



**General Certificate of Secondary Education
June 2013**

Design and Technology: 45601

Resistant Materials Technology

(Specification 4560)

Unit 1: Written Paper

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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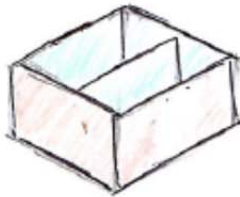
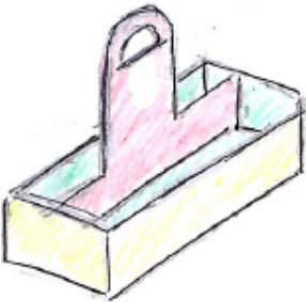
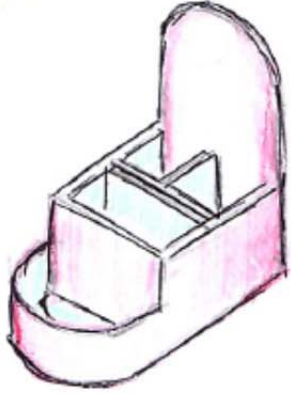
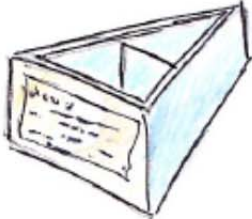
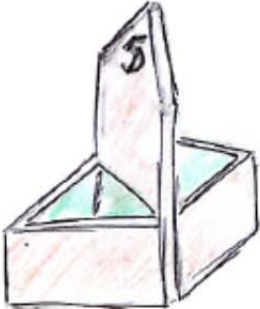
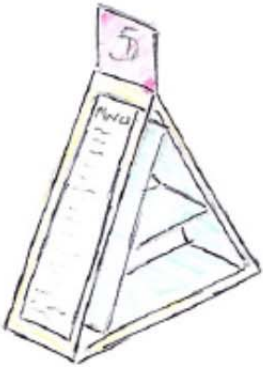


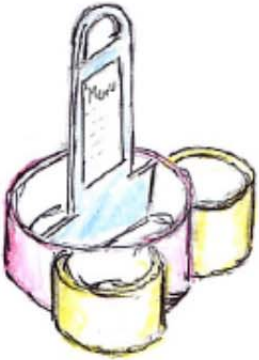
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Section A					
1			<p>Use the following criteria to mark questions 1 (a), (b) & (c). Award 1 mark for a correct Requirement and 1 mark for a correct Explanation</p> <p>Any three correctly identified requirements.</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Should be easy to carry • Must be soundly constructed • Should organise the items • Should be capable of being manufactured in quantity • Must be safe to use • Must be ergonomically designed • Must be durable • Must be compact • Must be stable • Must be easy to clean • Must use environmental friendly materials/ processes <p>Award marks for specific 'Art Deco' features.</p> <ul style="list-style-type: none"> • See 'Art Deco Style' sheet. <p>Do not accept</p> <ul style="list-style-type: none"> • Information given on Brief • Repeat answers <p>Candidates may place both parts of the answer in the 'Explanation or the 'Requirement'.</p> <p>Any three relevant explanations</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Staff will need to pick it up and move it quickly around the cafe/restaurant. • The device should not break when in use • This will make finding the items easy • Making things in bulk reduces the unit cost • No one should be injured when using the device • It should be easy and comfortable to use • It should withstand everyday use • It should not take up too much room on the table • The device should not topple over • The device must be hygienic • So the environment is not harmed 	3 x 1	
				3 x 1	Max 6 marks

2			Mark each idea out of 3 using the following scale: <ul style="list-style-type: none">• A repeat idea• A simple idea in the Art Deco style• An idea in the Art Deco style displaying some creativity or with additional design features• A creative idea in the Art Deco style	0 1 2 3 5 x 3 marks	Max 15 marks
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Q2 Exemplar answers

<p>1 mark</p> <p>A simple idea in the Art Deco style</p>	<p>2 marks</p> <p>An idea in the Art Deco style displaying some creativity or with additional design features</p>	<p>3 marks</p> <p>A creative idea in the Art Deco style</p>
		
		
		

3		<p>Development details could include:</p> <p>Materials and finish</p> <p>Award one mark each for details relating to two materials. Or Award two marks for a single material with a justification (Max 2 marks)</p> <p>Award one mark each for details relating to two types of finish Or Award two marks for a single finish with a justification (Max 2 marks)</p> <p>Construction</p> <p>Award up to three marks for constructional details</p> <ul style="list-style-type: none"> • A simple reference to a method of construction • A outline of a method of construction • Detailed information relating to a method of construction <p>Design features and sizes</p> <p>Award one mark each for details relating to two design features. (Max 2 marks) Award one mark each for two relevant sizes (Max 2 marks)</p>	<p>Max 3</p> <p>1 2 3</p> <p>Max 3</p>	<p>Max 9 marks</p>
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4		<p>Award one mark each for an analytical comment.</p> <p>Comments must be justified to be awarded mark.</p> <p>There are no marks for statements</p> <p>Look for connecting words such as 'therefore, so, because'</p>	<p>3 x 1</p>	<p>Max 3 marks</p>
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Section B					
5	(a)	Award one mark for each correctly entered cell			
		Plastic (Polymer)	Thermoplastic	Thermosetting plastic	
		Acrylic (PMMA)	✓		
		Urea formaldehyde (UF)		✓	
		Polyvinyl chloride (PVC)	✓		
		Polypropylene (PP)	✓		
		Polyethylene terephthalate (PET)	✓		
		Melamine formaldehyde (MF)		✓	
Candidates ticking in both boxes score no marks			Max 5 marks		
5	(b)	(i)	Thermoplastic	1	
5	(b)	(ii)	<p>Award one mark each for details relating to:</p> <ul style="list-style-type: none"> • Can be moulded with the use of heat • Easily recycled • Cost effective <p>The explanation must relate to specific properties of a thermoplastic. Do not award marks for generic comments relating to plastics e.g. colourful, shiny.</p>	Max 2 marks	
5	(c)	(i)	Thermosetting/thermoset plastic	1	
5	(c)	(ii)	<p>Award one mark each for details relating to:</p> <ul style="list-style-type: none"> • Does not distort with heat • Rigid • Durable/Hard wearing • Fire resistant/ does not melt <p>The explanation must relate to specific properties of a thermosetting plastic. Do not award marks for generic comments relating to plastics e.g. colourful, shiny.</p>	Max 2 marks	

6		<p>Award marks using the following descriptors:</p> <p>If a candidate has chosen just one part of the lamp they can still gain full marks.</p> <p>Stage 1: Marking out (traditional)</p> <p>Sufficient detail for a part or parts to be marked out by a third party, as a one off. Most tools and equipment given.</p> <p>Tools: pencil, rule, compass</p> <p>Sufficient detail for a part or parts of the design to be marked out by a third party, in quantity, using a template. Most tools and equipment given.</p> <p>Tools: pencil, rule, compass, scissors, card/ply template</p> <p><i>Or</i></p> <p>Stage 1: Marking out (CAD)</p> <p>Sufficient detail for a part or parts of the design to be drawn by CAD by a third party. Most tools and equipment given.</p> <p>Look for details relating to:</p> <ul style="list-style-type: none"> • Computer hardware • Drawing on screen • Naming software • Use of different coloured lines/tool path <p>Stage 2: Cutting and shaping (traditional)</p> <p>Sufficient detail for a part or parts of the design to be cut and shaped by a third party as a one off. Most tools and equipment given</p> <p>Sufficient detail for most of the design to be cut and shaped by a third party, in quantity, using jigs/templates/power tools. Most tools and equipment given.</p> <p>Tools: Jig/Bandsaw, disc sander, router</p> <p><i>Or</i></p> <p>Stage 2: Cutting and shaping (CAM)</p> <p>Sufficient detail for the design to be manufactured by CAM. Most tools and equipment given.</p> <p>Look for details relating to:</p> <ul style="list-style-type: none"> • Transfer of data to CAM • CNC router • Clamping work piece 	<p>1 – 2</p> <p>3 – 4</p> <p>1 – 4</p> <p>1 – 2</p> <p>3 – 4</p>	
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		<ul style="list-style-type: none"> • Changing tools • Safety <p>Answers that relate to use of the Laser cutter can only be awarded 2 marks unless the candidate provides specific details on how the material would be cut out in thin (3mm layers) and then built up. Or, the candidate may have indicated that the cutting would be done using multiple passes.</p> <p>Stage 3: Joining</p> <p>Limited details of a simple method of joining the stem to the base. Some tools and equipment given.</p> <p>E.g. Gluing</p> <ul style="list-style-type: none"> • Applying glue • Clamping <p>Detailed description of a suitable method of joining the stem to the base. Most tools and equipment given.</p> <p>E.g. Screwing</p> <ul style="list-style-type: none"> • Pilot hole • Clearance hole • Countersink • Screw • Screwdriver <p>Dowelling</p> <ul style="list-style-type: none"> • Marking out holes • Drilling • Applying glue • Fitting dowels • Clamping <p>Mortise and tenon</p> <ul style="list-style-type: none"> • Marking out • Cutting mortise hole • Cutting tenon • Applying glue • Clamping <p>Biscuit</p> <ul style="list-style-type: none"> • Marking out • Cutting the slot • Applying glue • Clamping <p>Stage 4: Securing the wires to the switch</p> <p>Limited details of a simple method of securing the wires to the switch. Some tools and equipment given.</p>	1 – 4	
			1 – 2	
			1 – 4	


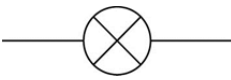
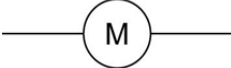
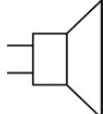
		<p>E.g. Twisting the wires onto the terminals</p> <p>Detailed description of a suitable method of joining the stem to the base. Most tools and equipment given.</p> <p>E.g. Soldering</p> <ul style="list-style-type: none"> • Stripping the wires • Using a soldering iron • Adding solder <p>Using spade connectors</p> <ul style="list-style-type: none"> • Stripping the wires • Using a spade connector • Using a crimping tool <p>Small nut, bolt and washer</p> <ul style="list-style-type: none"> • Stripping the wires • Using nut, bolt and washer 	<p>1</p> <p>1 – 4</p>	<p>Max 16 marks</p>
7	(a)	<p>Wooden chair</p> <p>Award one mark each for correctly identifying a suitable hardwood:</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Teak • Mahogany • Oak • Ash • Beech <p>Award one mark for giving a suitable reason:</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Strong • Durable • This material has natural properties that make it suitable for outdoor use • Attractive/stylish <p>Award one mark for giving its original source:</p> <ul style="list-style-type: none"> • Tree/forest <p>Candidates may be awarded marks for a correct reason even if the material is wrong.</p> <p>Metal chair</p> <p>Award one mark each for correctly identifying a suitable metal:</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Aluminium/ stainless steel 	<p>1</p> <p>1</p> <p>1</p>	

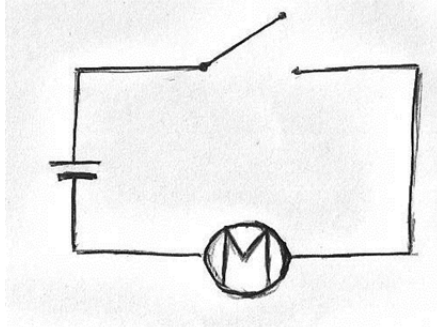
		<ul style="list-style-type: none"> • Steel only if plated (Galvanising/ chrome plating) <p>Award one mark for giving a suitable reason: Possible responses:</p> <ul style="list-style-type: none"> • Strong • Suitable for outdoor use • Lightweight <p>Award one mark for giving its original source:</p> <ul style="list-style-type: none"> • Bauxite • Ore (iron) <p>Candidates may be awarded marks for a correct reason even if the material is wrong</p>	1 1 1	Max 6 marks
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7	(b)	<p>Look for details relating to the possible environmental impact of using plastics (polymers) to manufacture products:</p> <ul style="list-style-type: none"> • Plastics come from crude oil • Crude oil is a non renewable resource • The transportation of oil can be dangerous for the environment • Non renewable fossil fuels are burnt in the refining of oil into plastic • Pollution is caused when refining oil into plastic • Non renewable fossil fuels are used when moulding plastics into products • Pollution is caused when moulding plastics into products • The pollution leads to climate change • The pollution causes acid rain • Plastic products can be recycled • Plastic products are durable • Many plastic products are very slow to degrade <p>Mark the answer for its technical content and then apply it to the following criteria.</p> <ul style="list-style-type: none"> • A response which is poorly structured with no relevant examples. There is very little or no use of design technology terminology and with many errors in grammar, punctuation and spelling. • A response which contains very limited reference to any of the examples above. The answer is vague or poorly structured, with little use of design & technology 	0	
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		<p>terminology and with a considerable number of errors in grammar, punctuation and spelling.</p> <ul style="list-style-type: none"> • A fairly detailed response which refers to some of the examples above. The answer is fairly well structured, with some use of design & technology terminology and with a small number of errors in grammar, punctuation and spelling. • A detailed and comprehensive response that includes several of the examples above. The answer is well-structured, with good use of appropriate design & technology terminology and showing a good grasp of grammar, punctuation and spelling. • A fully detailed and comprehensive response that includes details of most of the examples above. The answer is well-structured, with good use of appropriate design & technology terminology and showing a good grasp of grammar, punctuation and spelling. 	<p>1 – 2</p> <p>3 – 4</p> <p>5 – 6</p> <p>7 – 8</p>	<p>Max 8 marks</p>
8	(a)	<p>Use the following criteria to mark questions 8 (a) (i), (a) (ii), (a) (iii) & (a) (iv)</p> <p>Award one mark for each correctly identified ergonomic feature and 1 mark for each suitable explanation.</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • The strap Prevents you dropping the torch on the floor if you lose your grip on the handle/can be hooked on a belt • The handle Has a textured surface to prevent slipping The diameter makes it easy to hold • The wind up handle Is long enough to make winding easy/folds away after use/has a spinning handle • The operating buttons Are easy to access with your fingers Are coloured to indicate on/off • The focussing ring It is serrated for easy grip • The balance of weight Making it comfortable to hold • The body Bright colour so it can be easily seen Curved body to fit in the hand 		<p>Max 8 marks</p>

9	(a)	<p>Award one mark for naming a 'one off' product and up to three marks for a suitable detailed explanation of the term 'one off' production:</p> <p>Possible products:</p> <ul style="list-style-type: none"> • Wedding ring • Bespoke furniture • Hand-made musical instrument e.g. guitar, violin <p>Accept non Resistant Materials</p> <p>Possible explanation:</p> <ul style="list-style-type: none"> • One product is being produced • Manufactured by a highly skilled craftsman • Very expensive • Labour intensive 	1 Max 3	Max 4 marks
9	(b)	<p>Award one mark for naming a 'batch produced' product and up to three marks for a suitable detailed explanation of the term 'batch' production:</p> <p>Possible products:</p> <ul style="list-style-type: none"> • Cars • Mountain bikes • House hold appliances e.g. vacuum cleaner, fridge, cooker. <p>Accept non Resistant Materials</p> <p>Possible explanation:</p> <ul style="list-style-type: none"> • Many similar products are being made • Usually for the mass market • Manufactured by machines • Affordable prices • Flexible machining options 	1 Max 3	Max 4 marks
9	(c)	<p>Award one mark for naming a product made by 'continuous' production and up to three marks for a suitable detailed explanation of the term 'continuous' production:</p> <p>Possible products:</p> <ul style="list-style-type: none"> • Plastic bottles • Food cans • Paper <p>Accept non Resistant Materials</p> <p>Possible explanation:</p> <ul style="list-style-type: none"> • One product is being made 24/7 • There is a constant demand • Full automated manufacturing plants • Very high set up costs 	1 Max 3	Max 4 marks

10	(a)	(i)	Award one mark for each correctly entered cell				Max 4 marks
			Component	Symbol	Function		
			Switch		It switches the circuit on and off (1 mark)		
			Lamp		It converts electrical energy into light (1 mark)		
			Motor		It converts electrical energy into rotary motion (1 mark)		
Speaker (1 mark) Not bell/buzzer		It converts electrical energy into sound					

10	(a)	(ii)	Award one mark for each correctly drawn component and one mark for correctly connecting up the circuit with straight lines.				Max 4 marks
							

10	(b)	(i)	<p>Award one mark for each correct reason.</p> <p>Possible responses:</p> <ul style="list-style-type: none"> • Copper is a good electrical conductor • Copper wire is very flexible • Copper can easily be soldered <p>Do not accept cheap</p>		Max 2 marks									
10	(b)	(ii)	<p>Award one mark for a correct material Material: PVC/Polypropylene/Polyethylene/Rubber</p> <p>Award one mark for a correct reason Possible responses:</p> <ul style="list-style-type: none"> • It is a good insulator of electricity • flexible • can easily be colour coded • waterproof • durable does not break down, degrade 	1 1										
10	(c)		<p>Award one mark for each correctly entered cell</p> <table border="1"> <thead> <tr> <th>Health and safety issue</th> <th>Hazard</th> <th>Precaution</th> </tr> </thead> <tbody> <tr> <td>The tip of the soldering iron gets hot</td> <td>You could burn your fingers / table top (1 mark)</td> <td>Keep your fingers away from the tip / make sure you replace it into its device after use. (1 mark)</td> </tr> <tr> <td>Soldering gives off fumes</td> <td>The fumes could give you breathing difficulties (1 mark)</td> <td>Make sure you are in a well-ventilated area / make sure you are using extraction equipment/wear a mask (1 mark)</td> </tr> </tbody> </table>	Health and safety issue	Hazard	Precaution	The tip of the soldering iron gets hot	You could burn your fingers / table top (1 mark)	Keep your fingers away from the tip / make sure you replace it into its device after use. (1 mark)	Soldering gives off fumes	The fumes could give you breathing difficulties (1 mark)	Make sure you are in a well-ventilated area / make sure you are using extraction equipment/wear a mask (1 mark)		Max 4 marks
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