RECOGNISING ACHIEVEMENT

GCE

Design and Technology

Advanced GCE

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

Mark Scheme for June 2011

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1. Built Environment and Construction						
Question			**Expected answers**	**Rationale**		**Mark**
1	**(a)**		**Give four design requirements for the floor structure shown in Fig.1.** **Justify each requirement.** • The floor must provide a smooth and level surface • The floor must provide stability to walls • The floor must resist live or imposed loads eg furniture, people etc • The floor must resist dead loads eg floor finishes, partition walls, ceiling finishes etc • The floor must provide an acceptable level of fire resistance • The floor must provide an acceptable level of sound insulation • The floor must provide an acceptable level of heat loss • The floor must provide resistance to dampness and condensation.	Clear statement and justification required for 1 mark. Must be related to the floor – no marks for generic responses. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of flooring.** **Use sketches and/or notes where appropriate.** • The amount of deflection/spring of the floor to ease stress on leg/ankle joints and muscle fatigue ie when used for dance floors, aerobic/fitness centres, recreation rooms, workshops • Affects on hearing where a lightweight floor structure transmits impact noise to another room. A dense ie, concrete floor would absorb the noise • Texture of the floor finish for non-slip applications ie wet-rooms, changing rooms, • Colour/luminance to contrast the floor surface with the walls to aid visually impaired people	brief description 1 mark detailed description with clear indication and description of the factor 2 marks **Two** factors clearly described. Allow reference to given product.	2x2	**4**

1. Built Environment and Construction						
Question			**Expected answers**	**Rationale**		**Mark**
			• No changes in the level of the floor or obstructions ie thresholds at openings to comply with the DDA.			
	(c)		**Describe two ways in which designs relating to the Built Environment and Construction can be legally protected.** • Design rights-protection in UK of design • Registered designs – ownership of appearance/shape/pattern • Patents – protection against copying of technical/functional aspects • Copyright – protects original ideas – books/software/works of art/music.	Brief explanation 1 mark Detailed explanation 2 marks **Two** examples clearly explained. Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality product in relation to the Built Environment and Construction.** • Brand reliability/reputation • 3rd party testing British Standard • Quality control systems in manufacturing process • Consumer reports eg Which • British Board of Agreement Certificate • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). brief explanation with example 1 mark detailed explanation with example 2 mark **Two** features clearly explained.	2x2	**4**

1. Built Environment and Construction						
Question			Expected answers	Rationale		Mark
	(e)	(i)	**State a suitable specific material for the finish to the floor structure shown in Fig.1.** **Give two properties or characteristics that make the material suitable for this use.** **Material** • Tongue and groove softwood boarding • Hardwood strip boarding • Particle board (flooring grade) including laminated • Plywood (flooring grade) • Wood blocks • Carpet and carpet tiles • Vinyl sheet and tiles. **Properties or characteristics** • Resistant to wear • Resistant to water • Resistant to indentation and impact • Resistant to chemicals • Appearance • Ease of cleaning • Fire resistance • Slipperiness • Cost • Warmth • Resistant to impact sound.	Award 1 mark for other appropriate material not listed. 1x1 mark Award 1 mark for other appropriate property/characteristic. 2x1 mark	1 2x1	**3**

1. Built Environment and Construction						
Question			Expected answers	Rationale		Mark
		(ii)	**Describe, in detail, how an upper floor structure can provide lateral restraint to an external cavity wall. Use annotated diagrams to support your answer.** Joists parallel to the wall Description and sketch to include the use of: • Galvanised steel restraint straps fastened to the top edge of a minimum of three joists and hooked over the internal leaf of the cavity wall. The straps used at no more than 2m centres • A packing piece used between the face of the inner leaf and the adjacent joist • Noggings fastened between each joist to support the steel strap. The noggings should be at least half of the joist depth. Joists at right angles to the wall Description and sketch to include the use of: • Galvanised restraint hangers supporting the ends of the joists and hooked over the inner leaf of the cavity wall.	**Level 1 (0-2 marks)** Some features outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key features identified and reasonably well described. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include details of both situations for full marks. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. Quality of description and communication Basic sketches with limited annotation 1 mark Good sketches with main features identified and labelled 2 marks Detailed sketches with clear annotation 3 marks Maximum of 1 mark if no sketch used Award full 3 marks if candidate demonstrates good communication. Award credit where possible if response doesn't link to chosen material.	6 3	**9**

1. Built Environment and Construction						
Question			Expected answers	Rationale		Mark
	(f)		**Discuss the factors that influence scale of production in the domestic housing market.** • Government policy/initiatives regarding requirements for affordable homes, key workers, mixed-use/tenure for families, single people, sheltered accommodation, owner-occupier, social housing, privately rented etc • Government grants for the regeneration of brownfield sites • Local Authority release of land in green belts/wedges for housing • The supply of land with planning permission • Government fiscal/monetary policy influencing the cost and availability of finance. The raising of interest rates reducing demand or inflation causing a rise in house prices • Planning policy in terms of density of houses allowed per hectare • Planning policy in terms of rural communities aesthetics/style of existing houses and the need to use local materials and vernacular designs • More demanding Building Regulations in terms of houses being zero carbon rated • Modern methods of production ie factory pre-fabrication allowing the standardisation of components and modular/volumetric pods • Cost of land/materials/labour together with a shortage of skilled labour.	**Level 1 (0-2 marks)** Some measures outlined, bullet points (usually focused on one issue) no further or very limited discussion, limited use of examples. **Level 2 (3-5 marks)** One or two measures described with some discussion. Appropriate use of technical vocabulary demonstrating a good understanding of the issues. Introduction of one example. **Level 3 (6-8 marks)** Clear, cogent and well – structured answer with two or three measures well explained. Good use of examples and additional evidence to support discussion. Good use of technical vocabulary. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 1 Total	**36**

2. Engineering						
Question			**Expected answers**	**Additional Guidance**		**Mark**
2	**(a)**		**Give four design requirements for the decorative screen shown in Fig. 2.** **Justify each requirement.** • Should be aesthetically pleasing so as not to detract from building design • Able to be firmly fixed in place for safety • Able to be removed if needed for maintenance • No sharp corners or edges that could cause injury • High enough to prevent someone falling over • No gaps large enough for a child to get through or caught in • Sufficiently open to allow minimal restriction to view from balcony • Resistant to weather for outside use.	Clear statement and justification required for a mark. Must be related to product – no marks for generic responses. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the decorative metal screen on a hotel balcony shown in Fig. 2.** **Use sketches and/or notes where appropriate.** • Overall height of screen • Height of screen base above floor • Maximum size of 'gaps' in screen • Thickness of metal used in construction of screen • Position/security of fixings.	brief description 1 mark detailed description with clear indication and description of example 2 marks anthropometric examples must be specific and relevant **Two** examples clearly described. Allow reference to given product.	2x2	**4**
	(c)		**Describe two ways in which the design of engineered products can be legally protected.** • Design rights • Copyrights • Registered design • Patenting • Trademarks.	brief description 1 mark detailed description 2 marks **Two** ways clearly described Allow reference to given product.	2x2	**4**

2. Engineering						
Question			Expected answers	Additional Guidance		Mark
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality engineered product.** • BSI/ISO approval • Trades description act • Sale of goods act • Personal recommendation • Brand loyalty • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). brief description 1 mark detailed description 2 marks **Two** ways clearly described.	2x2	**4**
	(e)	(i)	**State a suitable specific metal for the scroll shown in Fig.3.** **Give two properties or characteristics that make the metal suitable for this use.** **Material** • Steel – low carbon/mild • Stainless steel • aluminium alloy. **Properties or characteristics** will include • ease of working/shaping • relative cost • relative strength (small section material) • Ease of surface finishing (for corrosion resistance) • Corrosion resistance • Weldability.	1 mark Properties must relate to material stated and be relevant eg not relative cost or ease of finishing if stainless steel stated. 2x1 mark	1 2x1	**3**

2. Engineering						
Question			Expected answers	Additional Guidance		Mark
		(ii)	**Describe, in detail, how the scroll shown in Fig. 3 would be manufactured.** **Give details of any special tooling and quality control checks that would be used.** **Use a flowchart and /or annotated diagrams to support your answer.** • Cut metal strip to length (QC – gauge to ensure consistency) • Mark position of holes (QC – template to ensure equi-distant from ends) • Drill holes (QC – jig to position accurately or punch and use M/C vice) • Bend scroll on each end of strip (heat required if done manually) using former/scroll iron • (QC – use template to check accuracy of shape and size). Note:- holes may be drilled after scrolling but must show use of jig or other means of ensuring accuracy when drilling • Remove all sharp and rough edges from finished scroll (QC – visual check). Note:- If special purpose/hydraulic forming machine is used, annotated diagrams needed to explain operation. Award credit for candidates who describe the adding of a suitable surface finish, eg paint, powder coat etc	**Level 1 (0-2 marks)** Some stages outlined (up to 2);very limited description; limited. **Level 2 (3-4 marks)** Key stages presented; reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described; key features and technical details identified. Answer must include detail of quality control checks for full marks. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. **Quality of description and communication** Basic diagrams/chart with limited annotation 1 mark Good diagrams/chart with main features identified and labelled 2 marks Detailed diagrams/chart with clear annotation 3 marks Max 1 mark in this strand if no diagrams or flowchart used Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart. Award credit where possible if response doesn't link to chosen material.	6 3	**9**

2. Engineering						
Question			Expected answers	Additional Guidance		Mark
	(f)		**Discuss the factors that influence scale of production of engineered products.** Possible issues: • demand • economic factors/wages/energy • material availability • manufacturing capacity • commercial back-up • nature of product /number of component parts/assembly/complexity of product. Examples/evidence • specific product – one-off/batch/high volume • specific detail – economic factors/manufacturing • specific commercial requirement – example • details of resources (physical and human).	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **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. **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. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 2 Total	**36**

3. Food						
Question			Expected answers	Rationale		Mark
3	(a)		**Give four design requirements for a lemon meringue pie shown in Fig. 4.** **Justify each requirement.** • Function: dessert product in a pastry case • Tangy lemon flavour sauce base, set to a depth of 2.5 cm • Natural lemon colour base to make it look appealing • Meringue topping to a depth of 6 cm in the middle to give a substantial portion size • Six portion size for a family product • Crisp meringue so that the raw egg is well cooked • Pastry Base of shortcrust pastry so that it will easily cut into portions • Lemon base must be set to cut into neat slices.	Clear statement and justification required for a mark. Must be related to product – no marks for generic or obvious responses. Do accept lemon flavour/meringue topping must be more specific. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the pie slice as shown in Fig.2.** **Use sketches and/or notes where appropriate.** • Handle/grip/diameter/length • Size of the 'lifting' part of the pie slice/width is portion sized, length will support an average sized pie or cake • Gap between the handle and the pie support part allows user to give additional support from their thumb .	brief description 1 mark detailed description with clear understanding of example 2 marks **Two** different examples clearly described. Allow reference to given product.	2x2	**4**

3. Food						
Question			Expected answers	Rationale		Mark
	(c)		**Describe two ways in which the design of food products can be legally protected.** • Patent gives the designer protection copying of the technical and functional aspects • Design rights concerns the rights of the creator unless a third party commissions the work • Registered designs give you ownership rights for the appearance of the product, • Trademark identifies and distinguishes its products (word/name logo/slogan).	brief description 1 mark detailed description 2 mark **Two** ways clearly described Eg Recipes Product names Product ranges eg 'Finest' 'Value' Packaging designs Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality food product.** Quality assurance by: • Use of logos that guarantee high standards eg organic • Quality control checks carried out • HACCP systems in place in manufacturing • Reputation of a reliable food manufacturing company • Descriptors eg luxury product • Date marking – Use by and best before date • Ingredient list eg British Beef/Free range • Luxury range products with specific named ingredients • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). Statement 1 mark Statement explained 1 mark **Two** quality assurance systems clearly explained. Do not accept 'sell by date'.	2x2	**4**

3. Food						
Question			Expected answers	Rationale		Mark
	(e)	(i)	**State a suitable specific ingredient for making meringue. Give two properties or characteristics that make the ingredient suitable for this use.** **Ingredient** • Egg white (albumin) • Castor sugar. **Properties** **Egg white** • Egg white can be aerated due the ability of the ovalbumin (egg protein) to stretch and hold air • When egg white is whisked the proteins are denatured and they uncoil • This forms a 3D air/liquid structure that can hold air. • The foam is stable but can be affected by other ingredients. **Castor Sugar** • Interferes with the bonds that form when egg whites uncoil as they are whisked • Whisking time is increased therefore the foam is denser • The foam is much more stable.	1x1 mark Must state either egg white (albumen) Or castor sugar Do not accept the words egg or sugar on their own. 2x1 mark for any of two of the points listed. Award 1 mark for other appropriate point.	1 2x1	**3**

3. Food						
Question			Expected answers	Rationale		Mark
		(ii)	**Describe, in detail, how the pastry case for the lemon meringue pie shown in Fig.4 would be manufactured as a batch of 20.** **Include details of all ingredients and the scientific principles underlying the process.** **Use a flowchart and/or annotated diagrams to support your answer.** Pastry • Basic ingredients are flour, fat and water rubbed together until it looks like breadcrumbs • Fat used could be a commercial shortening produced for shortcrust/margarine gives flavour/lard has a good plasticity and is used for shortening • Fat acts as a shortening agent by coating the flour particles and preventing them from absorbing water • Air is incorporated by the rubbing in process • Cold water is added and is absorbed by the uncoated flour • The dough sticks together(gluten strands are formed) • Rolling stretches the gluten • Pastry cases are cut out and flan cases lined. • Pastry cases may be baked blind or pricked to release air • Pastry cases are baked • Fat melts and is absorbed by the starch (gelatinises) • Air and steam expand to lighten the pastry • Coagulation of the gluten sets the pastry.	**Level 1 (0-2 marks)** Some stages outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key stages presented, reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include detail of scientific principles for full marks. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. **Quality of description and communication** Basic information with limited scientific knowledge **1 mark** Good detail with main scientific principles identified and labelled **2 marks** Detailed scientific principles **3 marks** Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart.	6 3	**9**

3. Food						
Question			Expected answers	Rationale		Mark
	(f)		**Discuss the factors that influence scale of production in the Food Industry.** Issues • Demand/quantity of products to be produced • economic factors/wages/energy • material availability/seasonal products • manufacturing capacity of equipment • commercial backup • nature of product /skill level required • results of small scale factory trial • scaling up of the recipe. Examples/evidence • specific product – one off – wedding cake batch – cook chill high volume – baked beans • specific detail re – economic factors/manufacturing • specific commercial requirement.	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **Level 2 (3-5 marks)** One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of the concept. Introduction of one example or supporting evidence. **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 Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 3 Total	**36**

4. Graphic Products						
Question			Expected answers	Rationale		Mark
4	(a)		**Give four design requirements for the printed credit card shown in Fig. 5.** **Justify each requirement.** • It must be easy to read, graphic material should not obscure digits • It should reflect the corporate identity of the company • The signature strip should be large enough to sign • It must be flexible so it maintains its shape when stored • It should contain a holographic image for security purposes • Contact telephone numbers should be printed onto the card for security purposes • It should be durable and not snap • It should be easy to store in a wallet eg round edges.	Clear statement and justification required for a mark. Must be related to product – no marks for generic responses. Aesthetic/environment response must have example for mark. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the credit card shown in Fig.5.** **Use sketches and/or notes where appropriate.** • Size of the card – easy to fit into a wallet • Universal size • The shape of the card – rounded corners, sometimes has a wave cut out of one end • Durable, easy to use • Clear graphical design – easy to read the information printed on the card.	brief description 1 mark detailed description with clear indication and description of example 2 marks must be methods of producing prototypes – Using different materials. **Two** examples clearly described. Allow reference to given product.	2x2	**4**

4. Graphic Products						
Question			Expected answers	Rationale		Mark
	(c)		**Describe two ways in which the design of graphic products can be legally protected.** • Design rights-protection in UK of design • Registered designs – ownership of appearance/shape /pattern • Patents – protection against copying of technical/functional aspects • Copyright– protects original ideas– books/software/works of art/music.	brief description 1 mark detailed description 2 mark Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing quality graphic products.** • Brand reliability/reputation • 3rd party testing British Standard • Quality control systems in manufacturing process • Consumer reports eg Which • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). brief explanation with example 1 mark detailed explanation with example 2 mark **Two** examples clearly explained.	2x2	**4**
	(e)	(i)	**State a suitable specific material for the credit card. Give two properties or characteristics that make the material suitable for this use.** • PVCA – polyvinyl chloride acetate • Allow ABS, polypropylene, PVC, uPVC • NOT acrylic • Easily manufactured using high speed production • Aesthetically appropriate • Easy to die cut.	award 1 mark for other appropriate material not listed 1x1 mark Award 1 mark for other appropriate property/characteristic. 2x1 mark	1x1 2x2 2x1	**3**

4. Graphic Products						
Question			Expected answers	Rationale		Mark
		(ii)	**Describe, in detail, how the background image would be applied to the credit card blank, manufactured in a batch of 100 000.** **Use a flowchart and/or annotated diagrams to support your answer.** **Part A** **Silk Screen Printing.** Standard explanation of the process, it should include sketches: • Origination of artwork using a suitable/relevant software package • A stencil is manufactured using a photochemical process • Two types of threads for screen fabric, monofilament is used primarily for commercial printing as it is easier to clean. Normally made from polyester – strong and stable • An emulsion is applied to the screen, this is a light sensitive material which hardens when exposed to light • Normally the emulsion is presensitized allowing it to be used immediately • The screen is exposed to a positive film image in a vacuum frame, it is then normally washed, the unexposed areas of the emulsion simply wash away leaving the stencil in place • The stencil/emulsion defines the area of the image which will be printed • Separate stencils are used for each colour eg cmyk • Colour applied and then squeegeed through	**Sketches can be used to support the explanation** **Level 1 (0-2 marks)** Some stages outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key stages presented, reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include correct terminology and an understanding of the difference between this type of printing and litho. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. Quality of description and communication Basic sketch/chart with limited annotation 1 mark Good sketch/chart with main features identified and labelled 2 marks Detailed sketch/chart with clear annotation 3 marks Max 1 if no sketch used Award full 3 marks if candidate demonstrates good	6	

4. Graphic Products						
Question			Expected answers	Rationale		Mark
			• Colour must be dry before moving on to the next process, can be dried using UV, UV inks may also be used • Screen should be placed accurately above the image, if classroom based this should be mentioned • Process is repeated.	communication. NB A sequence of manufacturing stages can be given in place of a flowchart. Award credit where possible if response doesn't link to chosen material.	3	**9**
	(f)		**Discuss the factors that influence scale of production in the Graphics Industry.** Issues • demand • economic factors/wages/energy • material availability • manufacturing capacity • commercial backup • nature of product /number of component parts/assembly/complexity of product. Examples/evidence • specific product – one/off/batch /high volume • specific detail re – economic factors/manufacturing • specific commercial requirement.	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **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. **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 Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 4 Total	**36**

5. Manufacturing						
Question			Expected answers	Additional Guidance		Mark
5	(a)		**Give four design requirements for the chair shown in Fig. 6.** **Justify each requirement.** • Stable to prevent toppling • Strong enough to take large adults weight • Comfortable for person to sit on • Give adequate support for person • Safe construction with no 'pinch points' • Well upholstered for comfort and durability • Aesthetically pleasing to fit into surroundings • Finish applied to wooden frames for smoothness and protection • Ergonomics/anthropometric reference.	Clear statement and justification required for a mark. Must be related to product – no marks for generic responses. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the chair shown in Fig. 6.** **Use sketches and/or notes where appropriate.** • Angle/height of chair back • Height of chair seat • Depth of seat (front to back) • Width of chair between frames • Width of frame 'armrest' • Height of armrest • Hardness of padding • Choice of upholstery material.	brief description 1 mark detailed description with clear indication and description of example 2 marks anthropometric examples must be specific and justified **Two** examples clearly described. Allow reference to given product.	2x2	**4**

5. Manufacturing						
Question			Expected answers	Additional Guidance		Mark
	(c)		**Describe two ways in which the design of manufactured products can be legally protected.** • Design rights • Copyrights • Registered design • Patenting • Trademarks.	brief description 1 mark detailed description 2 marks **Two** ways clearly described. Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality manufactured product.** • BSI/ISO approval • Trades description act • Sale of goods act • Personal recommendation • Brand loyalty • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). brief explanation 1 mark detailed explanation 2 marks **Two** ways clearly described.	2x2	**4**
	(e)	(i)	**State a suitable specific material for the side frame shown in Fig. 7.** **Give two properties or characteristics that make the material suitable for this use.** **Material** • Suitable hardwood, eg beech, birch, maple, mahogany, cherry • NOT MDF	Accept 'plywood' with no specified timber. 1 mark	1	

5. Manufacturing						
Question			Expected answers	Additional Guidance		Mark
			• Laminated strips/veneers of hardwood. **Properties or characteristics** will include • Strength/closeness of grain • Visual appearance • Sustainable resource • Relative cost • Suitability for bending/laminating.	Award 1 mark for other appropriate property/characteristic. 2x1 mark	2x1	**3**
		(ii)	**Describe, in detail, how the side frame shown in Fig. 7 would be manufactured as a batch of 5 000.** **Include details of any special equipment and quality control checks that would be used.** **Use a flowchart and/or annotated diagrams to support your answer.** • Cut timber/strips to length • Steam solid timber/glue strips for laminating • (QC – control steaming time/ensure even coverage of strips with adhesive) • Clamp softened timber/assembled strips onto pre-prepared former • (QC – ensure full contact with former – visual; remove excess adhesive from edges of laminations) • Drying timber/curing adhesive • Remove completed arm from former • (QC – ensure fully dried/cured) • Trim ends of arm and finish to shape/size • (QC – check against template for accuracy) • Drill holes (QC – use of jig to ensure alignment) • Final sanding • Apply finish • Final QC check	**Level 1 (0-2 marks)** Some stages outlined (up to 2),very limited description, limited. **Level 2 (3-4 marks)** Key stages presented, reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include detail of quality control checks for full marks. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. **Quality of description and communication**	6	

5. Manufacturing						
Question			Expected answers	Additional Guidance		Mark
			Fully/semi-automated process to include the above stages; details required of special equipment/procedures at each stage.	Basic diagrams/chart with limited annotation 1 mark Good diagrams/chart with main features identified and labelled 2 marks Detailed diagrams/chart with clear annotation 3 marks Max 1 mark in this strand if no diagrams or flowchart used. Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart. Award credit where possible if response doesn't link to chosen material.	3	**9**
	(f)		**Discuss the factors that influence scale of production in the Manufacturing Industry.** Issues • demand • economic factors/wages/energy • material availability • manufacturing capacity • commercial back-up • nature of product /number of component parts/assembly/complexity of product. Examples/evidence • specific product – one-off/batch/high volume • specific detail – economic factors/manufacturing • specific commercial requirement – example • details of resources (physical and human).	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **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. **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. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 5 Total	**36**

6. Resistant materials						
Question			Expected answers	Rationale		Mark
6	(a)		**Give four design requirements for the holder of art materials shown in Fig 8.** **Justify each requirement.** • The holder must be washable as art materials may spill • The holder must be well balanced so as not to cause discomfort when carrying • The grip must be comfortable to avoid discomfort when carrying the holder over long distances • The holder must be rain/weather resistant as it will be used outside • The holder must contain the materials securely to prevent spillage/damage • The holder must enable the user to easily extract art materials without difficulty • The holder must be robust to cope with knocks when used outdoors.	Clear statement and justification required for a mark Must be related to product – no marks for generic responses **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the holder of art materials shown in Fig. 8.** **Use sketches and/or notes where appropriate.** • Handle thickness, • Handle width • Balance of holder for ease of carrying • Weight of unit • Narrowness of unit to prevent banging against leg when carrying.	brief description 1 mark detailed description with clear indication and description of example 2 marks anthropometric examples must have reference to body eg hand grip for handle **Two** examples clearly described. Allow reference to given product.	2x2	**4**

6. Resistant materials						
Question			Expected answers	Rationale		Mark
	(c)		**Describe two ways in which the design of resistant material products can be legally protected.** • Design rights-protection in UK of design • Registered designs – ownership of appearance/shape /pattern • Patents – protection against copying of technical/functional aspects • Copyright – protects original ideas– books/software/works of art/music.	brief description 1 mark detailed description 2 mark **Two** ways clearly described Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality resistant materials product.** • Brand reliability/reputation • 3rd party testing British Standard • Quality control sytems in manufacturing process • Consumer reports eg Which • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). Stage 1 mark Impact explained 1 mark **Two** stages clearly explained.	2x2	**4**

6. Resistant materials						
Question			Expected answers	Rationale		Mark
	(e)	(i)	**State a suitable specific material for the holder of art materials shown in Fig. 8.** **Give two properties or characteristics that make the material suitable for this use.** **Material** • abs; • polypropylene; • aluminium; • mdf • plywood • pine, deal, beech, cherry. **Properties or characteristics** • easily formed to required shape; • produces rigid structure; • takes a quality finish; • durable, takes knocks.	award 1 mark for other appropriate material not listed 1x1 mark Award 1 mark for other appropriate property/characteristic. 2x1 mark	1 2x1	**3**

6. Resistant materials						
Question			Expected answers	Rationale		Mark
		(ii)	**Describe, in detail, how the holder of art materials shown in Fig.8 would be manufactured as a batch of 100.** **Include details of any jigs and formers used.** **Use a flowchart and/or annotated diagrams to support your answer.** Could be a combination of materials (base/handle) and manufacturing processes. Plastic forming • mark out/cut developments (batch of 100) • use strip heater/bending jig to form base/sides • secure corners (adhesive, corner strip • turn, shape and locate handle. Plastic assembly • mark out parts (batch of 100) • cut and prepare shapes • assemble using appropriate cement/adhesive and jig/former to hold whilst setting • handle made and secured • edges finished. Laser cutting/thermoforming • design created CAD • print details setup/speed, thickness of material • laser cutter set up, auto focus • laser cut • auto removal/replacement • thermoformed using line bend system • held until shape set	**Level 1 (0-2 marks)** Some stages outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key stages presented, reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. Quality of description and communication Basic sketch/chart with limited annotation 1 mark Good sketch/chart with main features identified and labelled 2 marks Detailed sketch/chart with clear annotation 3 marks Max 1 if no sketch used Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart.	6 3	

6. Resistant materials						
Question			Expected answers	Rationale		Mark
			• Other parts assembled (adhesive/cement) or all parts could be designed to join/clip together • edges may be flame polished • attach handle. Wood construction • pieces marked and cut (batch of 100) • appropriate joining method (eg comb/finger joint using router/saw) • routed groove or rebate for base • parts assembled (glued and clamped) • handle turned and attached • appropriate finish.	Award credit where possible if response doesn't link to chosen material.		9

6. Resistant materials						
Question			Expected answers	Rationale		Mark
	(f)		**Discuss the factors that influence scale of production of resistant material products.** Issues • demand • economic factors/wages/energy • material availability • manufacturing capacity • commercial backup • nature of product /number of component parts/assembly/complexity of product. Examples/evidence • specific product – one/off/batch /high volume • specific detail re – economic factors/manufacturing • specific commercial requirement.	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **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. **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. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 6 Total	**36**

7. Systems and Control						
Question			Expected answers	Rationale		Mark
7	(a)		**Give four design requirements for a cordless food mixer shown in Fig. 9.** **Justify each requirement.** • The mixer must be powerful enough to mix all common food mixtures, including stiffer ones • The mixer must not be too heavy and must be balanced so that it is comfortable and not tiring to hold • The beaters must be removable for easy washing (eg in a dishwasher) • The mixer's casing must be able to be cleaned as it will get splashed by food products during use • There must be simple and clear controls for on/off/speed etc so that the product is user friendly • The cordless battery must last at least long enough to carry out a food preparation task to make the mixer fit for purpose • There must be a minimal risk of injury if fingers accidentally become trapped in the beaters so that it is not dangerous to children • The speed must be variable to provide the user with full control over the mixing task.	Clear statement and justification required for a mark. Must be related to product – no marks for generic responses. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the cordless food mixer shown in Fig. 9.** **Use sketches and/or notes where appropriate.** • Handle thickness, width and length – so that the mixer can be held securely and comfortably • Finger aperture dimensions – so that all users can hold the mixer	brief description 1 mark detailed description with clear indication and description of example 2 marks anthropometric examples must have reference to body eg length of thumb so that control position can be determined. **Two** examples clearly described. Allow reference to given product.	2x2	**4**

7. Systems and Control						
Question			Expected answers	Rationale		Mark
			• Balance of mixer for ease of holding during use – the designer can position the balance point to minimise strain on the user's wrist • Weight of mixer – too heavy and it is tiring to hold, too light and the product will jump and jitter in the user's hand during use • Positioning of controls for easy operation by thumb – so that the mixer can be easily and safely operated with one hand whilst the other hand holds the mixing bowl.			
	(c)		**Describe two ways in which the design of electronic products can be legally protected.** • Patent protection of design function – to protect new, inventive and useful claims • Intellectual property protection and copyright – the rights granted to an author or creator of an original work, including drawings and software • Registered design protection – could refer to product logos, distinctive product shapes, product music or sound effects • Registered trademark protection – to protect a product logo or name or a unique icon related to a product during its use.	brief description 1 mark detailed description 2 mark **Two** ways clearly described. Allow reference to given product.	2x2	**4**

7. Systems and Control						
Question			Expected answers	Rationale		Mark
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality electronic product.** • Brand reliability/reputation • 3rd party testing – products built to BSI Quality control systems in the manufacturing process • Consumer reports eg Which • Consumer star-rating of products through web-based retailers • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe) Stage 1 mark Impact explained 1 mark **Two** stages clearly explained	2x2	**4**
	(e)	(i)	**Sketch a labelled diagram to show a mechanical system which could be used in a cordless food mixer to transfer rotary motion from the electric motor through 90 degrees and provide a speed reduction to drive the beaters.** Worm drive system or bevel gear system Diagram to show: • Labelled component parts • Method of transferring motion through 90 degrees • Method of providing speed reduction. It is not necessary to show how the two beaters are driven, nor how they rotate in contrary directions.	Labelled components in the gear system 1 mark Clear diagrammatic representation of motion transferred through 90 degrees 1 mark (A worm or bevel gear system is expected, but credit candidates who correctly draw other systems.) Clear indication of how speed reduction is achieved 1 mark (Award mark if this is apparent from the relative sizes of the gear components used.)	3x1	**3**

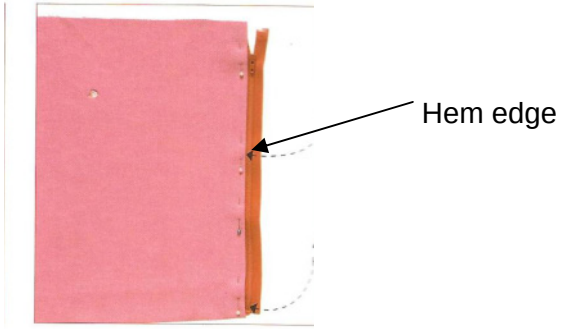
7. Systems and Control						
Question			Expected answers	Rationale		Mark
		(ii)	**Describe in detail how pulse width modulation can be used to control the speed of a DC electric motor. Use annotated diagrams to support your answer. Your answer should include a circuit diagram. Sketches and notes to convey the following information:** • Principle of PWM – rapid on/off pulsing of motor at full power • Understanding that this pulsing takes place very rapidly (typically about 1kHz frequency) • Waveforms to show mark:space ratio of PWM • Method of speed control – varying mark:space ratio (also known as the duty cycle) • Use of astable circuit to provide pulses • Astable circuit diagram (eg 555, NAND-gate astable, Schmitt NAND relaxation oscillator, transistor multivibrator or any other astable circuit) • Method of varying the mark:space ratio (NOT just the frequency). This will depend on the actual astable circuit drawn.	**Level 1 (0-2 marks)** PWM process outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key diagrammatic information presented, reasonable understanding, attempt at circuit or system diagram. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified. Answer must include circuit diagram for full marks. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. Quality of description and communication Basic sketches with limited annotation 1 mark Good sketches with main features Identified – correct circuit schematics used 2 marks Detailed sketches with clear annotation and competent circuit schematic layout 3 marks Max 1 if no sketches used Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart.	6 3	**9**

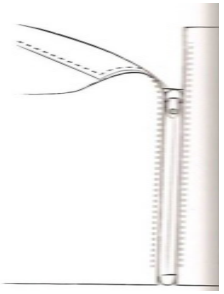
7. Systems and Control						
Question			Expected answers	Rationale		Mark
	(f)		**Discuss the factors that influence scale of production of electronic products.** Issues • Demand – based on current demand for similar products and future predictions based on consumer surveys and previous data • economic factors/wages/energy • material availability – whether the materials and sub-assemblies can be sourced at a rate to keep up with the production rate. The reliance on 'just-in-time' manufacturing • manufacturing capacity – the limits imposed by the rate at which a production plant can actually manufacture parts and assemble and ship products • commercial backup – the requirement for up-front payments from banks to initiate the production process and produce first batches before any revenue is generated by the sale of these first batches • nature of product /number of component parts/assembly – the ease with which the product can be manufactured, assembled, tested, packaged and shipped/complexity of product. Examples/evidence • specific product – one/off/batch /high volume • specific detail re – economic factors/manufacturing • specific commercial requirement.	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **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. **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. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 7 Total	**36**

8. Textiles						
Question			Expected answers	Rationale		Mark
8	(a)		**Give four design requirements for the outdoor jacket shown in Fig.10.** **Justify each requirement.** • Function: needs to provide protection from winter weather- warmth /waterproof/breathable • Purpose: for casual wear in winter or outdoor pursuits • Performance: keep wearer warm/dry/comfortable/be easy to put on/easy to maintain or launder • Needs to be available in a range of sizes to fit males and females • Aesthetics: needs to be in attractive colour range to suit many tastes • Ergonomics: jacket needs to be in arrange of sizes to fit as many people as possible • Safety standards: needs to comply with BS and International safety standards for protective wear • Fully lined to give added warmth and help with moisture control.	Clear statement and justification required for a mark. Must be related to product – no marks for generic responses. **Four** justified design requirements. Give one mark if two valid points given but not fully justified.	4x1	**4**
	(b)		**Describe two examples where ergonomics has influenced the design of the outdoor jacket shown in Fig. 10.** **Use sketches and/or notes where appropriate.** • Length of sleeves/length of jacket • Velcro fastener on sleeves • Position of pocket • Length of zip fastening at front • Hood shape • Adjustable hood • Sleeve shape.	brief description 1 mark detailed description with clear understanding of example 2 marks **Two** different examples clearly described. Allow reference to given product.	2x2	**4**

8. Textiles						
Question			Expected answers	Rationale		Mark
	(c)		**Describe two ways in which the design of textile products can be legally protected.** • Patent gives the designer protection copying of the technical and functional aspects • Design rights concerns the rights of the creator unless a third party commissions the work • Registered designs give you ownership rights for the appearance of the product, • Trademark identifies and distinguishes its products (word/name logo/slogan).	brief description 1 mark detailed description 2 mark **Two** ways clearly described Candidates may use examples such as copies of catwalk designs /cheaper mass produced versions of catwalk designs. Designs modified by using cheaper fabrics or making slight adaptations o the design Allow reference to given product.	2x2	**4**
	(d)		**Explain two ways in which consumers can be assured that they are purchasing a quality textile product.** Quality assurance by: • Use of logos that guarantee high standards eg Gortex/ • BSI markings • International standards eg CE • Reputation of a reliable textile manufacturing company • Offer of a manufacturer's warranty • Customer reviews • Try-before-you-buy • Paying a premium price for the product • The use of quality materials in the product.	Allow credit for each if candidate refers to BSI and CE standards in each part. Full credit if candidate has identified the difference between these (UK and Europe). Statement 1 mark Statement explained 1 mark **Two** quality assurance systems clearly explained.	2x2	**4**

8. Textiles						
Question			Expected answers	Rationale		Mark
	(e)	(i)	**State one suitable specific fibre for the outdoor jacket shown in Fig. 10.** **Give two performance characteristics that make the fibre suitable for this use.** **Fabric** • Polyester • Polyamide • Flourofibre (Gortex) • Sympatex • Cotton/nylon with a waterproof finish. **Properties or characteristics** **Polyester and Polyamide**: • Insulation. Microfibres trap air • Do not absorb water • Easy to wash and dry/ • Strong have excellent abrasion resistance • Good elasticity so recover from creases easily • Resistant to moulds • Dye well • Can be soft and lightweight • Microfibres can produce a 'breathable' fabric. **Flourofibre (Gore-tex)** Gortex is a laminate of an outer fabric, layer of Gore-tex (Flourofibres)membrane and an inner fabric Flourfibres are: • Chemically resistant to water • Undyeable and so are used to laminate other fibres • Windproof • Stain resistant • Breathable in a micro porous film.	1x1 mark Must state the name of the fibre. 2x1 mark for any of two of the points listed. Award 1 mark for other appropriate point.	1 2x1	**3**

8. Textiles						
Question			Expected answers	Rationale		Mark
		(ii)	**An open ended zip is used to fasten the front of the outdoor jacket to be manufactured as a batch of 5. Describe, in detail, how to insert the zip fastener and secure the lining.** **Use a flowchart and/or annotated diagrams to support your answer.** **Insert the zip** • On both front edges turn under the seam allowance at the centre front • Turn up the hem allowance and tack in place • Place the folded front edge of the centre front about 3mm from the zip teeth to allow for the puller to move. Place the bottom of the zip at the hem edge • Using the zip foot, machine the zip in place. Start with the zip open. Stitch to the end of the zip and on the right side stitch through the baffles as well. • Repeat the process with the left side • Once the zip is machined in place check that the hems line up. The zip should open completely. **Secure the lining** • The lining can be secured in two ways • It can be hand stitched directly on to the zip by slip hemming or • Machined to the zip and then the whole lining is 'bagged out' (turned inside out).	**Level 1 (0-2 marks)** Some stages outlined (up to 2), very limited description. **Level 2 (3-4 marks)** Key stages presented, reasonably well described with key features identified. **Level 3 (5-6 marks)** Process fully described, key features and technical details identified, Answer must include detail of scientific principles for full marks. To achieve full marks, the described process must be relevant for the batch size. Award maximum of Level 1 if an inappropriate process for the product (or the batch number) is described. **Quality of description and communication** Basic drawings/chart with limited knowledge 1 mark Good detail with main features identified and labelled 2 marks Detailed clear drawings/chart 3 marks Award full 3 marks if candidate demonstrates good communication. NB A sequence of manufacturing stages can be given in place of a flowchart.  	6 3	**9**

8. Textiles						
Question			Expected answers	Rationale		Mark
				 Open ended zip		

8. Textiles						
Question			Expected answers	Rationale		Mark
	(f)		**Discuss the factors that influence scale of production of textile products.** Issues • Demand/quantity of products to be produced • economic factors/wages/energy • material availability/ • seasonal products/fashion trends • manufacturing capacity of equipment • commercial backup available • nature of product/skill level required • results of small scale factory trial • /complexity of product. Examples/evidence • specific product – one off – couture/bespoke batch – fashion clothing high volume – utility clothing /bedding /vests/uniform • specific detail re – economic factors/manufacturing • specific commercial requirements • Use of JIT to respond to fashion trends.	**Level 1 (0-2 marks)** Some issues outlined, bullet points (usually focused on one issue) no further or very limited explanation, limited use of examples or supporting evidence. **Level 2 (3-5 marks)** One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of the concept. Introduction of one example or supporting evidence. **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. Award level 3 for a very detailed, clear response with no examples.		**8**
					Question 8 Total	**36**

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