

Design and Technology

Advanced GCE

Unit **F524/01**: Product Design: Component 1

Mark Scheme for June 2013

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Question		Answer	Mark	Guidance
1	(a)	<ul style="list-style-type: none"> • The wall should be strong enough to resist stresses due to its own weight, imposed and lateral wind loads. • The wall should have sufficient stability in terms of its resistance to overturning by lateral forces and buckling. This can be caused by the wall being too slender in relation to its height ie. slenderness ratio. • The wall should provide resistance to the weather and in particular penetration due to rain and wind. The amount of resistance required will depend on its height, the locality and degree of exposure to the elements. • The wall should be resistant to fire and stop a fire spreading to adjacent buildings. • The wall should have sufficient resistance to the passage of heat to satisfy the requirements of the Building Regulation's Approved Document L Conservation of Fuel and Power. • The wall should have sufficient resistance to the passage of sound, from both airborne and impact sources. If the external wall's other functional requirements are satisfied the passage of sound to the inside of the building should be excluded to an acceptable level. • The wall should have aesthetic appeal brought about by the colour, texture and shape of the materials used and the architectural style of the building. • The wall should provide security in that it prevents easy access or entry by people and animals. • The wall should provide privacy in that it provides areas that regulate or reduce vision. 	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	Quality control checks should include monitoring of each of the design functions identified in Question (a) particularly		<p>brief description or statement</p> <p>1 mark</p>

Question	Answer	Mark	Guidance
	<p>with regard to the appropriate Building Regulation's Approved Document, Approved Code of Practice (ACOP) etc and:</p> <ul style="list-style-type: none"> • Visual checks of materials/components together with relevant labelling/certification regarding British Standards, Euro Codes, British Board of Agreement etc. • Workmanship in terms of the wall is plumb with no bulging or bowing, level along its length and its dimensions are within the accepted industrial tolerances. 	[4]	<p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>
(c)	<p>Examples of environmentally friendly product design could be:</p> <ul style="list-style-type: none"> • Use of materials from sustainable sources eg. timber - Forestry Stewardship Council etc. • Use of local materials to avoid pollution due to transportation. • Use of recycled materials eg. crushed bricks/concrete from demolished buildings used for aggregates, waste paper, sheep's wool used in the production of insulating materials etc. • Use less materials • Use of alternative energy sources to process the material/manufacture the product ie. the reduction of embodied energy. • Use of hardwood veneers on softwood/plywood backing rather than full sectioned timber. • Ensure the product can be recycled at the end of its life to reduce landfill. 	[4]	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>

Question		Answer	Mark	Guidance
	(d)	<p>Benefits of JIT could include:</p> <ul style="list-style-type: none"> Minimal storage required – smaller factories Reduced wastage – only manufacture to order Allows bespoke specification for products Flexible system, can react to market demand Overall costs reduced – consumer benefits from low retail price <p>Can be built into CIM system for automatic stock control</p>	[4]	<p>Level 2 (3 - 4 marks)</p> <p>Two benefits well explained, demonstrating clear understanding of JIT, with examples used.</p> <p>Level 1 (0 – 2 marks)</p> <p>Brief/limited description of issue/s relating to JIT.</p>
	(e)	(i) <p>Material</p> <ul style="list-style-type: none"> Brick Mortar Stone Timber weatherboarding-cedar PvcU cladding Concrete block or plywood with a rendered finish <p>Properties or characteristics will be related to strength, durability, weight, rigidity, size and availability</p>	[3]	<p>award mark for other appropriate material not listed</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>
		(ii) <p>Cavity walls in masonry</p> <ul style="list-style-type: none"> Comprised of two leaves or skins tied together with stainless steel or plastic wall ties positioned at 900mm centres horizontally and 450mm vertically at 450mm offsets. Where an opening occurs the ties should be spaced at no more than 300mm vertically. The outer leaf is usually of facing brick in stretcher 		<p>Level 3 (5-6 marks)</p> <p>Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Level 2 (3-4 marks)</p> <p>Key stages presented, reasonably well described with key</p>

Question	Answer	Mark	Guidance
	<p>bond while the load-bearing inner leaf is constructed of lightweight or aerated concrete blocks.</p> <ul style="list-style-type: none"> • The cavity prevents any water that has penetrated the outer leaf from reaching the inner leaf and improves the thermal efficiency of the wall as the air in the cavity is a good insulator. • To achieve the standards of thermal insulation required by Approved Document L Conservation of Fuel and Power of the Building Regulations some form of insulation needs to be added to the wall. This can be in the form of partial cavity fill, full cavity fill or the insulation applied to outer face of the inner leaf. • Cavity walls should be built no more than 1000mm in height before the other leaf is built. • Where a section of the cavity wall is built below ground level it must be filled with weak concrete to prevent both leaves of the wall moving towards each other as a result of earth pressures. • A horizontal damp proof course should be incorporated into the wall at a minimum of 150mm above ground level and vertically at window/door openings. • Where the floor joists are parallel to the wall lateral restraint of the wall can be achieved by galvanised steel restraint straps fastened to the top edge of a minimum of three floor joists and hooked over the internal leaf of the wall. Where the floor joists are at right angles to the wall galvanised steel restraint hangers supporting the joists are hooked over the inner leaf of the wall. • At roof level the triangular section of brickwork of the gable end (pike) is restrained using galvanised steel restraint straps along the top and bottom chords of at least the last two trussed rafters and hooked over the inner leaf of the wall. The spacing of the restraint 		<p>features identified</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description</p> <p>Quality of description and communication</p> <p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

Question	Answer	Mark	Guidance
	<p>straps should not be greater than 2000mm. This has the effect of transmitting wind loads on the wall into the roof structure.</p> <p>Cavity walls with inner leaves of timber or steel frames</p> <ul style="list-style-type: none"> • The outer leaf is usually of facing brick in stretcher bond while the load-bearing inner leaf is manufactured in a factory using strength graded timber or steel frames. However, where conditions allow the outer brick leaf can be replaced by timber weatherboarding or pvcU cladding. • The ground floor frames are bolted to a wooden soleplate that is laid on an horizontal damp proof course to provide protection from moisture ingress. • To achieve the standards of thermal insulation required by Approved Document L Conservation of Fuel and Power of the Building Regulations some form of insulation needs to be added to the wall. This can be in the form of quilt insulation placed between the vertical studs of the frame. Alternatively, Structural Insulated Panels (SIPs) can be used where rigid insulation is incorporated into the panels at the manufacturing stage. • A vapour barrier is used behind the plasterboard to prevent vapour created when using kitchens, showers etc. permeating through the wall. • A vapour check is used on the cavity side of the frame to allow any vapour that has permeated into the wall through holes in the barrier where cut for light switches etc. to permeate into the cavity. • The two walls are tied together by fixing L shaped galvanised steel ties to the frame's vertical studs positioned at every fifth course of brickwork as the work proceeds. 		

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • Where the floor joists are parallel to the wall lateral restraint of the wall can be achieved by galvanised steel restraint straps fastened to the top edge of a minimum of three floor joists and hooked over the frame. Where the floor joists are at right angles to the wall galvanised steel restraint hangers supporting the joists are hooked over the frame. • At roof level the triangular section of brickwork of a gable end (pike) is restrained using galvanised steel restraint straps along the top and bottom chords of at least the last two trussed rafters and hooked over the frame. The spacing of the restraint straps should not be larger than 2000mm. This has the effect of transmitting wind loads on the wall into the roof structure. • To prevent fire spreading within the wall's cavity fire stopping is required around all openings, horizontally at joist and eaves levels and vertically to break up large areas of cavity. 	<p>[6]</p>	

Question	Answer	Mark	Guidance
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control in manufacture • Risk assessments • Legal implications • Cost implications • Manufacturer reputation • Appropriate testing <p>examples</p> <ul style="list-style-type: none"> • BSI – CE – BBA (construction) specific regulations • Specific testing/trialling examples • Specific product labelling • In-house testing • Third party testing • User trialling • 	[8]	<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
Q1 Total Mark 36			

Question		Answer	Mark	Guidance
2	(a)	<ul style="list-style-type: none"> The bracket must be strong enough to support the weight of a camera without collapsing The brackets must be able to be fixed firmly to a wall or other surface The material used for the bracket must resist corrosion to make it more durable The design of the bracket should allow easy connection of power to the camera The bracket must provide a stable platform for the camera to ensure clear images The bracket should be made 'vandal proof' to prevent malicious damage The mounting surface should be large enough to allow movement of the camera into different positions The design of the bracket should allow east mounting and removal of the camera for maintenance/repair 	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> Check positioning of holes for accuracy using jig/gauge Removal of machining 'burrs' before bending Check angle of bend for accuracy before fixing brace Check positioning of brace using jig before fixing in place Visual check of weld to ensure strength of joint Check for distortion after welding – visual/jig Visual/tactile test of surface prior to application of finish Final quality check for consistency/accuracy and 	[4]	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>

Question		Answer	Mark	Guidance
		surface finish		
	(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> • Use materials from sustainable/local sources • Use less materials • Design for easy disassembly for recycling • Reduce packaging • Flat-pack for more efficient transport • Use more readily recyclable materials • Keep amount of material in product to a minimum 	[4]	<p>brief description or statement 1 mark detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>
	(d)	<p>Benefits of JIT could include:</p> <ul style="list-style-type: none"> • Minimal storage required – smaller factories • Reduced wastage – only manufacture to order • Allows bespoke specification for products • Flexible system, can react to market demand • Overall costs reduced – consumer benefits from low retail price <p>Can be built into CIM system for automatic stock control</p>	[4]	<p>Level 2 (3 - 4 marks)</p> <p>Two benefits well explained, demonstrating clear understanding of JIT, with examples used.</p> <p>Level 1 (0 – 2 marks)</p> <p>Brief/limited description of issue/s relating to JIT.</p>
	(e) (i)	<p>Material</p> <p>Steel (accept any form) Stainless steel Aluminium alloy</p> <p>Properties or characteristics</p> <ul style="list-style-type: none"> • easy to form into shapes required • can produce strong structures • accepts finishes easily/ corrosion resistant • relatively inexpensive 		<p>Award mark for other appropriate material not listed, but must not be soft or brittle.</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic, but must clearly relate to the material given</p> <p>2x1 mark</p>

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • readily fabricated/welded • easily machined (drilling holes) 	[3]	
	<p>(ii) Mounting bracket</p> <ul style="list-style-type: none"> • material for bracket cut to size from 100x5 strip • bracket shape and hole positions marked on strip or programmed into CNC machine • bracket shape and holes cut – flame/plasma cutter; milling machine; drilling machine or CNC miller/laser cutter/water-jet cutter <p>QC – check positioning of holes and outline shape accuracy - jig/template/scan</p> <ul style="list-style-type: none"> • mark and cut bracket brace from 50x5 strip – cut-off saw/disc • Bend bracket and brace to required angles – bending jigs (heat required unless hydraulics used to provide bending force) • QC - inspection and trial assembly before joining process • assemble bracket and brace in jig to maintain alignment while welding 		<p>Level 3 (5-6 marks) Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Level 2 (3-4 marks) Key stages presented, reasonably well described with key features identified</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description</p> <p>Quality of description and communication</p> <p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p> <p>Max 1 if no sketch/chart used</p>

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • weld bracket and brace together – metal arc/MIG/TIG (TIG if aluminium alloy used for parts) QC – check alignment and security of welds • Apply suitable finish if required (not stainless steel) Final QC – visual check for finish quality/defects <p>Use of presswork for producing shape accepted but inappropriate for batch size.</p>	[9]	Award credit where possible if response doesn't link to chosen material or specified batch size.
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control in manufacture • Risk assessments • Legal implications • Cost implications • Manufacturer reputation • Appropriate testing <p>Examples:</p> <ul style="list-style-type: none"> • BSI – CE – specific regulations. Eg. EN 71-1:2005+A8:2009 Safety of toys: Mechanical and physical properties • Specific testing/trialling examples – crash dummy testing; flameproof testing of electrical equipment • Specific product labelling 	[8]	<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
Q2 Total Mark			36

Question		Answer	Mark	Guidance
3	(a)	<ul style="list-style-type: none"> • Appropriate size(15 cm-20cm) family sized • (20 30 cm) party sized • Attractive appearance , decorated with icing sugar/icing/ piping • Light texture of cake can be cut easily and eaten in the hand • Colour of the cake , golden to reflect eggs/butter • 1 cm layer of whipped cream/butter cream to give luxury market appeal • Whole fruit jam layer to add colour/texture/ flavour • Use UK grown fruit jam to reflect local/ seasonal foods 	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> • Checking ingredients for date marking/damage/contamination • Accurate weighing of ingredients-to obtain correct consistency • Time and speed of mixing –to have even texture • Consistency of dough-to have an even texture • Portion size into cake tins- equal shaped/weight cakes • Temperature control—even cooking/colour • Time control- ensure even cooking and consistency in finish/cooked for colour and texture • Colour sensor-to guarantee colour • Cooling time- prevent a soggy finish • Checking quality of components on arrival/check date marks • Metal detector for safety • Bacterial content check • Computer sensors monitor pH levels 	4	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>

Question		Answer	Mark	Guidance
		<ul style="list-style-type: none"> • Weight of finish cake • Accuracy and finish of decoration • Sealing packaging –to exclude air • Moisture sensor- to ensure correct degree of crispness 		
	(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> • Use locally grown ingredients to reduce carbon footprint/food miles • Reduce packaging-single wrapped • make packaging reusable eg bags/jars • Use recycled materials for packaging • Make packaging biodegradable • Use paper or card from sustainable forests • Avoid harmful processes such as bleaching • Include recycling information on the packaging • Avoid the use of mixed material packaging which is difficult to recycle • Reduce use of GM /irradiated food -use Organic foods with no artificial pesticides • Buy local /UK -reduce carbon footprint of imported foods • Minimum reheating / use of microwave to reduce energy use 	4	<p>brief description or statement 1 mark detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • Forms an emulsion with fat to trap air bubbles • Increases bulk • Castor is a fine ground sugar with a high surface area to trap more air <p>Vanilla essence</p> <ul style="list-style-type: none"> • Adds flavour • Improves aroma 	3	
	<p>(ii) Ingredients : butter or margarine, castor sugar, eggs, self raising flour, vanilla essence</p> <ul style="list-style-type: none"> • Butter or margarine and sugar is creamed in a mixer . Air is beaten in to form an air – in –fat foam. The abrasive action of the sugar crystals separates the fat and air becomes trapped in the mixture • Egg is gradually added this allows some of the sugar to dissolve. • Further beating holds some air in the stretchy protein network. • Flour is gently folded in to prevent the displacement of some of the air. • A smooth dropping consistency is required to allow the air to expand • Mixture is extruded into moulds in exact amounts • Baked in a tunnel oven for an exact amount of time and temperature <p>In the oven:</p> <ul style="list-style-type: none"> • the fat melts and is absorbed by the starch in the flour • the self raising flour containing baking powder releases carbon dioxide • liquid from eggs is released a steam • air , steam and carbon dioxide expand, causing the 		<p>Level 3 (5-6 marks) Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Level 2 (3-4 marks) Key stages presented, reasonably well described with key features identified</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description</p> <p>Quality of description and communication</p> <p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

Question	Answer	Mark	Guidance
	<p>cake to rise</p> <ul style="list-style-type: none"> • starch gelatinises • protein coagulates inside the mixture • the surface of the cake browns due to non- enzymic browning reaction between the carbohydrates and the protein <p>Assembly</p> <ul style="list-style-type: none"> • The cooked cakes are cooled in a blast chiller • Cakes assembled – Base layer • Jam deposited and spread <p>Cream extruded and piped into place Top layer added Icing sugar is dusted over the surface</p>	9	
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control system –HACCP • Strict hygiene regulations throughout the food chain for all workers • Legal implications • Cost implications • Training of workers • Quality control in manufacture • Risk assessments • Manufacturer reputation • Appropriate testing 		<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>

Question	Answer	Mark	Guidance
	<p>Examples could be:</p> <ul style="list-style-type: none"> • Microbial testing of raw ingredients/stages of manufacture/final product • Microbial testing carried on storage time and conditions • Packaging information on storage conditions/cooking/reheating times and temperatures • Food safety regulations: Food Safety Act 1990 –all stages of production are included. • Environmental health officers can enter premises and inspect food • Food Safety Act 1995 – ensures high standards • Food premises should be clean and in good repair/easy to disinfect • Adequate lighting and ventilation • Food safety temperature Control 1995 gives guidance on temperatures 	8	
Q3 Total Mark			36

Question		Answer	Mark	Guidance
4	(a)	<ul style="list-style-type: none"> The sign must be waterproof. The sign should be flexible to withstand the weather, wind etc. The sign material should be suitable for screen printing. The sign should be easy to read from a distance. The sign should be easy to erect at various heights if required. There should be enough room for all of the information. Appropriate use of fonts. Spot colours can be used creating a vibrant eye catching design. 	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> Visual checks of colour application Visual checks of assembly details Measurement checks of individual parts Quality/clarity of printing Hole positioning 	4	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>
	(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> Use materials from sustainable/local sources Use less materials Use more environmentally friendly inks Design for easy disassembly for recycling Reduce packaging Flat-pack for more efficient transport 	4	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>

Question		Answer	Mark	Guidance
		<ul style="list-style-type: none"> • Use more readily recyclable materials • Keep amount of material in product to a minimum • Use digital graphics to eliminate the need for paper/ink 		
	(d)	<p>Benefits of JIT could include:</p> <ul style="list-style-type: none"> • Minimal storage required – smaller factories • Reduced wastage – only manufacture to order • Allows bespoke specification for products • Flexible system, can react to market demand • Overall costs reduced – consumer benefits from low retail price • Can be built into CIM system for automatic stock control 	4	<p>Level 2 (3 - 4 marks)</p> <p>Two benefits well explained, demonstrating clear understanding of JIT, with examples used.</p> <p>Level 1 (0 – 2 marks)</p> <p>Brief/limited description of issue/s relating to JIT.</p>
	(e) (i)	<p>Sign Material</p> <ul style="list-style-type: none"> • Corroflute, correx, fluted sheet etc. • Foamed/blown plastic sheet. • Aluminium sheet, exterior quality plywood. <p>Properties or characteristics</p> <ul style="list-style-type: none"> • high quality finish; • easy to screen print onto • lightweight • easy to finish • quick to manufacture the final product • weather/UV resistant 	[3]	<p>award mark for other appropriate material not listed</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>

Question		Answer	Mark	Guidance
		<p>Examples:</p> <ul style="list-style-type: none"> • BSI – CE – specific regulations. Eg. EN 71-1:2005+A8:2009 Safety of toys: Mechanical and physical properties • Specific testing/trialling examples – crash dummy testing; flameproof testing of electrical equipment • Specific product labelling 	[8]	<p>good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks)</p> <p>Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
				Q4 Total Mark 36

Question		Answer	Mark	Guidance
5	(a)	<ul style="list-style-type: none"> • The shelving system should take different sized brackets for different shelf widths • The brackets must fit firmly into the support rails to avoid the danger of them falling out • Must be made of a material that is strong enough to take the weight of shelves full of books or other items • The slots in the support rails must allow the brackets to be moved without difficulty or tools • The system must be aesthetically pleasing as it may be used in any room of the house • The support rails must have enough fixing holes to allow them to attached firmly to a wall • The material used for the system must resist corrosion to make it more durable 	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> • Material testing to ensure suitability for forming process • Check accuracy of channel section after bending/extrusion before beginning drilling/piercing • Check positioning of fixing holes using jig/gauge 		<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p>

Question		Answer	Mark	Guidance
		<ul style="list-style-type: none"> • Check alignment and positioning of bracket slots – jig/scanner • Visual/tactile test of surface prior to application of finish • Final quality check for consistency/accuracy and surface finish 	4	Two quality control checks clearly described
	(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> • Use materials from sustainable/local sources • Use less materials • Design for easy disassembly for recycling • Reduce packaging • Flat-pack for more efficient transport • Use more readily recyclable materials • Keep amount of material in product to a minimum 	4	<p>brief description or statement 1 mark detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>
	(d)	<p>Benefits of JIT could include:</p> <ul style="list-style-type: none"> • Minimal storage required – smaller factories • Reduced wastage – only manufacture to order • Allows bespoke specification for products • Flexible system, can react to market demand • Overall costs reduced – consumer benefits from low retail price • Can be built into CIM system for automatic stock control 	4	<p>Level 2 (3 - 4 marks)</p> <p>Two benefits well explained, demonstrating clear understanding of JIT, with examples used.</p> <p>Level 1 (0 – 2 marks)</p> <p>Brief/limited description of issue/s relating to JIT.</p>

Question		Answer	Mark	Guidance
	(e) (i)	<p>Material</p> <p>Steel (accept any form) Stainless steel Aluminium alloy Brass</p> <p>Accept thermoplastics such as ABS, HIPS (polypropylene) But not PETE or other polyethylene variants</p> <p>Properties or characteristics</p> <ul style="list-style-type: none"> • easy to form into shapes required • strong enough to carry weight of loaded shelves • accepts finishes easily • corrosion resistance / durability • readily recycled after use • relatively inexpensive 	3	<p>Award mark for other appropriate material not listed, but must not be soft or brittle.</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic, but must clearly relate to the material given</p> <p>eg. <u>Not</u> relatively inexpensive if <u>Brass</u> is given</p> <p>2x1 mark</p>
	(ii)	<p>Support rail</p> <ul style="list-style-type: none"> • material made into 'channel' section steel/stainless steel – pressed/rolled aluminium alloy/brass/plastics - extrusion • rolled sections cropped to length; extruded • sections cut-off from extruder • bracket slots cut into rails punching/pressing (progression tool)/laser cutting QC – check positioning/spacing of slots – jig/template/scan • fixing holes cut into rails – jig drilled / CNC miller/ punching/pressing (not plastics) 		<p>Level 3 (5-6 marks) Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Level 2 (3-4 marks) Key stages presented, reasonably well described with key features identified</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description</p> <p>Quality of description and communication</p>

Question	Answer	Mark	Guidance
	<p>*'pierce and plunge' may be done to produce countersink on metal rails</p> <p>QC - final inspection before finishing processes</p> <ul style="list-style-type: none"> • finish applied (metal rails only) – stainless steel – none steel – paint; plastic/powder coating brass – polish and lacquer aluminium alloy – anodising/polish and lacquer <p>Final QC – visual check for finish quality/defects</p>	9	<p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material or specified batch size.</p>
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control in manufacture • Risk assessments • Legal implications • Cost implications • Manufacturer reputation • Appropriate testing <p>Examples:</p> <ul style="list-style-type: none"> • BSI – CE – specific regulations. Eg. EN 71-1:2005+A8:2009 Safety of toys: Mechanical and physical properties • Specific testing/trialling examples – crash dummy testing; flameproof testing of electrical equipment • Specific product labelling • In-house testing • 3rd party testing • User trialling 	8	<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
Q5 Total Mark 36			

Question		Answer	Mark	Guidance
6	(a)	<ul style="list-style-type: none"> The storage unit must be of sufficient size to accommodate a reasonable range of toys The storage unit must be robust as toys will be thrown in The storage unit must have a bright, colourful finish to fit into the child bedroom environment The storage unit lid must have a handle or be able to easily lift by a child There must be some way in which the lid cannot fall onto the child causing harm Parts of the unit must be well secured and not come off causing a hazard. 	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> Visual checks of colour application Visual checks of assembly details Measurement checks of individual parts after lengthy runs (1000) – tool wear Practical assembly checks – axles fitting, wheels secure – lid closes correctly 	4	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>
	(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> Use materials from sustainable/local sources Use less materials Design for easy disassembly for recycling Reduce packaging Flat pack for more efficient transport Extend the product lifetime 	4	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>

Question	Answer	Mark	Guidance
	<p>Properties or characteristics</p> <ul style="list-style-type: none"> • Easily machined without deformation • Rigid in thin sheet form • can accept appropriate finish;- aluminium and acrylic self finished. <p>Part C - Wheel</p> <ul style="list-style-type: none"> • HDPE • ABS • Nylon <p>Properties or characteristics</p> <ul style="list-style-type: none"> • Available in range of colours; • Easily injection moulded; • Resist impact • Gives a good finish. 	3	
	<p>(ii)</p> <p>Part A - Side</p> <p>Machine routed</p> <ul style="list-style-type: none"> • CAD file created • Boards purchased/cut to size/tessellated • Secured to router bed – vacuum • Set tools • Set data point • Lid closed/extraction fixed • cut • edge treatment applied • CNC drill 8 holes • repeat 		<p>Level 3 (5-6 marks) Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Level 2 (3-4 marks) Key stages presented, reasonably well described with key features identified</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description</p> <p>Quality of description and communication</p>

Question	Answer	Mark	Guidance
	<p>Part B - Grill</p> <p>Metal cutting/stamping</p> <ul style="list-style-type: none"> • Cad file prepared • Press tool created • Grills cut/purchased at correct size • Place in press • Guards in place • Stamp • Check edges • Repeat <p>Injection moulding (must have details of mould for full marks)</p> <ul style="list-style-type: none"> • CAD file prepared • Mould created – single or multiple • Granules in hopper • Mould heated • Plastic heated/injected • Mould cooled • Grill ejected – edge treated • Repeat <p>Could also be industrially Laser cut</p> <p>Part C- Wheel</p> <p>Injection moulding (must have details of mould for full marks)</p> <ul style="list-style-type: none"> • CAD file prepared • Mould created – single or multiple 		<p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • Granules in hopper • Mould heated • Plastic heated/injected • Mould cooled • Wheel ejected – edge treated • Repeat 	9	
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control in manufacture • Risk assessments • Legal implications • Cost implications • Manufacturer reputation • Appropriate testing <p>examples</p> <ul style="list-style-type: none"> • BSI - CE – specific regulations eg. EN 71-1:2005+A8:2009 Safety of toys: Mechanical and physical properties - • Specific testing/trialling examples • Specific product labelling 	8	<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
Q6 Total Mark			36

Question		Answer	Mark	Guidance
7	(a)	<ul style="list-style-type: none"> The electronic kitchen scales should have a clear readout so that the user can easily see the weight. The scales should be able to measure small weights down to, say, 1g so that small quantities can be accurately weighed. The scales should be able to weigh large weights up to, say, 3kg so that large quantities can be weighed in one go. The scales should be at least splash proof so they are suitable for the kitchen environment. The scales should be able to be easily wiped clean for hygiene reasons. The scale pan should be removable so that spills can be easily cleaned off. There should be multiple weight units so that users can use the units they prefer. There should be a zero button (tare) so that quantities can be weighed in mixing bowls. 	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified.</p>
	(b)	<ul style="list-style-type: none"> Check that waterproof seals are correctly seated. Accuracy check after assembly using standard weights. Check that the display is correctly mounted – straight and level. Check the action of the buttons after assembly to ensure they move freely. Check the surface finish – no scratches – decals intact and straight. Check that case parts are joined correctly – no gaps. 	[4]	<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p>

Question		Answer	Mark	Guidance
	(c)	<ul style="list-style-type: none"> • Use of lead free solder. • Use of RoHS certified components. • Use rechargeable batteries instead of disposable batteries. • Use of solar panel to power the product. • Use recycled materials for construction. • Use less materials • Use of reused parts during construction. • Use reduced energy manufacturing techniques. • Design product to be repairable. • Design product to be easily separated into recyclable parts. • Use materials from sustainable/local sources • Reduce packaging • Keep amount of material in product to a minimum • 	[4]	brief description or statement 1 mark detailed description or justification of statement 2 marks Two examples clearly described
	(d)	Benefits of JIT could include: <ul style="list-style-type: none"> • Minimal storage required – smaller factories • Reduced wastage – only manufacture to order • Allows bespoke specification for products • Flexible system, can react to market demand • Overall costs reduced – consumer benefits from low retail price • Can be built into CIM system for automatic stock control 	[4]	Level 2 (3 - 4 marks) Two benefits well explained, demonstrating clear understanding of JIT, with examples used. Level 1 (0 – 2 marks) Brief/limited description of issue/s relating to JIT.
	(e) (i)	Could use: <ul style="list-style-type: none"> • Strain gauge mounted on a bar or beam which bends when weight is applied. The strain gauge must be mounted on some kind of substrate for full marks. • Variable resistor connected by a linkage to the scale pan – the pan must be spring-loaded. • QTC material which changes resistance when weight 	[3]	Sensor named 1 mark Clear diagram 1 mark Principle of operation clear 1 mark

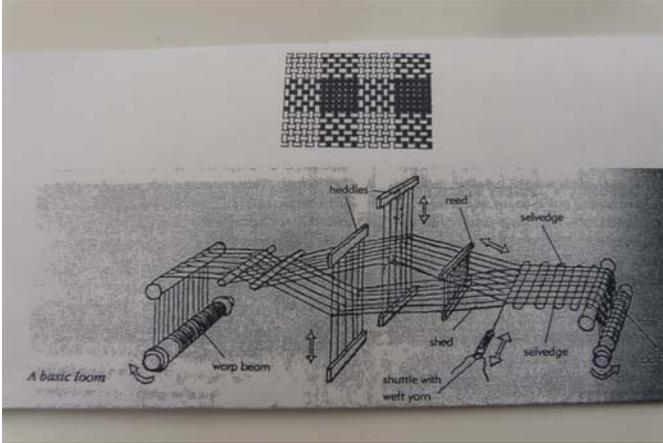
Question	Answer	Mark	Guidance
	<p>is applied. Other correct methods may be described.</p>		
(ii)	<p>Candidates should produce a circuit diagram to process the signal from the named sensor and then display the weight. The candidate should specify the type of display.</p> <p>There are a number of different ways of achieving this. Expected answers might include <u>some</u> of the following features:</p> <ul style="list-style-type: none"> • Amplifier to process the signal from a strain gauge. • Analogue-to-digital converter. • Voltage comparator to compare an analogue voltage to a reference. • Power supply lines identified. • Use of a programmable microcontroller (e.g. PIC or GENIE) with input/output connections to appropriate transducers. An accompanying program flowchart must be given for full marks to be awarded. • Output display – digital readout, LED bargraph, analogue meter, voltmeter etc. 	[9]	<p>Level 3 (5-6 marks) Clear and correctly functional circuit diagram with few errors. Output display described and appropriate for the signal processing method chosen.</p> <p>Level 2 (3-4 marks) Clear circuit diagram containing some relevant functional features. Output display described but may not be suitable for the signal processing method (e.g. a digital display driven by an analogue amplifier).</p> <p>Level 1 (0-2 marks) Attempt at a circuit diagram with little relevance to the application. Output display not described.</p> <p>Quality of description and communication</p> <p>Circuit diagram with some correct BSI symbols 1 mark</p> <p>Complete circuit diagram with mostly correct BSI symbols 2 marks</p> <p>Complete circuit diagram with correct BSI symbols and appropriate annotation (e.g. labelled power supply) 3 marks</p>
(f)	<p>Issues could be:</p> <ul style="list-style-type: none"> • Designing the product to failsafe. • Use of quality materials for safety critical parts. • BSI or CE certification. • Cost implications 		<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks)</p>

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • Legal implications • Manufacturer reputation/history • Quality control in manufacture • Risk assessments <p>Examples could be</p> <ul style="list-style-type: none"> • Electrical safety. • Use of warning stickers on the product. • Quality control during manufacture. • Quality tests after manufacture. • Destruction testing. • Soak testing. • Extreme environmental testing. • No user access to non-serviceable parts. 	[8]	<p>One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks)</p> <p>Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
			Q7 Total Mark 36

Question		Answer	Mark	Guidance
8	(a)	<ul style="list-style-type: none"> • Loose fitting- to be worn over the trousers • Short sleeved- suitable for summer /hot climates • Front fastening- for ease of getting on and off • Reinforced front band to strengthen button holes/buttons • Collar on a collar band – to keep shape of collar • Curved edges and slits at side to be worn comfortably 		<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p>Four justified design requirements.</p> <p>[4] Give one mark if two valid points given but not fully justified.</p>
	(b)	<p>Quality control checks could be:</p> <ul style="list-style-type: none"> • Fabric screening – to check for flaws/colour matches • Fibre analysis for performance characteristics • Accuracy of dimensions and tolerances on patterns • Checking fabrics for suitability for purpose /uniform thickness/durability/recovery etc • Manufactured components ie buttons are fault free • Manufactured processes eg seam contraction/ button holes • Visual checks to ensure colour match to specification • Checking against legislation • NACERAP system – standard system for identifying faults eg wrong needle size will cause puckering of seams. 		<p>brief description or statement 1 mark</p> <p>detailed description or justification of statement 2 marks</p> <p>Two quality control checks clearly described</p> <p>[4]</p>

Question	Answer	Mark	Guidance
(c)	<p>Examples could be:</p> <ul style="list-style-type: none"> • Materials from sustainable/local sources • Use less materials • Recycle water and heat used • Use easy care fabrics requiring a low temperature wash to reduce energy in use • Eco labelling system • Reduce pollution caused by fibre production/dyeing or fabric finishing eg Tencel • Use biodegradable materials • Life cycle analysis of products • Reduce water/chemicals/pesticides when producing natural fibres • Reduce packaging • Recycling materials eg polartec fleece from plastic bottles 	[4]	<p>brief description or statement 1 mark detailed description or justification of statement 2 marks</p> <p>Two examples clearly described</p>
(d)	<p>Benefits of JIT could include:</p> <ul style="list-style-type: none"> • Minimal storage required – smaller factories • Reduced wastage – only manufacture to order • Allows bespoke specification for products • Flexible system, can react to market demand • Overall costs reduced – consumer benefits from low retail price • Can be built into CIM system for automatic stock control 	[4]	<p>Level 2 (3 - 4 marks)</p> <p>Two benefits well explained, demonstrating clear understanding of JIT, with examples used.</p> <p>Level 1 (0 – 2 marks)</p> <p>Brief/limited description of issue/s relating to JIT.</p>

Question		Answer	Mark	Guidance
	(e) (i)	<p>Performance characteristics of linen could include:</p> <ul style="list-style-type: none"> • Cool- lightweight to wear • Comfortable – high moisture absorption retaining up to 50% • Reasonably hard wearing/long lasting - high abrasive resistance • Washes well – withstands a high temperature wash • Soft against the skin- it is a natural fibre non irritant • Shrink proof – good laundering characteristics • Dirt repellent and anti microbial • Dyes evenly giving pure and bright colours • Long fibres make it suitable for producing crisp attractive cool fabrics 	[3]	<p>1 mark for each valid point</p> <p>Three points required.</p>
	(ii)	<p>Two colour checked linen fabric production</p> <ul style="list-style-type: none"> • Flax plant/ annual crop spun into yarns • The yarns used to make the fabric are dyed different colours before the fabric is woven • Warp threads are arranged in colour groups on the loom(up and down) • Weft threads are woven across carried in a shuttle/ jet of water (left to right) • The heddles lift alternate warp threads to allow the shuttle carrying the weft threads through. These move up and down vertically • After the shuttle has travelled across the fabric the first heddle is lowered and the second heddle is raised for the weft threads to pass back. • The read beats the threads close together. • Changing the colour of the weft threads forms the checks. 		<p>Level 3 (5-6 marks) Process fully described, key features and technical details identified. Answer must include detail of specialist equipment for full marks.</p> <p>Level 2 (3-4 marks) Key stages presented, reasonably well described with key features identified.</p> <p>Level 1 (0-2 marks) Some stages outlined (up to 2), very limited description.</p> <p>Quality of description and communication</p> <p>Basic sketch or chart with limited annotation 1 mark</p> <p>Good sketch/chart with main features identified and labelled 2 marks</p> <p>Detailed sketch/chart with clear annotation 3 marks</p>

Question	Answer	Mark	Guidance
		<p>[9]</p>	<p>Max 1 if no sketch/chart used</p>
<p>(f)</p>	<p>Issues could be:</p> <ul style="list-style-type: none"> • Quality control during manufacture eg metal detection for pins/needles • Cost implications • Legal implications • Manufacturer reputation • Risk assessments • Appropriate testing <p>Examples could be:</p> <ul style="list-style-type: none"> • In house testing • BSI testing • User trials and feedback • Risk assessments tests of final products against safety criteria in the manufacturing specification against safety standards, and in extreme conditions 	<p>[8]</p>	<p>Level 3 (6-8 marks) Clear, cogent and well-structured response with two or three issues well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary</p> <p>Level 2 (3-5 marks) One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of one example or supporting evidence</p> <p>Level 1 (0-2 marks) Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited use of examples or supporting evidence</p>
			<p>Q8 Total Mark 36</p>

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