
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0 marks	No response worthy of credit.													

		This list is not exhaustive. Accept any other valid responses.		
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Qu	Part	Marking Guidance			Total marks	AO												
06		Three irregular but identical hexagons fit on a piece of material as shown in Figure 4. Calculate the length (x) of material needed to fit the three hexagons. Show your working out. <table><tr><td>Establishing half the height half of the hexagon</td><td>$240 \div 2$ $= 120$</td><td>1 mark (M1)</td></tr><tr><td>Establishing a^2 using Pythagoras</td><td>$130^2 - (\text{their } 120)^2 = (\text{their } b)^2$ $= (\text{their } 16\,900) - (\text{their } 14\,400)$ $= (\text{their } 2500)$ $= \sqrt{2500}$ $= 50$</td><td>1 mark (M1) 1 mark (A1)</td></tr><tr><td>Calculating the length of material needed to accommodate the hexagons</td><td>Hex 1 : $(\text{their } 50) + 80$ + Hex 2 : $(\text{their } 50) + 80 + (\text{their } 50)$ + Hex 3 : $80 + (\text{their } 50)$ or $(50 + 80 + 50) \times 2 + 80$ $= 440 \text{ mm long}$</td><td>1 mark (A1)</td></tr><tr><td>Length of material needed to accommodate the hexagons. Where no working has been shown but final answer is accurate</td><td>$= 440 \text{ mm long}$</td><td>4 marks</td></tr></table>			Establishing half the height half of the hexagon	$240 \div 2$ $= 120$	1 mark (M1)	Establishing a^2 using Pythagoras	$130^2 - (\text{their } 120)^2 = (\text{their } b)^2$ $= (\text{their } 16\,900) - (\text{their } 14\,400)$ $= (\text{their } 2500)$ $= \sqrt{2500}$ $= 50$	1 mark (M1) 1 mark (A1)	Calculating the length of material needed to accommodate the hexagons	Hex 1 : $(\text{their } 50) + 80$ + Hex 2 : $(\text{their } 50) + 80 + (\text{their } 50)$ + Hex 3 : $80 + (\text{their } 50)$ or $(50 + 80 + 50) \times 2 + 80$ $= 440 \text{ mm long}$	1 mark (A1)	Length of material needed to accommodate the hexagons. Where no working has been shown but final answer is accurate	$= 440 \text{ mm long}$	4 marks	4 marks	AO4 1c
Establishing half the height half of the hexagon	$240 \div 2$ $= 120$	1 mark (M1)																
Establishing a^2 using Pythagoras	$130^2 - (\text{their } 120)^2 = (\text{their } b)^2$ $= (\text{their } 16\,900) - (\text{their } 14\,400)$ $= (\text{their } 2500)$ $= \sqrt{2500}$ $= 50$	1 mark (M1) 1 mark (A1)																
Calculating the length of material needed to accommodate the hexagons	Hex 1 : $(\text{their } 50) + 80$ + Hex 2 : $(\text{their } 50) + 80 + (\text{their } 50)$ + Hex 3 : $80 + (\text{their } 50)$ or $(50 + 80 + 50) \times 2 + 80$ $= 440 \text{ mm long}$	1 mark (A1)																
Length of material needed to accommodate the hexagons. Where no working has been shown but final answer is accurate	$= 440 \text{ mm long}$	4 marks																

Qu	Part	Marking Guidance	Total marks	AO										
07		Discuss the advantages and disadvantages of using contact adhesive to join a laminate to a large sheet of manufactured board. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response includes detailed advantages and disadvantages of the use of the adhesive with appropriate reference to the given context. There may be reference to the application and performance of the adhesive. There may be some minor inaccuracies made but this will not detract from the overall quality of the response.</td></tr><tr><td>3–4 marks</td><td>The response includes both advantages and disadvantages of the use of the adhesive with some reference to the given context. The response may not address both areas equally.</td></tr><tr><td>1–2 marks</td><td>The response includes basic analysis and tends to be descriptive rather than evaluative and may not reference the given context.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content Advantages • Contact adhesive is often easy to apply to large surface areas as it can be applied by spray, brush or roller. • Contact adhesive is an appropriate adhesive for joining dissimilar materials such as a polymer and manufactured board. • Contact adhesive bonds quickly reducing the need for clamping and holding a laminate in position for an extended period of time. • Contact adhesive has good resistance to moisture and exposure to heat, so would be appropriate for the surface of a table or worksurface etc. Disadvantages • Contact adhesive does not allow for repositioning so it is tricky to get large pieces of material lined up when gluing. • It is hard to ensure an even coating of adhesive over a large area which can impact the integrity of the bonded surfaces. • Contact adhesive releases harmful fumes when being applied. • Although quick to initially bond the surfaces, contact adhesive can take a long time to cure meaning that there may be a delay in subsequent manufacture. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response includes detailed advantages and disadvantages of the use of the adhesive with appropriate reference to the given context. There may be reference to the application and performance of the adhesive. There may be some minor inaccuracies made but this will not detract from the overall quality of the response.	3–4 marks	The response includes both advantages and disadvantages of the use of the adhesive with some reference to the given context. The response may not address both areas equally.	1–2 marks	The response includes basic analysis and tends to be descriptive rather than evaluative and may not reference the given context.	0 marks	No response or nothing worthy of credit.	6 marks	AO3 2a AO3 2b
Marks	Description													
5–6 marks	The response includes detailed advantages and disadvantages of the use of the adhesive with appropriate reference to the given context. There may be reference to the application and performance of the adhesive. There may be some minor inaccuracies made but this will not detract from the overall quality of the response.													
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0 marks	No response or nothing worthy of credit.													

Qu	Part	Marking Guidance	Total marks	AO										
08		Compare and evaluate the suitability of using polyurethane varnish or a wood stain as a surface finish. You should refer to specific timber products in your response. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response includes detailed analysis and evaluation, comparing the two surface finishes with reference to their suitability for appropriate timber product examples.</td></tr><tr><td>3–4 marks</td><td>The response includes good analysis and evaluation, with some comparison of the suitability of the surface finishes for a relevant timber product example.</td></tr><tr><td>1–2 marks</td><td>The response includes basic analysis and tends to be descriptive rather than evaluative and may not use relevant examples.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content Polyurethane Varnish • Provides a tough hardwearing finish that would protect the timber product from wear and tear. • Provides an impermeable layer that would prevent water and moisture damaging or marking the surface of the timber. • Provides a clear surface finish that would allow the natural aesthetic of the timber to be seen and often enhanced. • May degrade over a period of time which would mean the surface may need to be maintained and revarnished. Stain • Stains are available in a wide range of colours and shades. • Stains can be applied to enhance the aesthetic of the grain pattern in the timber. • Stains can be applied to cheaper timbers to give the aesthetic appearance of a more expensive timber. • Stains absorb into the surface of the timber, so provide limited protection to the timber product. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response includes detailed analysis and evaluation, comparing the two surface finishes with reference to their suitability for appropriate timber product examples.	3–4 marks	The response includes good analysis and evaluation, with some comparison of the suitability of the surface finishes for a relevant timber product example.	1–2 marks	The response includes basic analysis and tends to be descriptive rather than evaluative and may not use relevant examples.	0 marks	No response or nothing worthy of credit.	6 marks	AO3 2a AO3 2b
Marks	Description													
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0 marks	No response or nothing worthy of credit.													

Qu	Part	Marking Guidance	Total marks	AO									
09	1	Figure 5 shows the dimensions of a triangle and semicircle that are to be cut from a piece of softwood. Show that, to the nearest whole number, the total surface area of one triangle and one semicircle is 5313 mm² Show your working out. <table><tr><td>Calculating the area of the triangle</td><td>$a = b \times h \div 2$ $70 \times 80 \div 2$ $= 2800 \text{ mm}^2$</td><td>1 mark (A1)</td></tr><tr><td>Calculating the area of the semi-circle</td><td>$a = \pi r^2 \div 2$ $\pi \times 40 \times 40 \div 2$ $= [2512, 2513.274] \text{ mm}^2$ or $= 800 \pi$</td><td>1 mark (M1)</td></tr><tr><td>Showing that the total area is 5313 mm²</td><td>area of semicircle + area of triangle $2800 + [2512, 2513.274] \text{ mm}^2$ $= [5312, 5313.274] \text{ mm}^2$</td><td>1 mark (A1)</td></tr></table>	Calculating the area of the triangle	$a = b \times h \div 2$ $70 \times 80 \div 2$ $= 2800 \text{ mm}^2$	1 mark (A1)	Calculating the area of the semi-circle	$a = \pi r^2 \div 2$ $\pi \times 40 \times 40 \div 2$ $= [2512, 2513.274] \text{ mm}^2$ or $= 800 \pi$	1 mark (M1)	Showing that the total area is 5313 mm²	area of semicircle + area of triangle $2800 + [2512, 2513.274] \text{ mm}^2$ $= [5312, 5313.274] \text{ mm}^2$	1 mark (A1)	3 marks	AO4 1c
Calculating the area of the triangle	$a = b \times h \div 2$ $70 \times 80 \div 2$ $= 2800 \text{ mm}^2$	1 mark (A1)											
Calculating the area of the semi-circle	$a = \pi r^2 \div 2$ $\pi \times 40 \times 40 \div 2$ $= [2512, 2513.274] \text{ mm}^2$ or $= 800 \pi$	1 mark (M1)											
Showing that the total area is 5313 mm²	area of semicircle + area of triangle $2800 + [2512, 2513.274] \text{ mm}^2$ $= [5312, 5313.274] \text{ mm}^2$	1 mark (A1)											

Qu	Part	Marking Guidance			Total marks	AO
09	2	The dimensions of the softwood are 80 mm x 150 mm.			3 marks	AO4 1c
		Calculate the percentage of waste generated when the triangle and semi-circle have been cut from the piece of softwood.				
		Show your working out.				
		Calculating the percentage of material used	(their 5313) ÷ (80 x 150) x 100 = 44.275	1 mark (M1)		
		Percentage of waste material generated	100 – (their 44.275) = [55.7, 56] %	1 mark (M1) 1 mark (A1)		
		Percentage of waste material generated Where no working has been shown but final answer is accurate	= [55.7, 56] %	3 marks		
		or				
		Calculating the percentage of material used	(their 5313) ÷ (80 x 150) = 0.44275	1 mark (M1)		
		Percentage of waste material generated	(1 – their 0.44275) x 100 = [55.7, 56] %	1 mark (M1) 1 mark (A1)		
		Percentage of waste material generated Where no working has been shown but final answer is accurate	= [55.7, 56] %	3 marks		

		or		
		Calculating the percentage of material used	12000 – (their 5313) or 6687 (their 6687) ÷ (80 x 150) x 100	1 mark (M1) 1 mark (M1)
		Percentage of waste material generated	= [55.7, 56] %	1 mark (A1)
		Percentage of waste material generated Where no working has been shown but final answer is accurate	= [55.7, 56] %	3 marks

Qu	Part	Marking Guidance	Total marks	AO										
10		Figure 6 shows a children’s stool designed to represent an elephant. It is available in a timber version or a polymer version. Analyse and evaluate the suitability of the materials and manufacturing methods used for each version of the children’s stool. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>9–12 marks</td><td>The response shows a detailed analysis and evaluation of the suitability of the chosen material and manufacturing methods of each version of the stool. The response clearly evaluates how the properties of the material and the way in which they are manufactured affect the suitability of choice for the manufacture of the stools and its suitability in use.</td></tr><tr><td>5–8 marks</td><td>The response shows good evaluation and analysis of the suitability of the chosen material and manufacturing methods of each version of the stool.</td></tr><tr><td>1–4 marks</td><td>The response shows a basic evaluation of the suitability of the chosen material and manufacturing process of each the stools, but tends to be descriptive rather than evaluative. The response may not reference each stool equally.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content Birch veneer • A veneer is a thin piece of natural timber that if thin enough would be able to bend and take the form of the stool components. • The birch timber would have an attractive grain that would match the aesthetics of the elephant stool. • Birch has a good level of hardness that would help prevent scratches and abrasions to the surface of the stool components. • Birch is a timber with close grain that resists warping, so is ideal to maintain the structure of the components once laminated. Lamination • Laminating would enable the manufacturer to achieve the desired thickness of the pieces by layering an appropriate number of sheets and securing with an adhesive. • The large body and shallow radius curves on both pieces of the stool are simple shapes that would be achievable by laminating. • Laminating would produce a strong rigid one-piece structure that would support the weight of the user without bending or breaking.	Marks	Description	9–12 marks	The response shows a detailed analysis and evaluation of the suitability of the chosen material and manufacturing methods of each version of the stool. The response clearly evaluates how the properties of the material and the way in which they are manufactured affect the suitability of choice for the manufacture of the stools and its suitability in use.	5–8 marks	The response shows good evaluation and analysis of the suitability of the chosen material and manufacturing methods of each version of the stool.	1–4 marks	The response shows a basic evaluation of the suitability of the chosen material and manufacturing process of each the stools, but tends to be descriptive rather than evaluative. The response may not reference each stool equally.	0 marks	No response or nothing worthy of credit.	12 marks	AO3 2a AO3 2b
Marks	Description													
9–12 marks	The response shows a detailed analysis and evaluation of the suitability of the chosen material and manufacturing methods of each version of the stool. The response clearly evaluates how the properties of the material and the way in which they are manufactured affect the suitability of choice for the manufacture of the stools and its suitability in use.													
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1–4 marks	The response shows a basic evaluation of the suitability of the chosen material and manufacturing process of each the stools, but tends to be descriptive rather than evaluative. The response may not reference each stool equally.													
0 marks	No response or nothing worthy of credit.													

		• Laminating would allow the curves to be produced in both directions in order to achieve the desired shape of the elephants' legs and head. • The external profile of the elephant would be challenging to achieve after lamination due to the organic shape of the elephant's body. Acrylonitrile Butadiene Styrene (ABS) • ABS can easily be pigmented during manufacture in order to produce the vivid pink colouration. • ABS is a tough material that will withstand the likely impact that may occur when being sat on, played with or stored. • ABS is a fairly rigid material which will allow the stool to resist the weight of the user without bending or fracturing. • ABS has good chemical resistance so will be able to be easily cleaned to maintain its attractive appearance. • The properties of ABS are not affected by the elements, so the stool could be used outside. Polymer deformation • Thermoforming would be an appropriate method manufacture based on the simple shapes found in the stool components and the thickness of the material used. • Using a two-part mould would successfully create the shape and profile of the stool components along with any surface texture. • Thermoforming would remove a range of issues that would be associated with injection moulding such as cooling, shrinkage, and the physical size of the machine needed to mould such a large shape. • The physical size of the mould needed to successfully produce the stool components would be significant. • Is an ideal deformation process for use with thermoplastics making it appropriate for moulding the ABS components. Method of assembly • Producing the head and body separately would help simplify both the laminating and thermoforming process. • Having the head and body separate may make packaging and shipping the product more straightforward. • The mechanical fixing may need to be tightened by the user during extended periods of use. This list is not exhaustive. Accept any other valid responses.		
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Qu	Part	Marking Guidance	Total marks	AO
11		Give two reasons why photochromic lenses are used in glasses. 1 mark per correct response provided. Indicative content • The tint or darkness of the lens will adjust in response to UV light, becoming more dark in bright sunlight. • The photochromic feature will help prevent damage to the eyes of the user by blocking the UV rays. • The glasses would constantly adapt to changing light conditions removing the need for additional glasses for different conditions. • The photochromic dye is able to be successfully incorporated into curved surfaces such as the lens. This list is not exhaustive. Accept any other valid responses.	2 marks	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO																								
12		A component takes 7 minutes to machine from high density modelling foam. The same component takes 5 minutes 20 seconds to machine from StyrofoamTM. Calculate the percentage of time saved when machining from StyrofoamTM. Show your working out. <table><tr><td>Converting the time into seconds</td><td>High Density Modelling Foam = (7 x 60) = 420 seconds Styrofoam = (5 x 60 +20) = 320 seconds</td><td>1 mark (M1)</td></tr><tr><td>Calculate the % of time saved</td><td>(their 320) ÷ (their 420) x 100 = 76.19 100 – 76.19</td><td>1 mark (M1)</td></tr><tr><td>% of time saved</td><td>=[23.8, 24] %</td><td>1 mark (A1)</td></tr><tr><td>Calculate the % of time saved Where no working has been shown but final answer is accurate</td><td>=[23.8, 24] %</td><td>3 marks</td></tr></table> or <table><tr><td>Establishing time as a fraction</td><td>7 - 5 1/3 = 5/3</td><td>1 mark (M1)</td></tr><tr><td></td><td>their 5/3 ÷ 7 x 100</td><td>1 mark (M1)</td></tr><tr><td>% of time saved</td><td>=[23.8, 24] %</td><td>1 mark (A1)</td></tr><tr><td>Calculate the % of time saved Where no working has been shown but final answer is accurate</td><td>=[23.8, 24] %</td><td>3 marks</td></tr></table>	Converting the time into seconds	High Density Modelling Foam = (7 x 60) = 420 seconds Styrofoam = (5 x 60 +20) = 320 seconds	1 mark (M1)	Calculate the % of time saved	(their 320) ÷ (their 420) x 100 = 76.19 100 – 76.19	1 mark (M1)	% of time saved	=[23.8, 24] %	1 mark (A1)	Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks	Establishing time as a fraction	7 - 5 1/3 = 5/3	1 mark (M1)		their 5/3 ÷ 7 x 100	1 mark (M1)	% of time saved	=[23.8, 24] %	1 mark (A1)	Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks	3 marks	AO4 1c
Converting the time into seconds	High Density Modelling Foam = (7 x 60) = 420 seconds Styrofoam = (5 x 60 +20) = 320 seconds	1 mark (M1)																										
Calculate the % of time saved	(their 320) ÷ (their 420) x 100 = 76.19 100 – 76.19	1 mark (M1)																										
% of time saved	=[23.8, 24] %	1 mark (A1)																										
Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks																										
Establishing time as a fraction	7 - 5 1/3 = 5/3	1 mark (M1)																										
	their 5/3 ÷ 7 x 100	1 mark (M1)																										
% of time saved	=[23.8, 24] %	1 mark (A1)																										
Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks																										

		or				
		Establishing time as a fraction	5 1/3 ÷ 7 Or 0.7619	1 mark (M1)		
			(1 - their 0.7619) x 100	1 mark (M1)		
		% of time saved	=[23.8, 24] %	1 mark (A1)		
		Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks		
		or				
		Converting the time into seconds	High Density Modelling Foam = (7 x 60) = 420 seconds Styrofoam = (5 x 60 +20) = 320 seconds	1 mark (M1)		
		Calculate the % of time saved	Difference in time = 100 secs 100 ÷ 420 x 100	1 mark (M1)		
		% of time saved	=[23.8, 24] %	1 mark (A1)		
		Calculate the % of time saved Where no working has been shown but final answer is accurate	=[23.8, 24] %	3 marks		

Qu	Part	Marking Guidance	Total marks	AO										
13		Explain how a product may be designed to ensure inclusivity for a wide range of users. You should refer to specific design examples in your response. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>7–9 marks</td><td>The response demonstrates a detailed and thorough understanding of how a product may be designed to ensure inclusivity for a wide range of users. The response clearly identifies a wide range of considerations and highlights their importance in ensuring inclusivity are provided with relevant examples.</td></tr><tr><td>4–6 marks</td><td>The response demonstrates a good understanding of how a product may be designed to ensure inclusivity for a wide range of users. Several relevant considerations are explained and their importance in ensuring inclusivity is provided with relevant examples.</td></tr><tr><td>1–3 marks</td><td>The response offers a basic understanding of how a product may be designed to ensure inclusivity for a wide range of users. Statements may lack explanation and be simple statements.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content • The product should be designed to accommodate the widest audience of users possible without the need for adaption. • Designers may refer to, and use anthropometric data (5th – 95th percentile) to consider the size and shape of a product. • User centered design should be implemented to ensure the designer understands the potential users needs and preferences. • Any product should be intuitive and simple to use to allow users of different ages or technical confidence to access the product. • Any interface should use recognised conventions, symbols and ideograms. • A product may incorporate a degree of adjustability for ergonomics such as adjustable height or reach. • A product may have the ability to customise settings such as language or font size. • Any user interface could have textured surface or over-moulded grips to help identify where to hold and securely interact with a product. • Any grips should feature gentle shapes rather than specific indentations for fingers etc, in order to be comfortable to use by the biggest audience of users.	Marks	Description	7–9 marks	The response demonstrates a detailed and thorough understanding of how a product may be designed to ensure inclusivity for a wide range of users. The response clearly identifies a wide range of considerations and highlights their importance in ensuring inclusivity are provided with relevant examples.	4–6 marks	The response demonstrates a good understanding of how a product may be designed to ensure inclusivity for a wide range of users. Several relevant considerations are explained and their importance in ensuring inclusivity is provided with relevant examples.	1–3 marks	The response offers a basic understanding of how a product may be designed to ensure inclusivity for a wide range of users. Statements may lack explanation and be simple statements.	0 marks	No response or nothing worthy of credit.	9 marks	AO4 1b
Marks	Description													
7–9 marks	The response demonstrates a detailed and thorough understanding of how a product may be designed to ensure inclusivity for a wide range of users. The response clearly identifies a wide range of considerations and highlights their importance in ensuring inclusivity are provided with relevant examples.													
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1–3 marks	The response offers a basic understanding of how a product may be designed to ensure inclusivity for a wide range of users. Statements may lack explanation and be simple statements.													
0 marks	No response or nothing worthy of credit.													

		• A surface may have a texture finish to provide tactile feedback to help those with visual impairments. • Digital interfaces should be backlit to aid clarity in use. • Products should feature ambidextrous design in order to be comfortable for both left and right-handed users. • Electronic products may be designed to incorporate multiple options for user interactions, such as voice, gesture or touch. • Labels or text should be replaced by ideograms to address different users' proficiency with language. • Any adjustable mechanism or components should not require excessive force or use of fine motor skills. This list is not exhaustive. Accept any other valid responses.		
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Qu	Part	Marking Guidance	Total marks	AO																								
14		Figure 7 shows a dimensioned drawing of a length of bar. Calculate the length of the bar. Show your working out. <table><tr><td>Calculating the horizontal length of the taper</td><td>$25.4 - 10 \div 2$ $= 7.7$</td><td>1 mark (M1)</td></tr><tr><td></td><td>$\tan 70 = X \div (\text{their } 7.7)$ $X = \tan 70 \times (\text{their } 7.7)$ $X = 2.75 \times 7.7$ $= [21.15, 21.20]$</td><td>1 mark (M1) 1 mark (A1)</td></tr><tr><td>Calculating the total length of the bar</td><td>$20 + [21.15, 21.20]$ $= [41.15, 41.20]$</td><td>1 mark (A1)</td></tr><tr><td>Calculating the total length of the bar Where no working has been shown but final answer is accurate</td><td>$= [41.15, 41.20]$</td><td>4 marks</td></tr></table> or <table><tr><td>Calculating the horizontal length of the taper</td><td>$25.4 - 10 \div 2$ $= 7.7$</td><td>1 mark (M1)</td></tr><tr><td></td><td>$\tan 20 = (\text{their } 7.7) \div X$ $X = (\text{their } 7.7) \div \tan 20$ $X = 7.7 \div \tan 20$ $= [21.15, 21.20]$</td><td>1 mark (M1) 1 mark (A1)</td></tr><tr><td>Calculating the total length of the bar</td><td>$20 + [21.15, 21.20]$ $= [41.15, 41.20]$</td><td>1 mark (A1)</td></tr><tr><td>Calculating the total length of the bar Where no working has been shown but final answer is accurate</td><td>$= [41.15, 41.20]$</td><td>4 marks</td></tr></table>	Calculating the horizontal length of the taper	$25.4 - 10 \div 2$ $= 7.7$	1 mark (M1)		$\tan 70 = X \div (\text{their } 7.7)$ $X = \tan 70 \times (\text{their } 7.7)$ $X = 2.75 \times 7.7$ $= [21.15, 21.20]$	1 mark (M1) 1 mark (A1)	Calculating the total length of the bar	$20 + [21.15, 21.20]$ $= [41.15, 41.20]$	1 mark (A1)	Calculating the total length of the bar Where no working has been shown but final answer is accurate	$= [41.15, 41.20]$	4 marks	Calculating the horizontal length of the taper	$25.4 - 10 \div 2$ $= 7.7$	1 mark (M1)		$\tan 20 = (\text{their } 7.7) \div X$ $X = (\text{their } 7.7) \div \tan 20$ $X = 7.7 \div \tan 20$ $= [21.15, 21.20]$	1 mark (M1) 1 mark (A1)	Calculating the total length of the bar	$20 + [21.15, 21.20]$ $= [41.15, 41.20]$	1 mark (A1)	Calculating the total length of the bar Where no working has been shown but final answer is accurate	$= [41.15, 41.20]$	4 marks	4 marks	AO4 1c
Calculating the horizontal length of the taper	$25.4 - 10 \div 2$ $= 7.7$	1 mark (M1)																										
	$\tan 70 = X \div (\text{their } 7.7)$ $X = \tan 70 \times (\text{their } 7.7)$ $X = 2.75 \times 7.7$ $= [21.15, 21.20]$	1 mark (M1) 1 mark (A1)																										
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Calculating the total length of the bar Where no working has been shown but final answer is accurate	$= [41.15, 41.20]$	4 marks																										

	or		
	Calculating the horizontal length of the taper	$25.4 - 10 \div 2$ $= 7.7$	1 mark (M1)
	Where the candidate has used pythagoras	$Y = (\text{their } 7.7) \div \sin 20$ $= 22.513$ $22.513^2 - (\text{their } 7.7)^2$ $= 447.545$ $= \sqrt{447.545}$ $= 21.15$	1 mark (M1) 1 mark (A1)
	Calculating the total length of the bar	$20 + 21.15$ $= [41.15, 41.20]$	1 mark (A1)
	Calculating the total length of the bar Where no working has been shown but final answer is accurate	$= [41.15, 41.20]$	4 marks

Qu	Part	Marking Guidance	Total marks	AO										
15		Outline the factors that a manufacturer needs to consider before choosing a surface finish for a product. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response shows a detailed understanding of a wide range of factors that a manufacturer needs to consider before choosing a surface finish for a product. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of some of the factors that a manufacturer needs to consider before choosing a surface finish for a product. The response may not address all IC but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic understanding of choosing a surface finish.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content Application The manufacturer would need to consider how the specific surface would be applied. This could be determined by the physical size of the product, the material, or specific surface finish needed. Performance The manufacturer would need to consider if there are any specific performance criteria that the finish needs to provide. This may be a need for the finish to protect the base material from corrosion, adapt to an external stimulus such as a smart material, insulate the material etc. Durability The manufacturer would need to consider how durable the surface finish would need to be. This may include, resistance to wear and tear or abrasion and intended lifespan. Aesthetics The manufacturer would need to consider the desired aesthetics of the finish. This could include colour or texture. Maintenance The manufacturer would need to consider whether the surface finish is likely to need any ongoing maintenance. This may include the ability to be cleaned or possible reapplication after a period of time which may also have a cost implication.	Marks	Description	5–6 marks	The response shows a detailed understanding of a wide range of factors that a manufacturer needs to consider before choosing a surface finish for a product. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.	3–4 marks	The response demonstrates a good understanding of some of the factors that a manufacturer needs to consider before choosing a surface finish for a product. The response may not address all IC but this will not detract from the overall quality of the response.	1–2 marks	The response offers a basic understanding of choosing a surface finish.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1b
Marks	Description													
5–6 marks	The response shows a detailed understanding of a wide range of factors that a manufacturer needs to consider before choosing a surface finish for a product. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.													
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1–2 marks	The response offers a basic understanding of choosing a surface finish.													
0 marks	No response or nothing worthy of credit.													

		Level of production The manufacturer would need to consider the level of production as smaller production volumes may be able to use more manual methods of application, where mass produced products may need a more automated method of application and this may have an impact on the cost. This list is not exhaustive. Accept any other valid responses.	6 marks	AO4 1b
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Qu	Part	Marking Guidance	Total marks	AO										
16		Explain why manufacturer's instructions for electronic products are now commonly found online rather than included in the product's packaging. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response shows a detailed and thorough understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. The response identifies and explains several benefits to the manufacturer, consumer, or both. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. The response identifies some benefits to the manufacturer, consumer, or both. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. At the lower end of the mark band statements will be largely generic.</td></tr><tr><td>0 marks</td><td>No response worthy of credit.</td></tr></table> Indicative content • It reduces the need to print instruction booklets in numerous languages, reducing the size of packaging and ultimately reducing the waste generated and has a cost saving for the manufacturer. • It enables the consumer to always have access to the instructions or servicing information at a later stage or when needed. • It allows the manufacturer to update the instructions immediately if needed throughout the lifespan of the product. • It would allow the consumer to download and print the instructions if necessary. • The instructions could be enlarged or be available in larger font size if digital. • The instructions could be searched online to allow consumers to find a specific detail quickly. • May have ongoing links to product recalls or specific safety information. • It may enable manufacturers to link videos or 'how to' guides to specific areas of the instructions.	Marks	Description	5–6 marks	The response shows a detailed and thorough understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. The response identifies and explains several benefits to the manufacturer, consumer, or both. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.	3–4 marks	The response demonstrates a good understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. The response identifies some benefits to the manufacturer, consumer, or both. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.	1–2 marks	The response offers a basic understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. At the lower end of the mark band statements will be largely generic.	0 marks	No response worthy of credit.	6 marks	AO4 1b
Marks	Description													
5–6 marks	The response shows a detailed and thorough understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. The response identifies and explains several benefits to the manufacturer, consumer, or both. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.													
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1–2 marks	The response offers a basic understanding of why manufacturer's instructions for electronic products are becoming commonly found online rather than included in the product's packaging. At the lower end of the mark band statements will be largely generic.													
0 marks	No response worthy of credit.													

		The product may include QR codes to easily direct consumers to the relevant page. This list is not exhaustive. Accept any other valid responses.		
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Qu	Part	Marking Guidance	Total marks	AO
17		State two ways that a UV stabiliser prolongs the life of a polymer. 1 mark per correct response provided. Indicative content - They can prevent the polymer from fading. - They can prevent the polymer from becoming brittle. - They can reduce the rate at which the polymer degrades. - They can prevent the polymer from losing flexibility. This list is not exhaustive. Accept any other valid responses.	2 marks	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
18		Give three reasons why sub-assemblies are used when manufacturing a complex product. 1 mark per correct response provided. Indicative content - Completed sub-assemblies can be bought from specialist manufacturers. - The assurance that the sub-assemblies will have been produced to a specific quality or standard. - It would be more cost-effective than manufacturing it themselves. - There would be no need for a manufacturer to have specialist machinery if the sub-assembly is bought in. - The reassurance that the assembly will integrate with other components. - It may allow a manufacturer to concentrate more on their core activity. - It allows for numerous manufacturing activities to take place simultaneously, reducing the overall time taken for manufacture. This list is not exhaustive. Accept any other valid responses.	3 marks	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO										
19		Explain why flexographic printing is a suitable method for applying a company logo to a Low Density Polyethylene (LDPE) carrier bag. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response demonstrates a detailed and thorough understanding of why flexographic printing is a suitable method for applying a company logo to an LDPE carrier bag. The response clearly links the benefits of the process to the carrier bag context.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of why flexographic printing is a suitable method for applying a company logo with some reference to the carrier bag context.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic explanation of flexographic printing with limited reference to the carrier bag context.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content • Flexographic inks are often quick drying which makes the process ideal for high-volume print runs as found with a product with a high level of demand. • LDPE carrier bags have a smooth surface which makes it an ideal substrate for flexographic printing. • The surface of LDPE is non-porous, so the ink substrate will adhere to the polymer surface successfully and not smudge. • Flexographic ink is designed to adhere to a flexible surface such as the carrier bag without cracking. • Flexographic printing is a cost-effective method for high-volume and high-speed production. • LDPE can be supplied in a large roll suitable for the flexographic printing process. • Flexographic printing can incorporate a range of colours within the printing process to allow for detailed designs or to match a company's branding. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response demonstrates a detailed and thorough understanding of why flexographic printing is a suitable method for applying a company logo to an LDPE carrier bag. The response clearly links the benefits of the process to the carrier bag context.	3–4 marks	The response demonstrates a good understanding of why flexographic printing is a suitable method for applying a company logo with some reference to the carrier bag context.	1–2 marks	The response offers a basic explanation of flexographic printing with limited reference to the carrier bag context.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1c
Marks	Description													
5–6 marks	The response demonstrates a detailed and thorough understanding of why flexographic printing is a suitable method for applying a company logo to an LDPE carrier bag. The response clearly links the benefits of the process to the carrier bag context.													
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1–2 marks	The response offers a basic explanation of flexographic printing with limited reference to the carrier bag context.													
0 marks	No response or nothing worthy of credit.													

Qu	Part	Marking Guidance	Total marks	AO
20		Define the term ‘translucency’. Indicative content • The ability of a material to let light pass through it, but where the light is diffused by the material. One mark for a correct definition that covers both elements of the definition. Accept any other valid responses.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO										
21		Explain how computer systems have assisted designers' ability to develop products collaboratively. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response demonstrates a detailed and thorough understanding of how computer systems have assisted designers' ability to develop products collaboratively. The response clearly identifies a wide range of benefits and highlights how their use impacts collaborative working methods.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of how computer systems have assisted designers' ability to develop products collaboratively. Several relevant points are explained and their impact provided.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic understanding of how computer systems have assisted designers' ability to develop products collaboratively. Responses tend to be descriptive in nature.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content • Computer systems allow for simultaneous real time access to files which allows designers to work together on a specific task or design. • The move to have files and data stored in the cloud, allow for shared access at any time. • Programmes such as Zoom or teams etc allow for video conferencing, bringing together designers and teams in to one virtual space. • Developments in the speed of information transfer such as fibre networking have increased the reliability and speed of communication. • Designers are able to join each other in virtual reality environments to interact with 3d models and designs. • Computer systems provide the facility to revisit earlier versions of designs to enable changes and iterations to be tracked and ensure that all designs are working on the latest iteration. • Computer systems have enabled international design teams to work together more easily, removing geographic constraints. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response demonstrates a detailed and thorough understanding of how computer systems have assisted designers' ability to develop products collaboratively. The response clearly identifies a wide range of benefits and highlights how their use impacts collaborative working methods.	3–4 marks	The response demonstrates a good understanding of how computer systems have assisted designers' ability to develop products collaboratively. Several relevant points are explained and their impact provided.	1–2 marks	The response offers a basic understanding of how computer systems have assisted designers' ability to develop products collaboratively. Responses tend to be descriptive in nature.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1b
Marks	Description													
5–6 marks	The response demonstrates a detailed and thorough understanding of how computer systems have assisted designers' ability to develop products collaboratively. The response clearly identifies a wide range of benefits and highlights how their use impacts collaborative working methods.													
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0 marks	No response or nothing worthy of credit.													

Qu	Part	Marking Guidance	Total marks	AO										
22		Explain why injection moulding is an appropriate manufacturing method for the construction bricks shown in Figure 8. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response demonstrates a detailed understanding of why injection moulding is used in the manufacture of the construction bricks. The response will refer to the manufacturing considerations, the aesthetic considerations of the product and the functional aspects of the construction bricks.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of why injection moulding is used in the manufacture of the construction bricks. The response may refer to some factors including manufacturing considerations, aesthetic considerations or the functional aspects of the construction bricks.</td></tr><tr><td>1–2 marks</td><td>The response demonstrates limited understanding of why injection moulding is used for the application. Responses tend to be generic points relating to injection moulding.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content: • Pigment can be added to the polymer before injection moulding to produce a wide range of coloured bricks. • There is a large market for the product which justifies the large setup costs involved in producing the injection moulding tool. • Injection moulding produces a product accurately with consistency so that every bricks dimensions are the same, allowing for reliable construction. • Injection moulding allows for the intricate detailed design of the brick to be produced. • Accurate tolerances can be achieved to allow the bricks to click together securely. • Details such as the logo on the top of each stud can be incorporated into the tool. This list is not exhaustive. Accept any other valid responses.	Marks	Description	5–6 marks	The response demonstrates a detailed understanding of why injection moulding is used in the manufacture of the construction bricks. The response will refer to the manufacturing considerations, the aesthetic considerations of the product and the functional aspects of the construction bricks.	3–4 marks	The response demonstrates a good understanding of why injection moulding is used in the manufacture of the construction bricks. The response may refer to some factors including manufacturing considerations, aesthetic considerations or the functional aspects of the construction bricks.	1–2 marks	The response demonstrates limited understanding of why injection moulding is used for the application. Responses tend to be generic points relating to injection moulding.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1c
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Qu	Part	Marking Guidance	Total marks	AO										
23		Explain how the implementation of Control of Substances Hazardous to Health (COSHH) regulations can protect workers from exposure to hazardous substances in a manufacturing environment. You should refer to hazards and control measures in your response. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response shows a detailed and thorough understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. The response identifies and explains several actions that may take place and the relevant control measures or actions taken. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.</td></tr><tr><td>3–4 marks</td><td>The response demonstrates a good understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. The response describes some of the actions that may take place and the relevant control measures or actions taken. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response offers a basic understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. At the lower end of the mark band statements will be largely generic points, possibly just stating a control measure or hazard.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content COSHH regulations protect workers from exposure to hazardous substances by: - ensuring that the employer has identified what the health hazards are - ensuring that the employer has undertaken a risk assessment to decide how to prevent harm to health - ensuring that the employer is providing control measures to reduce harm to health - ensuring that all control measures and risk assessment are actually being used - ensuring that all control measures in good working order - ensuring that employers are providing information, instruction and training for employees and others	Marks	Description	5–6 marks	The response shows a detailed and thorough understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. The response identifies and explains several actions that may take place and the relevant control measures or actions taken. There may be some minor irrelevant points made but this will not detract from the overall quality of the response.	3–4 marks	The response demonstrates a good understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. The response describes some of the actions that may take place and the relevant control measures or actions taken. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.	1–2 marks	The response offers a basic understanding of how the implementation of COSHH regulations can protect workers in a manufacturing environment. At the lower end of the mark band statements will be largely generic points, possibly just stating a control measure or hazard.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1b
Marks	Description													
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0 marks	No response or nothing worthy of credit.													

		• ensuring that employers are providing monitoring and health surveillance in appropriate cases • ensuring that employers have plans for emergencies. This list is not exhaustive. Accept any other valid responses.		
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Qu	Part	Marking Guidance	Total marks	AO										
24		Describe the process of manufacturing an aluminium component using sand casting in a school workshop environment. You should refer to the preparation of the mould and the casting process in your response. <table><tr><th>Marks</th><th>Description</th></tr><tr><td>5–6 marks</td><td>The response shows a detailed knowledge of the sand casting process with a clear understanding of both the preparation of the mould and casting process. The response covers in detail the required stages in a logical sequence to produce a successful sand cast component. Not all information needs to be covered in equal detail to access the top mark band.</td></tr><tr><td>3–4 marks</td><td>The response shows a good level of knowledge of the sand casting process. The response describes most of the main stages of the process which if followed would achieve a successful sand cast component. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.</td></tr><tr><td>1–2 marks</td><td>The response shows basic understanding of the sand casting process.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table> Indicative content Preparation of the mould • A pattern would be produced that represents the final component, and then placed inside the drag. • The pattern is then covered in casting sand and compacted until the drag is full and then the sand is levelled. (Parting powered may be used to help removal of the pattern and separation of the cope and drag later in the process.) • The drag is turned upside down and a second metal frame known as a ‘cope’ is located on top of the drag. The second half of the pattern is added. • Runners and risers are added and the cope then filled with sand and compacted. • The cope and drag separated and the pattern removed leaving a cavity in the shape of the desired component. • The cope and drag are re connected and placed near the crucible.	Marks	Description	5–6 marks	The response shows a detailed knowledge of the sand casting process with a clear understanding of both the preparation of the mould and casting process. The response covers in detail the required stages in a logical sequence to produce a successful sand cast component. Not all information needs to be covered in equal detail to access the top mark band.	3–4 marks	The response shows a good level of knowledge of the sand casting process. The response describes most of the main stages of the process which if followed would achieve a successful sand cast component. There may be some irrelevant points made or a lack of clarity but this will not detract from the overall quality of the response.	1–2 marks	The response shows basic understanding of the sand casting process.	0 marks	No response or nothing worthy of credit.	6 marks	AO4 1a
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1–2 marks	The response shows basic understanding of the sand casting process.													
0 marks	No response or nothing worthy of credit.													

		Moulding the component • The user must be wearing appropriate, specific PPE for casting, including heat proof apron, leg covering, gauntlets and full face shield. • The crucible is loaded with a sufficient amount of aluminium for the intended component and heated. • When molten, the crucible is turned off and any impurities removed from the top of the molten aluminium. • The molten aluminium is then poured into the sand mould through the runner until the aluminium can be seen at the top of the riser. • The mould is allowed to cool before the casting is removed and excess material removed with a hacksaw. This list is not exhaustive. Accept any other valid responses.		
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