



**General Certificate of Secondary Education
June 2011**

**Design and Technology: 45551
Product Design**

(Specification 4555)

Unit 1: Written Paper

Post-Standardisation

Mark Scheme

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Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	a	(i)	Bright, bold colours; geometric shapes; angles; textures and patterns; unconventional materials; mix of 20th century styles, colours and materials; drew inspiration from such movements as Art Deco and Pop Art, styles such as the 1950's Kitsch and futuristic themes; vibrant, eccentric and ornamental	4	For each feature: Concise and detailed response which makes reference to two of the above ideas in brief or one in detail. (2 marks) Brief / single word answer with reference to one idea only. (1 mark)
1	a	(ii)	Ettore Sottsass, Martine Bedin, Aldo Cibic, Michele De Lucchi, Matteo Thun and Marco Zanini, Andrea Branzi, Michael Graves, Alessandro Mendini, Paulo Navone, Christoph Radl, George Sowden, Nathalie du Pasquier, Peter Shire, Javier Mariscal, Hans Hollen, Shiro Kuramata, Arata Isozaki, Gerard Taylor.	1	<i>Please 'Google' any alternative responses to check.</i>
1	b		Any sensible design criteria identified appropriate for a child in the under-seven age range supported by appropriate reason such as colour to attract target user / activity; material; weight;	6	Design criteria identified (1 mark) A suitable reason provided and reason must match design criteria and target user (1 mark) A reason that is not relevant or incorrect (0 marks)
1	c		Creative response to brief, inclusion of innovative features. Innovative product idea which compliments some aspect of target user's lifestyle. Design solution significantly developed with clear links to Memphis design movement making use of block / bold colours, geometric shapes, angles, textures etc. Design work is fully annotated with suggested materials or ingredients, methods of joining, manufacturing processes. Designs are well drawn, with a good use of colour, texture and form. Design work is concise, easy to understand and well laid out in the space available. Design could be manufactured by a third party	15	<i>Holistic approach required - use exemplars for guidance. Try to find a best fit across the full range of marks rather than trying to fit response to one box.</i> (12-15 marks)

Question	Part	Sub Part	Marking Guidance	Mark	Comments
			<p>A reasonably creative response to brief and inclusion of some innovative design features. Some link to Memphis design movement making use of block / bold colours, geometric shapes, angles, textures etc. Product idea compliments some aspect of target user's lifestyle. Design is developed and includes detail of some appropriate materials or ingredients, construction techniques, designs are quite well drawn, colour and or texture has been used appropriately although there may be limited application. Designs are annotated although there may be some missing details. Work is fairly well laid out in the space provided.</p>		(9-11 marks)
			<p>Response to brief has limited creativity and/or innovative design features. May be a link to Memphis design movement making use of block / bold colours, geometric shapes, angles, textures etc. Product idea may compliment some aspect of target user's lifestyle. Design may not be fully developed and may lack detail of materials, ingredients, construction techniques. Designs may not be very well drawn and there may be no or limited application of colour or texture. Annotation lacks some essential information.</p>		(6-8 marks)
			<p>Limited response to brief, little or no link to Memphis design movement making use of block / bold colours, geometric shapes, angles, textures etc. Product idea may not compliment an aspect of identified target user's lifestyle. Design is not fully developed and lacks essential details of materials, ingredients, construction techniques. Designs are not very well drawn and there may be no or limited application of colour or texture. Annotation may be limited or missing.</p>		(3-5 marks)

Question	Part	Sub Part	Marking Guidance	Mark	Comments
			Very limited or no response to brief, little or no link to Memphis design movement. Product idea does not compliment an aspect of target user's lifestyle. Design is not developed and lacks information of materials, ingredients, construction techniques. Designs are poorly drawn and there is no or limited application of colour or texture. Annotation is limited or missing.		(0 – 2 marks)
1	d		<p>Concise evaluation with several well reasoned points clearly linked to original design criteria. Opportunities for improvement or further development to design may also have been identified. Response well structured with good use of appropriate design and technology terminology and showing a good grasp of grammar, punctuation and spelling. (5-6 marks)</p> <p>Some well reasoned points linked to original design criteria although response may be lacking in some detail or reference to further development opportunities. Response fairly well structured with some use of design and technology terminology with a small number of errors in grammar, punctuation and spelling. (3-4 marks)</p> <p>One point fairly well reasoned or some vague points which might not be linked to original design criteria. Little or no reference to further development opportunities. Response poorly structured with little or no use of design and technology terminology and with numerous errors in grammar, punctuation and spelling. (1-2 marks)</p> <p>No relevant evaluation presented. (0 marks)</p>	6	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a			9	Please refer to table and answers below. One mark for each correct answer.

Source	Specific material	Renewable	Non-renewable	Product
<i>The Earth and rocks</i>	<i>Aluminium</i>		✓	<i>ladder</i>
Oil	Any named plastics or synthetic materials; printing inks and varnishes used in packaging industries. Plastics used in packaging (almost anything with a POLY in front!)		✓	Any appropriate product which matches the named material
Plants and trees	Any named papers and boards, timber and manufactured boards, nuts, grains, seeds, fruit and vegetables, rice etc. any appropriate named food ingredients; textiles, natural plastics.	✓		
Animals	Any named natural textiles, meat, bone/horn or dairy food ingredients. Tortoise shell, mother of pearl, coral used in decorative items such as jewellery and jewellery boxes, bone glue used in cabinet making (also hide glue, fish glue, hoof glue etc) Rabbit skin glue used in book binding Casein glue is made from milk and is one of our last remaining natural glues used industrially. Laminating ply is a common use as it can be set with heat.	✓		

2	b	i	Identification of new/smart material: e.g starch based polymers, precious metal clays, quantum tunnelling composite, carbon fibre etc. See further information below.	1	
2	b	ii	Appropriate and detailed description of material's properties including an example of its use in a real product. (3 marks) Sound description of material's properties and an appropriate example of its use or detailed description with no example. (2 marks) Superficial description of material's properties or example of use. (1 mark) Incorrect description of properties with no reference to use. (0 marks)		

New/smart material	Property / function	Example of use
Carbon fibre	Thin carbon fibres twisted together to form a yarn and woven to create fabric. Combined with resin which bonds the fibres together and creates a very strong very lightweight composite material	Formula One racing cars Technical cycles Helicopter rotor blades
Fibre optics	Glass or plastic fibres used to transport light and to transport data over long distances effectively.	lighting applications communications e.g. computers / telephone
Goretex & sympatex	Waterproof and breathable fabrics consist of porous membrane laminated to high performance textile fabrics.	Activity clothing for walking , skiing, cycling etc.
Kevlar	Highly flame retardant. Weight for weight, five times stronger than steel, plastic based material, flexible. Woven and used in layers.	Bicycle tyres, body armour. Cables for boat rigging and oil rigs, conveyor belts.
Maplex	Plain brown board similar to plywood made of 100% pressed wood fibres using water heat and pressure but no glues or binders. Strong, easily moulded and completely biodegradable.	Chair
Polycaprolactone (PLC) (polymorph)	Low melting point, biodegradable thermoplastic material	Medical applications. Easily shaped by hand to resemble injection moulded products.
Precious metal clays	A clay-like medium consists of very small particles of precious metals (such as silver, gold or platinum) mixed with an organic binder and water.	Used to make jewellery, beads and small sculpture.
Quantum Tunnelling Compound (QIC)	Electro-resistive properties	Switches
Corn starch polymers	Biodegradable, doesn't give off toxic fumes when burned so more environmentally friendly than oil based polymers	Food packaging Disposable cutlery
Thermochromic pigments	Change colour with temperature, can be added to polymers	Kettles Thermal warming

		Patches in baby feeding products
Shape memory alloys/smart alloys	When heated, metal gains a memory. Wire (Nitinol) shrinks by 5% in length when electrical current is passed through it.	Spectacle frames. Placed in collapsed blood vessels e.g. stent. Used to hold broken bones together.

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a	i	Brand identity is typically the attributes associated with a brand, how the brand owner wants the consumer to perceive the brand – and by extension the branded company, organization, product or service. A 'brand' involves using a name, term, colour, symbol, design or combination of these to identify the goods or services to make them appealing. Brands often speak to who we are and our aspirations, humanise the product and give it a personality of its own. E.g. Nike – 'swoosh', energy, movement, quality, a way of life, free, independent, overcoming all obstacles, physical limitations and inhibitions, 'tick' – affirmative, 'just do it'. Swoosh – Single image communicates what the organisation want its customers to know about them.	4	<p>Concise and detailed response which makes reference to two or more of the opposite ideas in detail and includes appropriate brand / product examples given which support points made. (4 marks)</p> <p>Sound response which makes reference to two of the opposite ideas in brief or one in detail with at least one appropriate example to support points made. (3 marks)</p> <p>Basic response which makes reference to one of the above ideas in brief but may not have included an example or example is not relevant. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p>
3	b	i	<p>Any three appropriate advertising methods a manufacturer might use to market their products.</p> <p>e.g. Billboard/bus stop/bus poster campaign, newspapers and magazines; product placement in TV programmes; TV, radio and cinema advertising; sports sponsorship; celebrity endorsement/ 'face of', consumer advertising (large logos on clothing etc.)</p> <p>Viral marketing – internet social networks, buzz words.</p>	3	3 x 1 mark





Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	b	ii	<p>A concise and detailed response showing a good understanding of how the specific method of advertising increases sales and including relevant examples of products. (4 marks)</p> <p>A sound response showing a basic understanding of how the specific method of advertising increases sales and may include a relevant product example. (2–3 marks)</p> <p>A simplistic statement which mentions one point only or a relevant example product only. (0-1 mark)</p>	4	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	a		<p>Solution is fully feasible and suitable for manufacture in this quantity. Surface decoration is appropriate and compliments the design. (4 marks)</p> <p>Solution might not be completely feasible / suitable for manufacture in this quantity. Surface decoration may not have been added or be appropriate or compliment the design. (2 – 3 marks)</p> <p>Solution is insufficiently detailed, not feasible or suitable for manufacture in this quantity. No surface decoration. (1 mark)</p>	4	
4	b	i	<p>A suitable material that is specifically named. E.g. plywood, MDF, aluminium, polystyrene, acrylic, felt, card, biscuit mix, pastry etc. (1 mark)</p>	1	
4	b	ii	<p>The reason shows good understanding of the working properties of the material. (2 marks)</p> <p>The reason is vague and lacking in understanding of the properties of the materials. (1 mark)</p>	2	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	c		<p>All main stages of manufacture listed correct and in correct order. Appropriate quality control measures identified and in the correct place. (7 – 8 marks)</p> <p>Most main stages of manufacture listed and correct but may not be in correct order. Appropriate quality control measures identified but may not be in correct place. (5 – 6 marks)</p> <p>Some main stages of manufacture identified but information may be insufficiently detailed and in wrong order. Appropriate quality control measures may not have been identified or may be incorrect for the manufacturing process. (3 – 4 marks)</p> <p>Little or no main stages of manufacture identified or information is vague and/or in wrong order. Appropriate quality control measures have been identified or may be incorrect for the manufacturing process. (0 – 2 marks)</p>		
4	d		<p>A well planned layout and feasible order of processes, sequence is clear with no major omissions. Appropriate division of labour. Suitable for producing 20. Correctly named tools and equipment for major stages of manufacture. Comprehensive and appropriate quality control measures and feedback included. (8-10 marks)</p> <p>A generally correct layout and sequence of manufacturing detailed but maybe some omissions. Division of labour is feasible but may be disproportionate for some tasks. Suitable for producing 20. Correctly named tools and equipment for major stages of manufacture. Quality of communication is reasonable. Some appropriate quality control measures and feedback included. (5-7 marks)</p> <p>Only part of the layout or process superficially detailed or unsuitable</p>	10	

			<p>for producing 20. Division of labour may not be feasible or may have not been considered. Some tools and equipment are correctly named. Quality control measures or feedback may not be included or may not be appropriate to process. (2-4 marks)</p> <p>Limited or no response. (0-1 marks)</p>		
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Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	a			8	Please refer to table and answers below. (8 X 1 mark)

Symbol	Meaning	Product
	Recyclable material	Any acceptable product which can be recycled e.g. sandwich packaging
	Recyclable – high density polystyrene Accept recyclable plastic Resin Identification Code to help recyclers to identify main plastic used.	Milk crates. Bottles, barrels, tanks, pipes, chemical pumps, machine parts (e.g. gear wheels). Houseware (e.g. buckets, bowls)
	Reusable – take to bottle bank	Wine bottle
	Do not throw in everyday bin	Batteries

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	b		Any two strategies supermarkets employ to encourage us to stop wasting materials. E.g. bags for life; limiting giving out of carrier bags; less plastic used in manufacture of carrier bags; carrier bags fully recyclable; reducing packaging; recycling banks in car parks; replacing non-renewable packaging materials for renewable ones e.g. using card instead of plastic; using recycled Polyethylene Terephthalate (rPET), which can itself be fully recycled, in food packaging.	4	Sound response which makes reference to two of the opposite ideas or one idea in detail. (2 marks) Brief / single word answer with reference to one idea only. (1 mark) 2 x 2 marks

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	c	i	<p>Compact discs are made of non-recyclable plastic and have a limited life span in use as they can be scratched. CD packaging (to protect and market the CD) uses large amounts of plastics and printed card. CD players are still in use but reducing in popularity as they are a permanent media which cannot be renewed or refreshed – the music is pre-recorded to the CD and cannot then be removed or the playlist edited. Music tends to be a collection of tracks from one artist which cannot be edited by the user. Production of CDs uses energy and produces waste. To dispose of would be thrown away which wastes plastics which are non-renewable; will end up in a land fill.</p>	3	<p>A concise and detailed response relating to environmental impact showing a good understanding of two or more points fully expanded. (3 marks)</p> <p>A clear description relating to environmental impact which mentions more than one issue. (2 marks)</p> <p>A simplistic statement which mentions one point only. (1 mark)</p>
5	c	ii	<p>Music is downloaded from a computer and is the user's choice of tracks; music can originally come from the internet taking away the need to buy CDs and therefore reducing consumption of plastics and card for the CD and its packaging and the energy and resources used in their manufacture. The user can purchase individual tracks rather than albums. Can use rechargeable batteries which is better for the environment as batteries have a much longer life span and so less end up in landfill;</p> <p>Other suggestions:</p> <p>MP3 players store music as a data file and not many can be stored at a time and deleted when finished with. No waste materials.</p> <p>Fewer moving/mechanical parts hence product has a potentially longer life cycle.</p> <p>No transport costs involved in downloading tracks. CD's have to be transported to a point of sale.</p>	3	<p>A concise and detailed response relating to reduced environmental impact showing a good understanding of two or more points fully expanded. (3 marks)</p> <p>A clear description relating to reduced environmental impact which mentions more than one issue. (2 marks)</p> <p>A simplistic statement which mentions one point only. (1 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	a	i	<p>Checks made before, during and after manufacture is a key phrase lots of candidates will use.</p> <p>Quality Assurance: an overall approach to ensure products attain a consistently high standard. Throughout the manufacturing process, materials, equipment, production processes and training of staff need to be checked and monitored. Consumer views may also be considered. The British Kite Mark and CE mark relate to quality assurance as well as product safety.</p>	2	<p>Sound response which makes reference to two of the opposite idea in brief or one idea in detail. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p> <p>Max one mark for QC checks.</p>
6	a	ii	<p>Tolerance: If a large quantity of a product is made, it is not always possible to guarantee that every product is absolutely identical. A tolerance is applied dictating, for example, the minimum and maximum measurements. Tolerances are the acceptable range of differences from the agreed standard, documented as plus and minus values and applied to such factors as size, weight and performance.</p>	2	<p>Sound response which makes reference to two of the opposite ideas in brief or one idea in detail. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p>
6	b		<p>British Standards Kite Mark helps to ensure the safety and quality of products and services. A standard is made up of a series of tests and companies pay to have their products tested against national standards. BSI Kitemark is a quality standard to guarantee to the consumer that the products are consistently of a high quality and safety standard. Conformance European ensures the product meets a minimum standard to be sold within the EU. The two differ in that BSI is a guarantee of a much higher quality standard than CE.</p>	3	<p>A concise and detailed response showing a good understanding of two or more points fully expanded. (3 marks)</p> <p>A clear description which mentions more than one issue. (2 marks)</p> <p>A simplistic statement which mentions one point only. (1 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	c		<p>A concise and detailed response showing a good understanding of how a manufacturer would apply quality control testing to one of the products shown including relevant examples of tests. (4 marks)</p> <p>A sound response showing a basic understanding of how a manufacturer would apply quality control testing to one of the products shown and may include a relevant qc test. (2 – 3 marks)</p> <p>A simplistic statement which mentions one point only or a relevant example test only. (1 mark)</p>	4	See specific responses below.



Chair

Visual checks for faults in materials, surface finishes, joints. Legs / frame joined to seat/back securely. Seat/back curve matches pattern/former. Destruction, wear tests; weightbearing; fire retardancy.



Shirt

Visual checks for faults in materials, surface decoration, seams straight; Buttons sewn on securely and in straight line; Size – in tolerance with standard sizing; Destruction, wear tests.



Apple pie

HACCP, proportion of filling to case; thickness of pastry; cooking time; time taken to go off; taste tests – sampling.



Tea cup and saucer

Smooth surface – removal of sprue. Complete components; application of glaze; Transfer print registration; wear tests (dishwasher?); heat resistance, water resistance.



Greetings Cards

Print registration; die cutting registration; colour rendition; straight fold; faults in materials (card) components.



Scientific calculator

Visual checks for faults in materials, button panel fit; surface symbol registration; Destruction, wear tests; Case fit; battery life; electronic function; circuit board assembly.

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	a		<p>Explain the value of modelling and prototyping in the development of a new product.</p> <p>Can test 2D idea in 3D to check proportions, functionality, aesthetics, materials, wear in use, market testing, construction techniques. Testing the design in 3D helps to identify unresolved design issues which the designer may not have thought of or realised. Would need to include stress analysis, costings, manufacturing / assembly issues such as moulds, etc. Fully developed prototypes are the result of many developments of the original design – the design improved significantly upon the original.</p>	4	<p>Concise and detailed response which makes reference to two or more of the opposite ideas in detail. (4 marks)</p> <p>Sound response which makes reference to two of the opposite ideas in brief or one in detail. (3 marks)</p> <p>Basic response which makes reference to one of the opposite ideas in brief. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	b		<p>Describe some of the ways Information Communication Technology (ICT) can be used in developing and modelling ideas.</p> <p>CAD 3D modelling using AutoCAD/ pro desktop etc. – To show virtual product which can be machined out using a 3D prototype to test before incurring cost of setting machinery to manufacture; to help the designer visualise the product in 3D; to interface with CAM equipment (CNC).</p> <p>Would need to include stress analysis, destructive testing, marketing/seeking customer feedback, production planning etc.</p> <p>CAD 2D designing applications such as photoshop, corel draw, 2D design can be used to develop product in 2D. Drawings can be output to laser cutter / vinyl cutter / digital printer etc. Files can be edited to test different colourways, effects, sizes etc and each development saved.</p> <p>Files can be saved, shared with others in different locations by email, edited without needing to start again.</p>	6	<p>Concise, detailed and well reasoned response which makes reference to three or more of the opposite ideas in detail. (5 – 6 marks)</p> <p>Sound response which makes reference to two of the opposite ideas in detail or several in brief. (3 – 4 marks)</p> <p>Basic response which makes reference to one of the opposite ideas in detail or two in brief. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p>