

AS Level  
DESIGN AND TECHNOLOGY (PRODUCT  
DESIGN)  
755W/1

PAPER 1

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Mark scheme

Specimen Papers

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v1.0

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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 Assessment Writer.

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](http://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.

Qu	Part	Marking guidance	Total marks	AO
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**Section A**

1		Low Density Polyethylene (LDPE) food wrap film	1 mark	AO41B
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2				5 marks	AO41C	
		Volume of cylinder	$\pi r^2 h$ $3.142 \times 4.8^2 \times 2.8$ <b>202.670 (3sf)</b>			1 mark
		Volume of hemisphere	$\frac{2}{3}\pi r^3$ $\frac{2}{3} \times 3.142 \times 4.8^3$ <b>231.623(3sf)</b>			2 marks
		Total volume	$202.670 + 231.623$ <b>= 434.35cm<sup>3</sup></b>			1 mark
		Mass = Density x Volume	Mass = 7.29 X 434.35 <b>Mass =</b> 3166.412g(3sf) <b>3166g</b>			1 mark

3				1 mark	AO41C
		Number of paper weights that can be made	10kg = 10000g $10000 / 3166.412 =$ 3.145(3sf) <b>3 paper weights</b>		

<b>4</b>			<b>6</b> marks AO32A: 3 marks AO32B: 3 marks	AO3								
		<table border="1"> <tr> <td style="text-align: center;">5 – 6 marks</td> <td>Full and comprehensive analysis of a wide range of environmental issues associated with the use of polymers such as PVC. Responses should make reference to polymers other than PVC and evaluate both negative and positive impacts upon the environment</td> </tr> <tr> <td style="text-align: center;">3 – 4 marks</td> <td>Some analysis of the different environmental issues associated with the use of polymers. May only evaluate negative impacts and will not reference other polymers.</td> </tr> <tr> <td style="text-align: center;">1 – 2 marks</td> <td>Limited analysis and evaluation of how polymers have an impact upon the environment with a number of generalisations rather than specific references to either PVC or other polymers.</td> </tr> <tr> <td style="text-align: center;">0 marks</td> <td>No response worthy of credit</td> </tr> </table>	5 – 6 marks	Full and comprehensive analysis of a wide range of environmental issues associated with the use of polymers such as PVC. Responses should make reference to polymers other than PVC and evaluate both negative and positive impacts upon the environment	3 – 4 marks	Some analysis of the different environmental issues associated with the use of polymers. May only evaluate negative impacts and will not reference other polymers.	1 – 2 marks	Limited analysis and evaluation of how polymers have an impact upon the environment with a number of generalisations rather than specific references to either PVC or other polymers.	0 marks	No response worthy of credit		
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		<p><b>Indicative content:</b></p> <p>May include positive and negative environmental issues such as:</p> <p>Positive environmental issues</p> <ul style="list-style-type: none"> <li>• PVC is a thermoplastic and can be recycled at the end of its life, thus not using a finite resource.</li> <li>• Thermoplastics have a long shelf life which means the product will not have to be re-manufactured frequently, preserving finite resources.</li> <li>• The use of thermoplastics may benefit manufacturers who need to meet eco legislation for manufacturing and/or companies using/selling the final product.</li> </ul> <p>Negative environmental issues</p> <ul style="list-style-type: none"> <li>• PVC comes from Crude oil which is a non-renewable resource, once it is gone it cannot be replaced.</li> <li>• Crude oil extraction can cause damage to sea beds and marine habitats.</li> <li>• Crude oil can be spilled which can kill marine life.</li> <li>• Crude oil spillage is a bio-hazard.</li> <li>• Crude oil production includes use of a flame stack on the oil rig, this may release harmful greenhouse gases.</li> <li>• If in landfill it will not degrade for 100+years causing an eyesore and/or harm to wildlife/plantlife</li> </ul> <ul style="list-style-type: none"> <li>• Accept any other valid response</li> </ul>										

<p><b>5</b></p>	<p>1 mark for reference to physical properties 1 mark for reference to response to a specific external input or change in the environment such as temperature, light or pressure.</p> <p>Indicative content: A material that changes its physical properties in response to an input.</p>	<p>2 marks <b>AO41A</b></p>	
<p><b>6</b></p>	<p>1 mark for smart material 1 mark for relevant energy saving product made from the stated smart material</p> <p>Indicative content:</p> <ul style="list-style-type: none"> <li>• Phosphorescent material: Used in emergency lighting to remove the need for a power source</li> <li>• Thermochromic pigment: Used in kettles to indicate when water is still hot, removing the need to re-boil which saves energy</li> <li>• Shape Memory Alloys (SMA): Used in devices such as greenhouse window openers to respond to temperature changes, removing the need for power source</li> <li>• Accept any other valid responses</li> </ul>	<p>2 marks <b>AO41A</b></p>	
<p><b>7</b></p>	<p>1 mark description of the specific smart properties 1 mark explanation of how this saves energy.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> <li>• Thermoforming materials change colour in response to temperature change (1 mark) this indicates the kettle is still hot, removing the need to re-boil which saves energy (2 marks).</li> <li>• Accept any other valid responses</li> </ul>	<p>2 marks <b>AO41A</b></p>	

<b>8</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Marks</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">6-8 marks</td> <td>Full explanation of testing process including test set up, explanation of how the test is carried out, control measures and how results are compared in order to select a suitable wood.</td> </tr> <tr> <td style="text-align: center;">3-5 marks</td> <td>Answer contains some correct points but is not well developed. There may be some descriptive comments about the test rather than explanation as to how samples are tested and results analysed.</td> </tr> <tr> <td style="text-align: center;">1-2 marks</td> <td>Basic answer with few correct points describing the testing process. Test chosen may not be explained regarding the set up. Little reference to how the test is carried out or how results would be analysed.</td> </tr> <tr> <td style="text-align: center;">0 marks</td> <td>Nothing worthy of credit</td> </tr> </tbody> </table> <p>Indicative content:</p> <p>Wood samples of the same size and thickness are collected e.g. pine, beech, ash.          The centre of each material sample is marked out.          A dot punch is placed in the centre of the material sample on the surface of the material.          The dot punch is hit once with force. The same force must be used for each material sample. The dot punch will make an indent into the surface of the wood.          A scratch test could be carried out by scratching the surface of the wood in a controlled, repeated manner.          The smaller the indent, the harder the material. The hardest material will be the most suitable for the child's toy as the toy needs to resist surface indentation from playing or if the child bites the toy.          Control measure must be used within the test to ensure accuracy of results:</p> <ul style="list-style-type: none"> <li>• The test must take place on a flat, firm surface</li> <li>• The surface of the material being tested needs to be smooth</li> <li>• Wood samples need to be at the same temperature</li> <li>• Accept any other valid response</li> </ul>	Marks	Description	6-8 marks	Full explanation of testing process including test set up, explanation of how the test is carried out, control measures and how results are compared in order to select a suitable wood.	3-5 marks	Answer contains some correct points but is not well developed. There may be some descriptive comments about the test rather than explanation as to how samples are tested and results analysed.	1-2 marks	Basic answer with few correct points describing the testing process. Test chosen may not be explained regarding the set up. Little reference to how the test is carried out or how results would be analysed.	0 marks	Nothing worthy of credit	<b>8 marks AO41B</b>
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6  
marks  
**AO41C**



<b>10</b>	5-6	The response demonstrates excellent analysis and compares the two materials in detail with reference to characteristics such as: physical and mechanical properties of the materials, working characteristics, manufacturing methods. The response provides detailed evaluation of the suitability of each in the context of office desk furniture and draws a justified conclusion.	<b>6 marks:</b> (3 marks AO32A 3 marks AO32B)
	3-4	The response demonstrates good analysis and makes some comparison between the two materials with reference to characteristics such as: physical and mechanical properties, working characteristics, manufacturing method. The response draws upon this analysis to evaluate the suitability of each material in the context of office desk furniture and draws a conclusion.	
	1-2	Response provides a basic comparison of the two materials with reference to their characteristics. The response is descriptive rather than evaluative and a conclusion may not be drawn.	
	0	Nothing worthy of credit	
	<ul style="list-style-type: none"> <li>• One sheet needed for MDF, therefore no joining methods are needed for the main shape</li> <li>• MDF gives a flat surface with no risk of warping due to the lack of grain structure</li> <li>• The MDF surface can be CNC processed easily</li> <li>• The MDF lacks ability to take screw fittings due to lack of grain structure</li> <li>• The edging strip is prone to peeling and chipping requiring removal and new application</li> <li>• The oak requires many joints and high labour costs to assemble</li> <li>• The oak can be sanded down if scratched</li> <li>• The MDF veneer grain runs in one direction which looks strange in a corner table</li> <li>• Fewer manufacturing stages when using manufactured board</li> <li>• Manufactured board is flat and stable, solid oak is not</li> <li>• Veneer is less likely to splinter</li> <li>• Veneer can be chipped or damaged whereas the solid timber is harder</li> <li>• Office furniture is likely to be changed every 5-10 years.</li> </ul>		

		<p>Cost of solid oak not justifiable</p> <ul style="list-style-type: none"> <li>• The 'L' shape of the table is easier to cut from oak v MDF due to the large sheet area</li> <li>• The veneer edge could be chipped</li> <li>• No grain issues</li> <li>• Solid oak requires more manufacture processes eg biscuit jointing</li> <li>• The solid oak table has greater longevity as it will withstand knocks and indents without surface damage</li> <li>• Solid oak would be more stable</li> <li>• One sheet needed for MDF, therefore no joining methods are needed for the main shape</li> <li>• MDF gives a flat surface with no risk of warping due to the lack of grain structure</li> <li>• The MDF surface can be CNC processed easily</li> <li>• The MDF lacks ability to take screw fittings due to lack of grain structure</li> <li>• The edging strip is prone to peeling and chipping requiring removal and new application</li> <li>• The oak requires many joints and high labour costs to assemble</li> <li>• The oak can be sanded down if scratched</li> <li>• The MDF veneer grain runs in one direction which looks strange on a corner table</li> <li>• Accept any other valid response</li> </ul>		
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	Indicative content:											
	Appropriate finishes: Powder coating, Dip coating, Cellulose spray paint											

	<p>Powder coating:</p> <ul style="list-style-type: none"> <li>• A uniform surface is achieved due to the electrostatic powder application</li> <li>• The surface finish is a hardwearing finish</li> <li>• There is minimum waste paint produced through the powder coating</li> <li>• The process does not use solvents, minimising the environmental impact</li> <li>• The process is suitable for large scale production</li> <li>• A wider variety of colours are available</li> </ul> <p>Dip coating:</p> <ul style="list-style-type: none"> <li>• Uniform surface is achieved through the dipping process</li> <li>• A wide variety of colours are available</li> </ul> <p>Cellulose spray paint:</p> <ul style="list-style-type: none"> <li>• A wide variety of colours are available</li> <li>• Low investment required into tooling and set up</li> <li>• Accept any other valid response</li> </ul>		
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<b>12</b>	<table border="1" data-bbox="295 1182 1214 1816"> <tr> <td data-bbox="295 1182 461 1480">5-6 marks</td> <td data-bbox="461 1182 1214 1480">The response demonstrates excellent analysis and relates to features of the craft knife design such as materials used, multiple components and manufacturing method to environmental impact. The response provides detailed evaluation of how these might impact on the disposal of the craft knife and the likely environmental impact at the end of its life.</td> </tr> <tr> <td data-bbox="295 1480 461 1666">3-4 marks</td> <td data-bbox="461 1480 1214 1666">The response refers to disassembly or use of multiple materials and provides some evaluation of how these might impact the disposal of the craft knife and the likely environmental impact at the end of its life.</td> </tr> <tr> <td data-bbox="295 1666 461 1778">1-2 marks</td> <td data-bbox="461 1666 1214 1778">The response refers to recycling of metals and elastomers. The response is descriptive rather than evaluative.</td> </tr> <tr> <td data-bbox="295 1778 461 1816">0 marks</td> <td data-bbox="461 1778 1214 1816">No answer worthy of credit</td> </tr> </table> <p><b>Indicative content</b></p> <ul style="list-style-type: none"> <li>• All components can be separated/disassembled for ease of recycling. Can be sorted for material specific recycling. Not going to landfill – environmental impact.</li> </ul>	5-6 marks	The response demonstrates excellent analysis and relates to features of the craft knife design such as materials used, multiple components and manufacturing method to environmental impact. The response provides detailed evaluation of how these might impact on the disposal of the craft knife and the likely environmental impact at the end of its life.	3-4 marks	The response refers to disassembly or use of multiple materials and provides some evaluation of how these might impact the disposal of the craft knife and the likely environmental impact at the end of its life.	1-2 marks	The response refers to recycling of metals and elastomers. The response is descriptive rather than evaluative.	0 marks	No answer worthy of credit	<b>6 marks</b> (3 marks AO31A; 3 marks AO31B)	
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		<ul style="list-style-type: none"><li>• Avoid unwanted byproducts from raw material extraction and material production</li><li>• The elastomer has been attached with an adhesive making separation harder.</li><li>• Removal of adhesive with heat may produce greenhouse gases</li><li>• The screw connection needs to be undone during disassembly</li><li>• The die casting needs heating to at least 400 degrees to melt</li><li>• The use of a TPE overmould means the elastomer can be melted and reused</li><li>• Accept any other valid response</li></ul>		
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<b>13</b>	<b>5-6 marks</b>	<p>The response demonstrates excellent analysis and relates features of the craft knife design related to aspects such as disassembly and the use of multiple components.</p> <p>The response provides detailed evaluation of how these features link to maintenance and might impact positively or negatively upon the maintenance of the craft knife.</p>	<b>6 marks</b> (3 marks AO31A, 3 marks AO31B)
	<b>3-4 marks</b>	<p>The response refers to disassembly or use of multiple components and provides some evaluation of how these might impact the disassembly of the craft knife and the impact upon maintenance.</p>	
	<b>1-2 marks</b>	<p>The response refers to features of the craft knife design. The response is descriptive rather than evaluative.</p>	
	<b>0 marks</b>	<p>No answer worthy of credit</p>	
	<p><b>Indicative content:</b></p> <ul style="list-style-type: none"> <li>• Use of a standardised blade</li> <li>• In-built storage for square blades</li> <li>• Limited/minimum parts used for ease of assembly/disassembly</li> <li>• Simple tools required for assembly/disassembly</li> <li>• Screw can be tightened/untightened using crosshead or flathead screwdriver</li> <li>• Blades have standard ‘lugs’ for attachment</li> <li>• Disassembly is clearly indicated and requires no instructions</li> <li>• Accept any other valid response</li> </ul>		

<b>14</b>	<b>8 marks</b> (4 marks AO31A, 4 marks AO31B)										
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1-2 marks	Basic answer identifying 1 or 2 features of the designs. There is little reference to design movements and/or principles. Answer will be largely descriptive rather than evaluative.										
0 marks	Nothing worthy of credit										
<p>Indicative content:</p> <p>Figure 4 Modernist</p> <ul style="list-style-type: none"> <li>• Form follows function, the product is clearly identifiable as a chair due to the seating area, back rest and arm rests.</li> <li>• Everyday objects for everyday people, the materials used, stainless steel tubing and rattan seat covering are inexpensive thus the product is affordable for most people.</li> <li>• Products for a machine age, the manufacture process involves simple pipe bending which is a standard tool, the seat parts would be simply attached with screws through drilled holes on a pillar drill which is a standard piece of tooling. Both can easily be set up for batch production.</li> <li>• Geometrically pure forms, the seat and back rest are both square shapes. The seat when viewed from the side, front and top is made up of a series of square shapes. Regular curves or arcs of a circle are used in the frame and arm rests.</li> </ul> <p>Figure 5 Post-Modernist</p> <ul style="list-style-type: none"> <li>• Aesthetics over function, on first glance it is unclear if this is a seat or a piece of art. The way the back tubing curves towards the front make the product look unstable. The arm rests look like decorative spheres and it does not look as though the arm could rest very comfortably as only the elbow would be supported.</li> <li>• Designs influenced by fashion and media, the chair has a</li> </ul>											

		<p>futuristic or pop art theme.</p> <ul style="list-style-type: none"><li>• Geometric shapes, the chair uses circles in the seat, backrest, arm rests and the loop of low carbon steel back to front support.</li><li>• Accept any other valid response</li></ul>		
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<b>15</b>	<b>6-7 marks</b>	The response shows excellent understanding and detailed knowledge of how touchscreens have increased the inclusivity of mobile phone design with reference to several design features and how these are an improvement.	<b>7 marks</b> AO42B
	<b>4-5 marks</b>	The response shows good understanding and knowledge of how touchscreens have increased the inclusivity of mobile phone design with reference to 2-3 design features and a good explanation of how these are an improvement.	
	<b>2-3 marks</b>	The response describes basic knowledge and understanding and references 1-2 adjustments available on mobile phones with basic explanation of how these are an improvement.	
	<b>1 mark</b>	A very basic response referring to a single adjustment or improvement	
	<b>0 marks</b>	Nothing worthy of credit	
	<b>Indicative Content:</b>		
<ul style="list-style-type: none"> <li>• The development of touchscreens means that button size is less restricted as they are virtual and displayed only when needed</li> <li>• The fact that buttons are only displayed when needed means that the text on the buttons changes dependent on the situation (no more pressing number keys multiple times to input text)</li> <li>• Positive audio feedback is given to indicate when buttons are pressed.</li> <li>• Visual feedback is given to support the audio feedback to show when buttons have been pressed.</li> <li>• Multiple language settings are available for different nationalities</li> <li>• Standardised colours are used to depict call and answer buttons</li> <li>• Standardised symbols are used on icons to break language barriers</li> <li>• Text sizes are adjustable for visually impaired users</li> <li>• A backlit screen lights up when in use</li> <li>• Accept any other valid response</li> </ul>			



<b>16</b>			<b>8 marks</b> AO42A
	7-8 marks	Detailed knowledge shown of the requirements of the health and safety at work act 1974. 3 to 4 types of health & safety responsibilities and their impact stated with recognition of how these responsibilities provide protection for employees.	
	5-6 marks	A good answer demonstrating sound knowledge of the requirements of the health and safety at work act 1974. 2 to 3 responsibilities stated and detail of how these responsibilities provide protection for employees is provided.	
	3-4 marks	2 to 3 responsibilities are outlined stating how these responsibilities provide protection for employees.	
	1-2 marks	1 or 2 responsibilities outlined without stating how these responsibilities provide protection for employees.	
0 mark	No response worthy of credit		
<p><b>Indicative content:</b> Employers must ensure that the workplace meets the requirements of the health and safety at work act 1974:</p> <p>Answers may include health and safety responsibilities for the employer such as:</p> <ul style="list-style-type: none"> <li>• Training for all employees on specialist machinery.</li> <li>• Various forms of personal protective clothing</li> <li>• Safety glasses should be worn whilst operating tools</li> <li>• All wires should be out of the cutting areas to avoid getting them tangled.</li> <li>• Protective apron should be worn at all times</li> <li>• First aid at work training given and first aiders appointed</li> <li>• Fully stocked first aid points</li> <li>• Hazard and warning signs displayed next to machinery for particular tasks.</li> <li>• Machines should be fitted with an emergency stop button</li> <li>• Cutting machines should have appropriate guards to protect the operator from injury</li> <li>• Work areas should be kept tidy and clean</li> <li>• Fire exits should be clearly marked and kept clean and tidy</li> <li>• Work areas should be lit well and ventilated</li> <li>• Data sheets must be available for COSHH materials</li> </ul>			

		<ul style="list-style-type: none"><li>• Manual handling guidance</li><li>• Machinery should be kept in good condition, especially electrical machinery</li><li>• Accept any other valid response</li></ul>		
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