



General Certificate of Education

AS Design and Technology Product Design (3-D Design) 1551

PROD1

Materials, Components and Application

Mark Scheme

2010 examination – January series

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

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Quality of Written Communication

The following marks are allocated to the quality of the candidate's written communication. Make a separate assessment of the candidate's overall ability as demonstrated across the paper using the criteria given below.

<i>Performance Criteria</i>	Marks
The candidate will express complex ideas extremely clearly and fluently. Sentences and paragraphs will follow on from one another smoothly and logically. Arguments will be consistently relevant and well structured. There will be few, if any, errors of grammar, punctuation and spelling.	4
The candidate will express moderately complex ideas clearly and reasonably fluently, through well-linked sentences and paragraphs. Arguments will be generally relevant and well structured. There may be occasional errors of grammar, punctuation and spelling.	3
The candidate will express straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.	2
The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.	1

This mark scheme is intended as a guide to the type of answer expected but is not intended to be exhaustive or prescriptive. If candidates offer other answers which are equally valid **they must be given full credit**.

Many responses at this level are assessed according to the **quality** of the work rather than the number of points included. The following level descriptors are intended to be a guide when assessing the quality of a candidate's response.

(low mark range)
The candidate has a basic but possibly confused grasp of the issues. Few correct examples are given to illustrate points made. This candidate does not have a clear idea of what s/he is writing about.
(mid mark range)
The candidate has some knowledge but there will be less clarity of understanding. Some correct examples given to illustrate points made. This candidate knows what s/he is writing about but is confused in part.
(high mark range)
The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. This candidate knows what s/he is writing about and provides clear evidence of understanding.

Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	a	i	Polystyrene, card, HIPs, PP, laminated card, acetate, LDPE, Metalised card, cardboard, carton board, PET/PETE, Aluminium foil, PLA/Biodegradable polymer.	1	
1	a	ii	E.g. Card is recyclable and can be printed on. PET/PP/LDPE etc are non toxic Laminated card, etc is hygienic Lightweight for ease of carrying/transport or reduced transport costs	1	
1	b	i	E.g. MDF, Chipboard Alternatives; Carbon Fibre (CFRP), Glass Fibre (GRP), Block board, Plywood, Kevlar, Alucomposite , Concrete. Cermets e.g. Tungsten Carbide, etc	1	
1	b	ii	E.g. Product: Flat-pack furniture Reason: MDF is a flat material that is not prone to warping, splitting, etc which makes it a good material for consistent quality in manufacture of furniture.	1 1	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a		<p>Component</p> <p>Securing square wooden legs to a flat pack dining table</p> <ul style="list-style-type: none"> - Corner Plate <p>Securing sheet aluminium together</p> <ul style="list-style-type: none"> - Pop Rivets or - Self tapping screws <p>Joining the sides of an MDF box together</p> <ul style="list-style-type: none"> - Dowels <p>Securing a battery compartment on a plastic toy</p> <ul style="list-style-type: none"> - Self tapping screws 	4	<p>One mark for each correct response.</p> <p>If candidate has given same response more than once then can only be awarded mark for one correct answer.</p>
2	b		<ol style="list-style-type: none"> 1. They make it easier to flat-pack furniture. 2. They speed up the manufacture/assembly of products. 3. Cheaper to buy than handcrafted items <p>Also accept</p> <p>Anyone can use them with simple hand tools</p> <p>They reduce costs of production for the manufacturer</p> <p>Reduced fuel/transport costs</p> <p>They can be used with semi skilled labour</p>	2	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a		Possible answers: Hardwoods: oak, beech, mahogany, balsa, iroko, teak, etc Softwoods: pine, spruce, red deal, scots pine, etc	4	
3	b		Possible answers: Beech - chopping board, Teak -outdoor furniture Mahogany - batch produced furniture Oak - wine barrels etc	1	

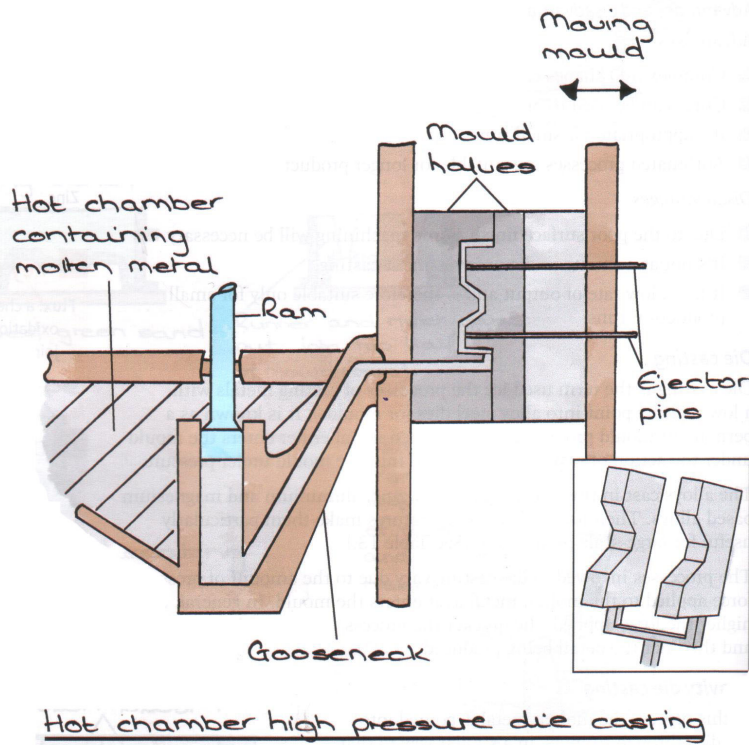
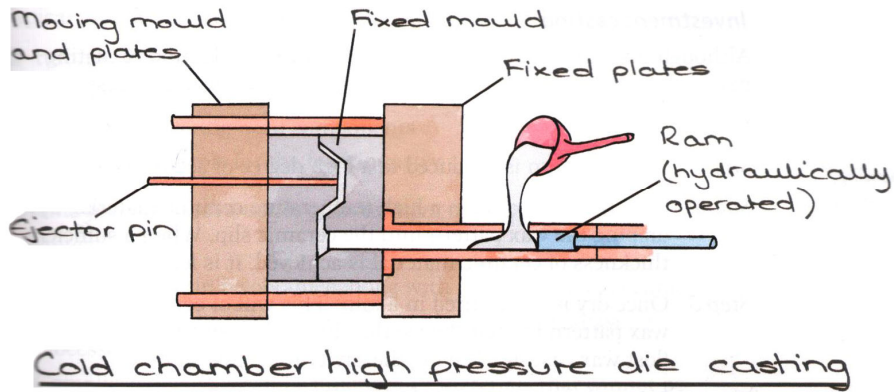
Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	a		Use: Dental braces or bone fixings, muscle wires, switches/actuators, surgical stents, etc.	1	
			Reason for use: e.g. Nitinol reacts to heat	1	
4	b		Use: Sunglasses, safety visors, etc Reason for use: Photochromic pigment reacts to bright light/UV darkening the lens to protect the user's eyes.	2	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	a		<p>Material Biodegradable Polymer is made from natural cellulose extracts. It will biodegrade when buried in landfill. This is important with disposable packaging which has a very short lifecycle. Because it is a polymer, it can be blow moulded to make the shape of a bottle. Generic properties of polymers that are relevant apply e.g. lightweight, chemical resistant, waterproof, transparent/clear, etc</p> <p>Product Detergent bottles</p>	4	<p>Breakdown:</p> <p>Two properties and relevance required.</p> <p>1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p>
5	b		<p>Material Flexible Plywood - The construction of the veneers in flexply allows the plywood to bend so it can be moulded over a curved former. Flexply comes in long wide boards which make it good to cover large surface areas for tables, etc.</p> <p>Product Laminated furniture</p>	4	<p>Breakdown:</p> <p>Two properties and relevance required.</p> <p>1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p>
5	c		<p>Material Tungsten carbide - Tungsten carbide is harder than most common metals so it is ideal for cutting hard alloys such as stainless steel. Tungsten carbide is resistant to heat caused by the friction created when cutting metals. Tungsten carbide tools blunt less quickly than those made from HSS.</p> <p>Product Cutting tools</p>	4	<p>Breakdown:</p> <p>Two properties and relevance required.</p> <p>1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p>

5	d		<p>Material Melamine Formaldehyde Laminate 'Formica' - Formica laminate is made using melamine formaldehyde which is resistant to heat. This makes it suitable to put hot saucepans on. Formica is a hard material and therefore resists scratching from utensils, etc</p> <p>Product Work surfaces</p>	4	<p>Breakdown:</p> <p>Two properties and relevance required.</p> <p>1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p>
5	e		<p>Material Metal effects card - Metal effects card has a reflective surface which is aesthetically appealing making the gift box attractive. Card can be cut and scored easily to make a 'net' required for boxes Lightweight- good for posting NO MARKS FOR RECYCLABLE/REUSABLE</p> <p>Product Gift boxes</p>	4	<p>Breakdown:</p> <p>Two properties and relevance required.</p> <p>1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	a		<p>Aluminium is a low melting point metal which is ideal for die casting because the dies will last longer than if using a higher melting point metal.</p> <p>Aluminium conducts heat well which makes it suitable for making the coffee on a stove.</p> <p>Aluminium does not corrode which would taint the water and spoil the taste of the drink.</p>	6	<p>Breakdown:</p> <p>1 - 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.</p> <p>Max 3 marks for a list of properties</p>

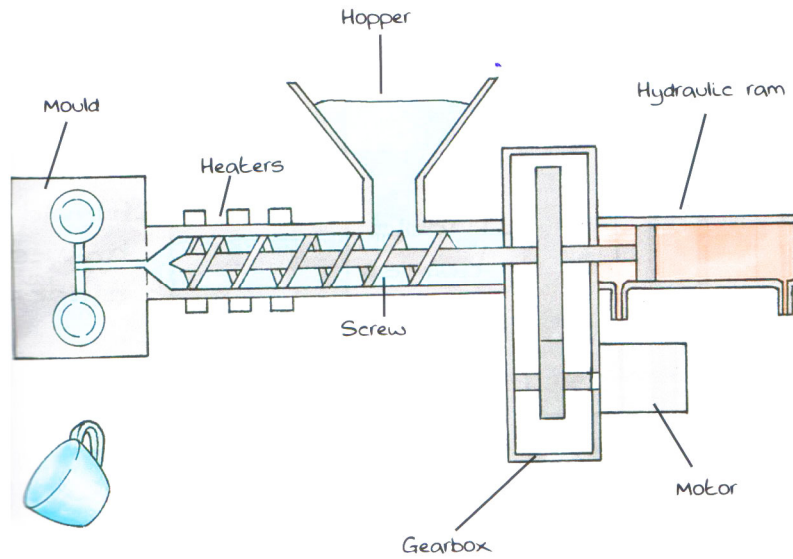
6b Note diagrams for illustration only. Dies might differ to look like the product and do not expect same level of line accuracy)



Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	b		<p>In pressure die casting, molten metal is poured into a cylinder from a ladle or crucible.</p> <p>A hydraulic ram forces the molten metal into the closed dies which are watercooled. Once cooled, the dies are opened and the product is removed. Flash is removed with filing and polishing.</p>	10	<p>Breakdown:</p> <ul style="list-style-type: none"> • Basic diagram of a suitable manufacturing process with a few points labelled <p>E.g. simple diagram of die with little detail. Labels such as 'mould', 'plunger'. Major points missing. Some confusion with injection moulding.</p> • Better diagram of a suitable manufacturing process with all points labelled and some explanatory notes. <p>E.g. die resembles product, some specific parts correctly labeled. Step by step process in note form but may have some steps missing or lacks clarity</p> • Detailed diagram with all points labelled and a good explanation of the process <p>E.g. die clearly resembles the product. Step by step process is correct with few if any details missing for the top mark.</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	a	i	E.g. Acetyl Polymer, PMMA (acrylic), ABS, HDPE, PP, Polycarbonate (PC), (not thermoset)	1	
7	a	ii	E.g.- Acrylic is a durable plastic which will withstand wear and tear from daily use. Acrylic is a thermoplastic which is ideal for injection moulding into the complex shape. Acrylic like all polymers is an insulator. It is safe to use with electricity and will not overheat from the heat of the hairdryer.	6	Breakdown: Three reasons required. 1 – 2 marks per relevant point. Award additional mark (s) for detail in explanation up to maximum.

7aiii Injection moulding- (Note diagram for illustration purposes- mould will differ and do not expect same level of line accuracy)



7	a	iii	<p>Stage 1 - Polymer granules are inserted into the hopper. The Archimedean screw moves the granules towards the heaters.</p> <p>Stage 2 - When sufficient polymer is melted, the hydraulic ram moves the screw forward and injects the polymer into the mould.</p> <p>Stage 3 - The polymer is allowed to cool in the mould. The mould opens and ejector pins push the completed moulding out.</p> <p>Stage 4 - Excess polymer (flash) is removed.</p>	9	<p>Breakdown:</p> <p>0 – 3</p> <ul style="list-style-type: none"> Basic diagram of a suitable manufacturing process with a few points labelled (1 mark for stating 'injection moulding' <p>E.g. simple diagram of injection moulder. Generic mould with little detail. Labels such as 'screw', 'plunger'. Major points missing.</p> <p>4 – 6</p> <ul style="list-style-type: none"> Better diagram of a suitable manufacturing process with all points labelled and some explanatory notes. <p>E.g. Mould resembles product, some specific parts correctly labelled such as Archimedean screw, hydraulic system, etc. Step by step process in note form but may have some steps missing or lacks clarity</p> <p>7 – 9</p> <ul style="list-style-type: none"> Detailed diagram with all points labelled and a good explanation of the process <p>E.g. Mould clearly resembles the product. Details of spit lines, water cooling, possibly cores, etc. Specific correct terminology such as 'ejector pins', 'hydraulic ram'.</p>
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					Step by step process is correct with few if any details missing for the top mark.
7	a	iv	E.g. Chrome plated mild steel. Accept aluminium or stainless steel. No marks for tin, galvanized mild steel, silver/silver plate	2	1 mark for 'steel' or mild steel
7	a	v	E.g. Mild steel is a malleable material which can be rolled into shape or extruded into a tube. Mild steel is a hard material and will withstand being dropped and the wear & tear of daily use. or Chrome plating protects the steel from corrosion and gives the product an aesthetically pleasing appearance. Etc	4	Breakdown: Two reasons required. 1 – 2 marks per relevant point. Two marks where point is explained. Award additional mark for further detail.
7	b		<ul style="list-style-type: none"> • Guards are fitted to each end of the hair dryer. This prevents hair going into the fan and fingers going into the heating elements. • Plastic guard on the hot end will not burn the user if it touches the skin. • The electric parts are well insulated and together with a polymer handle ensures that the hairdryer is totally safe to hold. • Hairdryers have a 13 Amp plug fitted. This protects the consumer in the event of an electrical fault such as the wire breaking 	6	Breakdown: 1 – 2 marks per relevant. Two marks where point is explained. Award additional mark for further explanation.
7	c		<ul style="list-style-type: none"> • Handle is angled to make it more comfortable on the wrist when directing the hairdryer to dry hair. • Handle is approximately 25mm in diameter which makes a good 'chunky' grip. 	12	Breakdown: 1 – 2 marks per diagram where they support answer. (Two marks where diagrams are clear and appropriately annotated).

			<ul style="list-style-type: none"> • Thumb-operated switches are easy to reach and operate. These switches are textured and have a ridge or raised section to make it easier to use. • Easy to read symbols indicate the heat and power settings. • Different heat and power settings make the hairdryer suitable for young children who generally prefer lower power and speed settings. • Overall, the weight of such products is kept as low as possible which make it comfortable to hold. 		<p>1 – 2 marks per point. Two marks where point is explained. Award additional marks for further explanation.</p>
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