

# **Design and Technology**

Advanced GCE **F524/01**

Product Design: Component 1

## **Mark Scheme for June 2010**

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## 1 Built Environment and Construction

Question	Expected answers	Mark	Additional Guidance
1 (a)	<p><b>Give <u>four</u> justified design requirements for the timber framed external wall.</b></p> <ul style="list-style-type: none"> <li>• Strength - the timber used should be stress graded and free from defects eg. knots, shakes, wane, slope of the grain etc. The ability to transfer loads successfully to the foundations.</li> <li>• Stability – Effective fixing to the foundation, upper floor, roof and outer leaf/skin. Measures for bracing and lateral stability (racking).</li> <li>• Resistance to weather and ground moisture – waterproofing measures including the type of external finish or protecting skin eg. timber or pvc U weatherboarding/cladding, tile hanging or a brick outer wall. The use of horizontal and vertical damp proof courses to prevent the ingress of water.</li> <li>• Durability and freedom from maintenance – the use of high specification materials to reduce the frequency and cost of maintenance. The type of preservative treatment used.</li> <li>• Fire safety – measures to provide fire resistance and to prevent the spread of fire with regard to Approved Document B.</li> <li>• Resistance to the passage of heat – measures to reduce heat loss through the incorporation of insulation etc. to comply with Approved Document L.</li> <li>• Resistance to airborne and impact sound - recognition of the small mass of timber framed walls affording little resistance to airborne sound. The inclusion of thermal insulation helps, but an outer brick skin is the main preventative measure.</li> <li>• Aesthetics – Visual effect of the external finish.</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘weatherproof– will not rot’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing for the built environment.</b></p> <ul style="list-style-type: none"> <li>• Broad customer surveys/questionnaires;</li> <li>• user groups;</li> <li>• specific market research;</li> <li>• look at success of existing products on market</li> </ul>	[4]	<p>brief description      1 mark detailed description      2 mark</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>

Question	Expected answers	Mark	Additional Guidance
(c)	<p><b>Describe <u>two</u> ways in which safety in the built environment is ensured.</b></p> <ul style="list-style-type: none"> <li>• H&amp;S legislation</li> <li>• Checks and inspections of practices/procedures</li> <li>• Checks of equipment/installations</li> <li>• Routines/practices -Fire Drills etc</li> <li>• Qualification checks of workforce</li> </ul>	<b>[4]</b>	<p>brief description      1 mark detailed description      2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>
(d)	<p><b>Explain the key stages of the Life Cycle Assessment (LCA) of a product utilised within the construction industry.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials;</li> <li>• transporting raw materials;</li> <li>• processing raw materials;</li> <li>• manufacturing product;</li> <li>• using product;</li> <li>• disposal of product.</li> </ul>	<b>[4]</b>	<p>Stage                      1 mark Impact explained      1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State a suitable specific material to provide weather protection to an external timber framed wall and give two properties or characteristics that make the material suitable for this use</b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• Brick.</li> <li>• Stone.</li> <li>• Timber weatherboarding.</li> <li>• Pvc U cladding.</li> <li>• Block or plywood with a rendered finish.</li> </ul> <p><b>Properties</b> will be related to strength, durability, weight, rigidity, size and availability</p>	<b>[3]</b>	<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	Expected answers	Mark	Additional Guidance
(ii)	<p><b>Describe, in detail, how a timber framed wall would be constructed. Include details of how stability is achieved. Use annotated sketches to support your answer.</b></p> <ul style="list-style-type: none"> <li>• Steel holding down straps or bolts from the foundation to the base of the timber frame fixed at a minimum of 2000mm centres along the length of the wall.</li> <li>• Wall ties are fixed to the vertical studs and built into the courses of masonry at 3 to 4 ties per square metre with additional ties at quoins, intersections and window/door openings.</li> <li>• Vertical studs at 400 to 600mm centres to suit the loadings.</li> <li>• Row(s) of horizontal noggings fixed between the studs to stiffen the wall against movement.</li> <li>• A face of plywood sheathing or other suitable material applied to the frame to provide lateral stability.</li> <li>• Internal partition walls to be connected at their junction with the timber frame to provide a buttress against wind forces.</li> <li>• Timber upper floors and the roof to be connected to the heads of the timber frame.</li> <li>• Steel straps anchored at the frame and fixed across the floor joists and roof rafters.</li> <li>• Where possible diagonal bracing can be incorporated between the vertical studs.</li> <li>• A timber ring beam should be incorporated at the intermediate floor junction with the wall.</li> </ul>	<b>[9]</b>	<p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 3 (5-6 marks)</b> Process fully described, key features and technical details identified, Answer must include detail of stability factors for full marks.</p> <p>Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark</p> <p>Good sketch with main features identified and labelled 2 marks</p> <p>Detailed sketch with clear annotation 3 marks</p> <p>Max 1 if no sketch used</p>
(f)	<p><b>Discuss the implications of energy conservation in the design of domestic dwellings.</b></p> <p>Issues</p> <ul style="list-style-type: none"> <li>• Cost implications</li> <li>• Material constructional considerations;</li> <li>• Global responsibility;</li> <li>• Legal requirements.</li> </ul>		<p><b>Level 1 (0-2 marks)</b> 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><b>Level 2 (3-5 marks)</b> One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good</p>

Question	Expected answers	Mark	Additional Guidance
	<p>Examples</p> <ul style="list-style-type: none"> <li>• Super thermal insulation.</li> <li>• Minimal energy consumption.</li> <li>• Wind turbines.</li> <li>• Solar/photovoltaic panels.</li> <li>• South facing building to maximise daylight.</li> <li>• Triple glazing.</li> <li>• Green roofs.</li> <li>• Geothermal/air pumps.</li> <li>• Combined heat and power units (CHP) fuelled by biomass fuel.</li> <li>• Heat exchange wind driven ventilation.</li> <li>• Airtightness ie. 2 ac/hr @ 50Pa.</li> <li>• Conservatory to harvest solar energy.</li> <li>• Other suitable answers.</li> </ul>	[8]	<p>understanding of concept. Introduction of one example or supporting evidence  <b>Level 3 (6-8 marks)</b>            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>
<b>Question 1 Total</b>			<b>36</b>

## 2 Engineering

Question	Expected answers	Mark	Additional Guidance
2 (a)	<p><b>Give <u>four</u> justified design requirements for the mechanical lifting platform.</b></p> <ul style="list-style-type: none"> <li>• Strong enough to lift and support heavy objects</li> <li>• Easy to operate without specialist skill/knowledge</li> <li>• Smooth in operation to prevent movement of load</li> <li>• Stable in all positions to prevent toppling</li> <li>• Safe in use ( elec. and mech. ) for operator</li> <li>• Easy to move around when loaded</li> <li>• Able to be locked in position to prevent accidental collapse</li> <li>• Easily fabricated to minimise manufacturing costs</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘ strong– carry weights’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing engineered products.</b></p> <ul style="list-style-type: none"> <li>• Broad customer surveys/questionnaires;</li> <li>• user groups;</li> <li>• specific market research;</li> <li>• look at success of existing products on market</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of engineered products is ensured.</b></p> <ul style="list-style-type: none"> <li>• Quality control checks</li> <li>• Third party testing eg BSI</li> <li>• User testing before sales</li> <li>• Specific material testing</li> <li>• ‘Stress modelling’ by computer</li> <li>• Application of ‘Factor of Safety’</li> <li>• Destructive testing – crash dummies</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>

Question	Expected answers	Mark	Additional Guidance
(d)	<p><b>Explain the key stages of the Life Cycle Assessment (LCA) of an engineered product.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials;</li> <li>• transporting raw materials;</li> <li>• processing raw materials;</li> <li>• manufacturing product;</li> <li>• using product;</li> <li>• disposal of product.</li> </ul>	<b>[4]</b>	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State a suitable specific material for the drive shaft and give two properties or characteristics that make the material suitable for this use</b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• steel</li> <li>• aluminium alloy</li> <li>• composite (carbon/glass/epoxy)</li> </ul> <p><b>Properties or characteristics</b> will include</p> <ul style="list-style-type: none"> <li>• torsional qualities,</li> <li>• surface hardness</li> <li>• rigidity</li> <li>• corrosion resistance ( ref. to stainless steel or aluminium alloy )</li> <li>• machinability (ref. to steels and aluminium alloys)</li> <li>• relative cost</li> </ul>	<b>[3]</b>	<p>Accept a range of steels including</p> <ul style="list-style-type: none"> <li>• case hardened mild steel</li> <li>• medium-high carbon steel</li> <li>• alloy steels</li> <li>• stainless steel</li> </ul> <p>Do NOT accept aluminium without ref. to alloy</p> <p>‘Composite’ material must be qualified to gain mark</p> <p>1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>



Question	Expected answers	Mark	Additional Guidance
(ii)	<p><i>Describe, in detail, how the drive shaft would be manufactured. Include details of quality control checks that you would use. Use annotated sketches to support your answer.</i></p> <ul style="list-style-type: none"> <li>• Bar cut to length</li> <li>• Face off both ends on centre lathe (QC check length – steel rule/vernier caliper)</li> <li>• Centre drill one end</li> <li>• Hold in chuck and support end with revolving centre</li> <li>• Turn to diameter up to shoulder- right hand knife or facing tool (QC diameter checked with micrometer, vernier caliper. Shoulder length-steel rule/vernier caliper)</li> <li>• Hold firm in vertical miller vice (or vee block in vice)</li> <li>• Check alignment</li> <li>• Cut keyway with end mill or slot drill (QC check depth with depth gauge; length with rule or vernier caliper)</li> <li>• Deburr</li> <li>• Final quality check (visual)</li> </ul>	<b>[9]</b>	<p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Level 2 (3-4 marks)</b> Key stages presented; reasonably well described with key features identified</p> <p><b>Level 3 (5-6 marks)</b> Process fully described; key features and technical details identified, Answer must include detail of quality control checks for full marks. Accept machining drive shaft from a length of bar and parting-off (centre or CNC lathe).</p> <p>Allow omission of use of centre if process is fully described without it.</p> <p>Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark</p> <p>Good sketch with main features identified and labelled 2 marks</p> <p>Detailed sketch with clear annotation 3 marks</p> <p>Max 1 in this element if no sketch used</p>

Question	Expected answers	Mark	Additional Guidance
(f)	<p><b><i>Discuss the implications of introducing robotics into an engineering company's production facility.</i></b></p> <p>Possible issues</p> <ul style="list-style-type: none"> <li>• Initial cost of new equipment (computer system &amp; machinery)</li> <li>• Recovery of investment</li> <li>• Re-arranging workplace to position robots/changing to cell or flow-line production</li> <li>• Training workforce for new skills and procedures</li> <li>• Loss of jobs/reduction in labour cost.</li> <li>• Increased output, more consistent work produced</li> <li>• 24 hour working possible without rest periods, flexibility of robots/re-program easily to carry out operations, ability to work in hazardous conditions</li> </ul> <p>Examples</p> <ul style="list-style-type: none"> <li>• Robots used for welding operations where heat, sparks and 'flashes' make for poor working conditions for humans</li> <li>• Use in other 'hazardous' conditions</li> <li>• Can easily reach into places normally inaccessible for humans</li> <li>• Smaller but more highly skilled (and paid) workforce</li> <li>• Integration into CIE system</li> </ul>	<b>[8]</b>	<p><b>Level 1 (0-2 marks)</b> 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><b>Level 2 (3-5 marks)</b> 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><b>Level 3 (6-8 marks)</b> 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>
<b>Question 2 Total 36</b>			

## 3 Food

Question	Expected answers	Mark	Additional Guidance
3 (a)	<p><b>Give <u>four</u> justified design requirements for the bread product.</b></p> <ul style="list-style-type: none"> <li>• Must consist of 4 rolls – average size for families</li> <li>• Must be baked in compact batches of 4 – to give a soft side to the rolls when they are broken apart</li> <li>• Must be ...size (accept reasonable size 8-10cm approx) so that they can be easily held/filled with savoury filling</li> <li>• Must be made from a whole grain /granary flour/wholewheat/wholemeal – to increase fibre content/white flour does not contain grain/bran</li> <li>• Must be unglazed – to give a soft top to the roll</li> <li>• Each roll must be the same weight – to ensure even quality of product</li> <li>• Must keep fresh for several days- to enable customer to keep the bread at home/extend shelf life</li> <li>• The texture of the bread should be soft-to enable the bread to be broken and eaten</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘tasty-to eat it/ healthy’ Do not accept ‘Brown flour’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing food products.</b></p> <ul style="list-style-type: none"> <li>• Customer surveys/questionnaires-large numbers of people are involved</li> <li>• User groups interviews/consumer profiles-to identify specific needs</li> <li>• Specific market research- internet data on consumer trends/sales figures</li> <li>• Evaluation of existing products on market-sensory testing/taste testing</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark Responses may include specific details on sensory testing eg rating/ranking/triangle testing <b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of food products is ensured.</b></p> <ul style="list-style-type: none"> <li>• H&amp;S legislation Food Safety Act 1990</li> <li>• Food Safety Regulations 1995 – rules of hygiene/risk assessments/HACCP system in place/critical control points monitored</li> <li>• Quality control of production, quality assurance at all levels of food production</li> <li>• Microbiological testing</li> <li>• Scanning- Metal detection /physical contamination</li> <li>• Temperature control-chill temp is 0°C-8°C -reheat 63°C -pasteurise 72°C</li> </ul>		<p>Responses should be precise. Do not accept ‘safety checks’ As a general term.</p> <p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>

	<p style="text-align: center;">-Sterilise 100°C</p> <ul style="list-style-type: none"> <li>• Checks by Environmental Health Officers/role of EHO</li> <li>• Food handlers must be trained and qualified</li> <li>• Temperature control during transportation</li> <li>• Cooking and storing instructions on packaging</li> <li>• Stock rotation by both manufactures/retailer/consumers</li> <li>• Date marking/ Use by date/best before</li> </ul>	<b>[4]</b>	
<b>(d)</b>	<p><b><i>Explain <u>two</u> key stages of the Life Cycle Assessment (LCA) of a food product.</i></b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials-e.g crops/animals/greenhouses/organic, free range</li> <li>• transporting raw materials- eg use of global ingredients</li> <li>• processing raw materials- eg refining/any named stage in manufacture</li> <li>• manufacturing product- eg batch/mass/wastage</li> <li>• using product; preparation/storage /cooking</li> <li>• disposal of product.-packaging and food waste eg biodegradable /reusable /compost able food waste</li> </ul>	<b>[4]</b>	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p> <p>In the explanation look for knowledge of food miles/organic food production/buying local/using seasonal foods</p>
<b>(e) (i)</b>	<p><b><i>State a suitable flour for the bread product and give two properties of the flour that make it suitable for this use</i></b></p> <ul style="list-style-type: none"> <li>• Whole wheat flour/wholemeal flour/ Wheat germ flour/granary flour/ Wheat meal flour</li> <li>• Strong plain flour mixed with any of the above</li> </ul> <p><b>Properties include</b></p> <ul style="list-style-type: none"> <li>• High gluten content</li> <li>• Strong flour</li> <li>• High level of protein</li> <li>• Proportion of whole grain within the flour</li> <li>• 100% extraction rate</li> </ul>	<b>[3]</b>	<p>Do not accept brown flour. Harvest grain implies that there is a higher fibre content and so do not accept strong white flour on its own. award mark for other appropriate flour not listed 1x1 mark</p> <p>Award mark for other appropriate property/characteristic Do not accept 'high in fibre' unless justified 2x1 mark</p>

<p>(ii)</p>	<p><b>Describe, in detail, how the bread product would be manufactured. Include details of all ingredients and the scientific principles underlying the process.</b>  <b>Use annotated sketches to support your answer.</b></p> <p>Stage 1</p> <ul style="list-style-type: none"> <li>• ingredients weighed carefully</li> </ul> <p>Reason</p> <ul style="list-style-type: none"> <li>– strong flour with high gluten content</li> <li>– fat or oil for flavour and to improve keeping quality</li> <li>– liquid (water or milk) at 25-27C</li> <li>– Yeast (fresh/dried or easy blend) raising agent</li> <li>– Salt to strengthen gluten and improve flavour</li> </ul> <p>Stage 2- Rubbing in</p> <ul style="list-style-type: none"> <li>• Rub fat into the flour or mix oil with the water – fat enriches the dough and strengthens the gluten</li> </ul> <p>Stage 3 -Mixing</p> <ul style="list-style-type: none"> <li>• Either – combine flour/salt liquid and easy blend yeast into a bowl – or – mix the fresh (or dried yeast) with a warm liquid and allow to start to ferment and then mix the yeast liquid into the flour, then salt and fat in a bowl.  The flour absorbs the water and gluten is formed. The yeast is evenly distributed throughout the dough.</li> </ul> <p>Stage 4 -Kneading</p> <ul style="list-style-type: none"> <li>• Knead well until the dough is elastic and smooth (approx 10 mins by hand or 3 mins by machine) – this traps air/develops the gluten/breaks up chains of yeast cells to give an even texture</li> <li>• Place the dough in either an oiled polythene bag or a covered bowl to prevent drying out</li> </ul> <p>Stage 5 Rising</p> <ul style="list-style-type: none"> <li>• Leave in a warm place until the dough is doubled in size-  The yeast begins to ferment and produce CO<sub>2</sub>./The enzyme diastase in the flour converts starch in the flour to maltose /  Yeast produces zymase complex and turns glucose into carbon dioxide</li> </ul>	<p>Candidates may not include the rising and knocking back stage (5 and 6) if they use easy blend yeast.</p> <p><b>Level 1 (0-2 marks)</b>  Some stages outlined (up to 2), very limited description, limited</p> <p><b>Level 2 (3-4 marks)</b>  Key stages presented, reasonably well described with key features identified and some scientific detail.</p> <p><b>Level 3 (5-6 marks)</b>  Process fully described, key features and technical details identified. Answer must include detail of ingredients and scientific principles underlying the process for full marks.</p> <p>Quality of description and communication</p> <p>Basic scientific details      1 mark</p> <p>Good scientific details with main features identified      2 marks</p> <p>Detailed scientific explanation 3 marks</p> <p>To gain 3 marks a candidate should show a sound understanding of the enzymic processes involved in the production of carbon dioxide. Correct terms for the stages</p>
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	<p>and alcohol/ Gases cause the dough to rise</p> <p>Stage 6 -Knocking back</p> <ul style="list-style-type: none"> <li>The risen dough is kneaded again lightly.-Large bubbles of carbon dioxide produced in the first rising are broken up and distributed as small bubbles throughout the dough to give a fine texture.</li> </ul> <p>This exposes the yeast to more oxygen and allow for a second rising</p> <p>Stage 7 Shaping</p> <ul style="list-style-type: none"> <li>Shape the dough into sets of even size round roles touching each other</li> </ul> <p>Stage 8 Proving</p> <ul style="list-style-type: none"> <li>Allow the dough to rise to double its volume – temperature not above 25C. The yeast ferments the dough evenly and a fine texture is produced.</li> </ul> <p>Stage 9 Baking</p> <ul style="list-style-type: none"> <li>Bake the bread in a very hot oven (230C gas 7) The dough rises rapidly as CO2 is produced and the gases expand. At 54C the yeast is killed. Fermentation ceases</li> </ul> <p>Starch gelatinises and gluten coagulates forming the framework. Water and alcohol are driven off through the crust.</p> <p>Starch on the surface forms dextrin (a sugar) and this caramelises to give the brown colour</p>		
(f)	<p><b>Discuss the implications of the changing pattern of food consumption and eating habits in the UK.</b></p> <p>Issues</p> <ul style="list-style-type: none"> <li>Changes in family structure use of more ready meals</li> <li>Changes in lifestyle- grazing/snacking/quick re heated convenience foods</li> <li>Increase in consumption of take away meals-often high in fat/sugar</li> <li>Reduction of consumption of fruit and vegetables especially in children-lowers fibre levels</li> <li>Low consumption of red meat esp in teenagers – lower levels of iron</li> <li>% of people who do not eat breakfast is increasing- encourages them to snack during the morning/ lowers milk consumption ( calcium levels)</li> <li>Coffee and snacks to go, high in fat increase calorie intake.</li> </ul>	[9]	<p><b>Level 1 (0-2 marks)</b></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 eg may just refer to increased levels of obesity in UK</p> <p><b>Level 2 (3-5 marks)</b></p> <p>One or two issues described with some explanation. Appropriate use of technical vocabulary demonstrating a good understanding of concept. Introduction of</p>

	<ul style="list-style-type: none"> <li>• Environmental issues-increased use of packaging</li> </ul> <p>Implications Health issues:</p> <ul style="list-style-type: none"> <li>• raised levels of obesity especially in young children</li> <li>• low levels of fibre in adults leading to cancers and diverticulitis</li> <li>• high levels of saturated fats leading to heart disease and obesity</li> <li>• low levels of iron especially in females</li> <li>• vitamin C consumption is lowered/low levels of antioxidants /risk of cancers</li> <li>• calcium levels are lowered</li> <li>• Increased levels of tooth decay in children</li> <li>• Increased pressure on the NHS</li> <li>• Environmental issues: Carbon footprint/ seasonability/ Packaging/waste</li> </ul>	<p>one example or supporting evidence Shows an understanding of the role of nutrients in the diet and the effects of deficiencies or excesses</p> <p><b>Level 3 (6-8 marks)</b> 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>Shows an excellent understanding of the role of nutrients in the diet and the effects of deficiencies or excesses and the importance of a balanced diet. Discusses the wider implications to include the effect on the environment or moral social implications</p> <p style="text-align: right;"><b>[8]</b></p>
<b>Question 3 Total 36</b>		

Question	Expected answers	Mark	Additional Guidance
4 (a)	<p><b>Give <u>four</u> justified design requirements for the promotional A4 folder.</b></p> <ul style="list-style-type: none"> <li>Needs to be durable – able to laminate for long term usage</li> <li>Easy to fold, not stick up and prevent storage</li> <li>Be able to be printed on/embossed for further finishing</li> <li>Easily cut/manufactured to enable cost effective to manufacture in small quantities</li> <li>Reference to aesthetics but must be qualified.</li> <li>Must hold paper securely to prevent it falling out.</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘strong –does not rip’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing graphics products.</b></p> <ul style="list-style-type: none"> <li>Broad customer surveys/questionnaires;</li> <li>user groups;</li> <li>specific market research;</li> <li>look at success of existing products on market</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of graphics products is ensured.</b></p> <ul style="list-style-type: none"> <li>Quality control checks</li> <li>Third party testing eg BSI</li> <li>User testing before sales</li> <li>Specific material testing</li> <li>Health and safety e.g production</li> <li>Destructive testing – crash dummies</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>
(d)	<p><b>Explain <u>two</u> key stages of the Life Cycle Assessment (LCA) of a graphics product.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>acquisition of materials;</li> <li>transporting raw materials;</li> <li>processing raw materials;</li> <li>manufacturing product;</li> <li>using product;</li> <li>disposal of product.</li> </ul>	[4]	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>



## 4 Graphic Products

Question	Expected answers	Mark	Additional Guidance
(e) (i)	<p><b><i>State a suitable specific material for the oversize A4 folder and give two properties or characteristics that make the material suitable for this use</i></b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• Card</li> <li>• Polypropylene</li> </ul> <p>Properties or characteristics include</p> <ul style="list-style-type: none"> <li>• Easy to manufacture</li> <li>• Good surface finish</li> <li>• Clean</li> <li>• Easy to transport/store</li> </ul>	[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><b><i>Describe, in detail, how the A4 folder would be manufactured as a batch of 50, 000. Include details of specialist equipment used. Use annotated sketches to support your answer.</i></b></p> <ul style="list-style-type: none"> <li>• Die cutting starts with paper template</li> <li>• Normally marked out onto an MDF base</li> <li>• Holes drilled through MDF, shape must be carefully planned so rules do not drop out.</li> <li>• Cutting knives (rules) are placed in the cutting area</li> <li>• Creasing knives are placed in areas of folds, these are lower</li> <li>• Foam placed around knives</li> <li>• Card inserted</li> <li>• Pressure exerted – Product cut</li> </ul>	[9]	<p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description, limited</p> <p><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 3 (5-6 marks)</b> Process fully described, key features and technical details identified, Answer must include detail of specialist equipment used for full marks.</p> <p>Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark</p> <p>Good sketch with main features identified and labelled 2 marks</p> <p>Detailed sketch with clear annotation 3 marks</p> <p>Max 1 if no sketch used</p>

Question	Expected answers	Mark	Additional Guidance
(f)	<p><b><i>Discuss the environmental implications of the use of new technologies within the print industry.</i></b></p> <p>issues</p> <ul style="list-style-type: none"> <li>• Reduction in chemical usage</li> <li>• Wastage (paper/card) limited through flexible systems</li> <li>• Waste dye must be disposed off correctly</li> <li>• Lower power requirements</li> <li>• Greater re-cycling potential- materials, plates/off-cuts</li> </ul> <p>Examples</p> <p>No need for films for making plates or go straight to direct to press, no need for plates and chemical process.</p> <p>Digital printing – lower numbers can be produced and therefore energy efficient and less waste.</p>	<b>[8]</b>	<p><b>Level 1 (0-2 marks)</b> 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><b>Level 2 (3-5 marks)</b> 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><b>Level 3 (6-8 marks)</b> 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>
<b>Question 4 Total 36</b>			

## 5 Manufacturing

Question	Expected answers	Mark	Additional Guidance
5 (a)	<p><b>Give <u>four</u> justified design requirements for the wall cupboard.</b></p> <ul style="list-style-type: none"> <li>• Easy to assemble for the purchaser</li> <li>• Strong construction when assembled to hold range of kitchen products</li> <li>• Accuracy of parts to ensure satisfactory quality and ease of assembly</li> <li>• Easy clean surfaces for hygiene</li> <li>• Maximum available space for contents, easy to see and remove</li> <li>• Ability to fix firmly to wall to prevent falling when full</li> <li>• Clear instructions given to ensure successful assembly</li> <li>• Designed to ensure ease of quantity production</li> <li>• Made to current standard sizes to fit into kitchens</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘big-hold lots’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing manufactured products.</b></p> <ul style="list-style-type: none"> <li>• Broad customer surveys/questionnaires;</li> <li>• user groups;</li> <li>• specific market research;</li> <li>• look at success of existing products on market</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of manufactured products is ensured.</b></p> <ul style="list-style-type: none"> <li>• Quality control checks</li> <li>• Third party testing eg BSI</li> <li>• User testing before sales</li> <li>• Specific material testing</li> <li>• Computer modelling/testing</li> <li>• Destructive testing</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> ways clearly described. Allow specific reference to given product.</p>

Question	Expected answers	Mark	Additional Guidance
(d)	<p><b>Explain the key stages of the Life Cycle Assessment (LCA) of a manufactured product.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials;</li> <li>• transporting raw materials;</li> <li>• processing raw materials;</li> <li>• manufacturing product;</li> <li>• using product;</li> <li>• disposal of product.</li> </ul>	[4]	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State a specific suitable material for the injection moulded handle and give two properties or characteristics that make the material suitable for this use</b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• ABS</li> <li>• Polypropylene</li> <li>• Polyethylene</li> <li>• HIPS</li> <li>• Polyamide (Nylon)</li> </ul> <p><b>Properties or characteristics</b></p> <ul style="list-style-type: none"> <li>• high quality finish</li> <li>• complex detail if required</li> <li>• range of colours/self-coloured</li> <li>• tough for regular use</li> <li>• highly suitable for high-volume production/injection moulding</li> </ul>	[3]	<p>Material must be a thermoplastic, but no mark given for simply ‘thermoplastic’ – must be named (spelling unimportant)</p> <p>1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>
(ii)	<p><b>Draw a flow chart to show the key stages of manufacture of the cupboard handle from raw material to final assembly. Include details of quality control checks.</b></p> <ul style="list-style-type: none"> <li>• Obtain mild steel components – check quality</li> </ul>		<p>Block diagram with clear flow/sequence/decision making indicated is acceptable</p>

Question	Expected answers	Mark	Additional Guidance
	<ul style="list-style-type: none"> <li>• Prepare injection mould – insert mild steel components</li> <li>• Insert mould into injection moulding machine</li> <li>• Preheat mould to enable plastic flow (check temp)</li> <li>• Insert plastic material in hopper</li> <li>• Commence heating and compaction of plastics (via archimedian screw in chamber)</li> <li>• When chamber full and at correct temperature – inject measured amount into mould</li> <li>• Cool mould</li> <li>• Mould opens, handle ejected with pins</li> <li>• Quality control check</li> <li>• Remove any flash/‘sprues’</li> </ul> <p>This relates to one-off type manufacture using a basic ‘triallying’ injection moulding machine.</p> <p>If high-volume production is described, inserting mould and heating/cooling will not be necessary; use of robotics for inserting inserts, removal of moulding and manipulation in quality control checks may be referenced. Detailed description of the automated process is required with appropriate annotated sketches.</p>	<p><b>[9]</b></p>	<p><b>Level 1 (0-2 marks)</b> Some stages outlined in sequence (up to 2), very limited description</p> <p><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified, clear order/sequence of stages, decisions/checks evident</p> <p><b>Level 3 (5-6 marks)</b> Process fully described, key features and technical details identified, Correct sequence and decision-making. Answer must include detail of quality control checks for full marks.</p> <p>Quality of description and communication</p> <p>Basic chart/diagram with limited annotation <span style="float: right;">1 mark</span> Good chart/diagram with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed chart/diagram with clear annotation <span style="float: right;">3 marks</span></p>

Question	Expected answers	Mark	Additional Guidance
(f)	<p><b><i>Discuss the implications to a company of introducing Computer Integrated Manufacturing CIM.</i></b></p> <p>Possible issues</p> <ul style="list-style-type: none"> <li>• Initial cost of hardware and equipment</li> <li>• Connection of all areas to main computer</li> <li>• Recovery of investment through savings made</li> <li>• Centralized control of the whole system by main computer</li> <li>• Workforce retraining for 'new' skills</li> <li>• Reduction in total workforce</li> <li>• Computer control of material/product movement around factory</li> <li>• Application to JIT</li> <li>• Improved output/efficiency</li> <li>• Quality control at all stages of manufacture</li> <li>• Ability to implement changes quickly when required</li> <li>• Quicker to get new designs/products to the manufacturing stage</li> </ul> <p>Examples</p> <ul style="list-style-type: none"> <li>• Major restructuring of factory to allow connection to system – machine movement; materials handling systems; production cells</li> <li>• Stages of a products manufacture from design to completion monitored and controlled centrally</li> <li>• Workforce reduces in overall size, but new skills required to deal with new technologies used.</li> <li>• Control allows 'round the clock' working</li> </ul>	<b>[8]</b>	<p><b>Level 1 (0-2 marks)</b> 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><b>Level 2 (3-5 marks)</b> 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><b>Level 3 (6-8 marks)</b> 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>
			<b>Question 5 Total 36</b>

## 6 Resistant Materials

Question	Expected answers	Mark	Additional Guidance
6 (a)	<p><b>Give <u>four</u> justified design requirements for the toast rack.</b></p> <ul style="list-style-type: none"> <li>• The toast rack must be easily cleaned for health/hygiene reasons;</li> <li>• there must be sufficient gap between the slices of toast to allow easy extraction;</li> <li>• the base must be smooth so as not to scratch the table surface;</li> <li>• the spaces for the slices of toast should accommodate thin to thick sliced bread to cater for personal preferences ;</li> <li>• the toast rack must be stable in use so that it does not rock, make usage difficult and irritate the user;</li> <li>• the toast rack should be robust enough to withstand dropping from table height.</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘ lightweight – carry easy’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing products.</b></p> <ul style="list-style-type: none"> <li>• Broad customer surveys/questionnaires;</li> <li>• user groups;</li> <li>• specific market research;</li> <li>• look at success of existing products on market</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of resistant material products is ensured.</b></p> <ul style="list-style-type: none"> <li>• Quality control checks</li> <li>• Third party testing eg BSI</li> <li>• User testing before sales</li> <li>• Specific material testing</li> <li>• Destructive testing – crash dummies</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>

Question	Expected answers	Mark	Additional Guidance
(d)	<p><b>Explain the key stages of the Life Cycle Assessment (LCA) of a resistant materials product.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials;</li> <li>• transporting raw materials;</li> <li>• processing raw materials;</li> <li>• manufacturing product;</li> <li>• using product;</li> <li>• disposal of product.</li> </ul>	<b>[4]</b>	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State a specific suitable material for the toast rack and give two properties or characteristics that make the material suitable for this use</b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• acrylic;</li> <li>• abs;</li> <li>• polypropylene;</li> <li>• laminated birch/beech/maple;</li> <li>• aluminium;</li> <li>• chromed (or plastic coated) mild steel;</li> <li>• copper;</li> <li>• Stainless steel</li> </ul> <p><b>Properties or characteristics</b></p> <ul style="list-style-type: none"> <li>• high quality finish;</li> <li>• does not easily degrade/corrode;</li> <li>• easily formed to required shape;</li> <li>• produces rigid structure;</li> </ul>	<b>[3]</b>	<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	Expected answers	Mark	Additional Guidance
(ii)	<p><i>Describe, in detail, how the toast rack shown in Fig. 8 would be manufactured as a batch of 50,000. Include details of specialist tooling used.</i></p> <p>Injection moulding</p> <ul style="list-style-type: none"> <li>• split mould prepared/preheated</li> <li>• plastic granules in hopper</li> <li>• granules heated in chamber, archimedian screw</li> <li>• molten plastic injected into mould</li> <li>• mould is water cooled</li> <li>• mould opens, toast rack is ejected</li> <li>• sprue/flashing removed</li> </ul> <p>Laser cutting/thermoforming</p> <ul style="list-style-type: none"> <li>• design created CAD</li> <li>• print details setup/speed, thickness of material</li> <li>• laser cutter set up, auto focus</li> <li>• laser cut</li> <li>• auto removal/replacement</li> <li>• thermoformed using line bend system</li> <li>• held until shape set.</li> <li>• edges may be flame polished</li> </ul> <p>Laminated</p> <ul style="list-style-type: none"> <li>• male/female former prepared (suitable material for 50,000 units)</li> <li>• veneers pre cut</li> <li>• automatic glue spreading (one side)</li> <li>• silicon release on former</li> <li>• veneers inserted into former</li> <li>• former closed - heat applied</li> <li>• shape released</li> <li>• edge shaping</li> <li>• finish applied</li> </ul>		<p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 3 (5-6 marks)</b> Process fully described, key features and technical details identified, Answer must include detail of specialist tooling for full marks.</p> <p>Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark</p> <p>Good sketch with main features identified and labelled 2 marks</p> <p>Detailed sketch with clear annotation 3 marks</p> <p>Max 1 if no sketch used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

Question	Expected answers	Mark	Additional Guidance
	Stamped – pressing <ul style="list-style-type: none"> <li>• stamping – press tool prepared</li> <li>• metal sheet positioned to ensure maximum usage, least wastage</li> <li>• metal secured, guards in place</li> <li>• press operated – produces blank</li> <li>• blank removed</li> <li>• next sheet/roll of metal positioned for next press (Candidates may describe process with roll of sheet metal and rotating drum stamping system.)</li> <li>• sharp edges ground</li> <li>• if appropriate, finish applied</li> </ul>	<b>[9]</b>	
<b>(f)</b>	<p><b><i>Discuss the implications to manufacturers of introducing a sustainable design strategy.</i></b></p> <p>issues</p> <ul style="list-style-type: none"> <li>• Must have up to date research/information (cost/manpower implications);</li> <li>• Initial cost implications if changing processes</li> <li>• Increased popularity with environmentally conscious consumer;</li> <li>• Possible changes to product design or choice of materials;</li> <li>• Possible changes to production process.</li> </ul> <p>examples</p> <ul style="list-style-type: none"> <li>• Specific recycling opportunities (car industry)</li> <li>• Other long life/durable products (bags for life, value products- minimum packaging)</li> </ul>	<b>[8]</b>	<p><b>Level 1 (0-2 marks)</b> 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><b>Level 2 (3-5 marks)</b> 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><b>Level 3 (6-8 marks)</b> 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>
			<b>Question 6 Total 36</b>

## 7 Systems and Control

Question	Expected answers	Mark	Additional Guidance
7 (a)	<p><b>Give <u>four</u> justified design requirements for the exercise bike.</b></p> <ul style="list-style-type: none"> <li>Adjustable seat height to cope with riders of different leg lengths,</li> <li>Comfortable seat to encourage user to sit and exercise for long periods,</li> <li>Sufficiently strong frame to cope with heavy (possibly overweight) users,</li> <li>Adjustable pedalling resistance to allow user to set a comfortable exercise,</li> <li>Warning labels regarding over-exercising to ensure user safety,</li> <li>Digital readout to show distance cycled, calories etc. to allow user to keep track of exercise regime,</li> <li>Ability for frame to be dismantled to allow shipping,</li> <li>Ability to hold water bottle to allow user to stay hydrated whilst exercising,</li> <li>Non-slip feet so there is no danger of bike sliding during use or whilst getting on/off saddle,</li> <li>Non-scratch feet so the floor is not damaged by the weight of the bike</li> <li>The bike should include clear instructions regarding how to exercise safely so that the user is not put at risk.</li> </ul>	[4]	<p>Other, valid, design requirements are allowed</p> <p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘easy to use’ or ‘suitable for children’ etc.</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing products that involve the use of systems and control.</b></p> <ul style="list-style-type: none"> <li>Broad customer surveys/questionnaires to discover society needs, fashion trends, existing practices;</li> <li>user groups – surveys, interviews and tests to discover specific user needs, range of users, to gather feedback and advice from users;</li> <li>specific market research to focus on information for later use,</li> <li>identify existing products on market and evaluate their success, also assess their specifications, identify fashions and spot gaps in the market.</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of products, that involve the use of systems and control, are ensured.</b></p> <ul style="list-style-type: none"> <li>warning labels for user placed on product regarding safe use of product,</li> <li>warning labels for service personnel regarding dangers of opening product</li> <li>quality checks during manufacture to ensure that critical sub-systems or components are safe,</li> <li>safety interlocks designed into the product to ensure that user error does not lead to injury,</li> <li>guards over moving parts (internal and external) to minimise trapping</li> </ul>		<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>

	<p>hazard,</p> <ul style="list-style-type: none"> <li>• electrical safety – product designed to standards of electrical safety to ensure no risk of shock,</li> <li>• tamper-proof screws/fasteners to prevent product being opened by unqualified person,</li> <li>• established system for safe disposal of product,</li> <li>• designing within safe parameters, BSI etc.</li> </ul>	[4]	
(d)	<p><b>Explain the key stages of the Life Cycle Assessment (LCA) of a product that involves the use of systems and control.</b></p> <p>Identification of the environmental and social impact caused by the following key stages:</p> <ul style="list-style-type: none"> <li>• acquisition of materials – can refer to a very wide range of materials used in the product, from the casing to the components/PCB/batteries etc. The effect on the earth's resources and social and environmental considerations;</li> <li>• transporting raw materials – which may involve huge distances across the world – energy usage;</li> <li>• processing raw materials – some materials, e.g. metal ores require very large amounts of energy to extract and refine the material, pollution generated by industrial processes;</li> <li>• manufacturing the product – can refer to manufacturing the components and assembling the product;</li> <li>• using the product – the energy used by the product and the pollution it creates during its working life;</li> <li>• disposal of the product – the energy required to recycle key parts and the environmental pollution.</li> </ul>	[4]	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State an electronic component which could be used on an exercise bike to sense the revolutions of the pedal wheel and sketch a labelled diagram to show how the component would be used.</b></p> <ul style="list-style-type: none"> <li>• Component identified (eg reed switch/magnet, opto switch, microswitch etc.)</li> <li>• Diagram to clearly show the interaction between pedal wheel and sensor, e.g. the magnet mounted on the pedal wheel passes close to the reed switch once every revolution, or, a small opaque tab on the pedal wheel passes through the slot on the opto</li> </ul>	[3]	<p>Sensor identified 1 mark</p> <p>Diagram illustrating position of sensor on the mechanism 1 mark</p> <p>Interaction between wheel and sensor clearly identified 1 mark</p>

	switch, or, a reflective spot on the pedal wheel passes in front of a reflective opto sensor, etc.		
(ii)	<p><b>The user of the exercise bike shown in Fig.10 has to pedal against a mechanical resistance. This resistance can be adjusted electronically by a control on the display panel.</b></p> <p><b>Use annotated sketches to show a method of producing a mechanical pedalling resistance, which can be adjusted electronically.</b></p> <ul style="list-style-type: none"> <li>• Flywheel or drum of some description linked to pedal wheel – this may be a hub on the pedal wheel or a separate flywheel linked by belt and pulleys or a gearing system,</li> <li>• One method of providing mechanical resistance, and method of adjusting that resistance e.g: <ul style="list-style-type: none"> <li>○ A friction brake acting on the drum, with a method of adjusting the pressure of the brake, perhaps by using a motor/gearbox system to turn an adjusting screw.</li> <li>○ magnets inducing eddy currents in the flywheel, and by adjusting the distance or the number of magnets, the resistance can be altered.</li> <li>○ A propeller to create an air current, by adjusting a vent more/less air is allowed to flow which varies the resistance.</li> <li>○ A hydraulic fluid pump, with an adjustable valve to change resistance to fluid flow.</li> <li>○ An electric dynamo linked to resistor, adjust the value of the resistor to vary the pedalling resistance.</li> <li>○ Other methods are possible and should be awarded on their likely effectiveness and easy of implementation.</li> </ul> </li> </ul> <p>The method of adjusting the resistance <u>electronically</u> must be shown for full marks, eg with use of an electric motor or other actuator to adjust the appropriate parameter mentioned above.</p>	[9]	<p><b>Level 1 (0-2 marks)</b> Some principles outlined (up to 2), very limited description, no adjustment of resistance.</p> <p><b>Level 2 (3-4 marks)</b> Key principles outlined, reasonably well described, some reference to exercise bike, basic adjustment of resistance.</p> <p><b>Level 3 (5-6 marks)</b> Principles fully described, reference to exercise bike explicit. Answer must include electronic adjustment of resistance for full marks.</p> <p>Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark Good sketches with main principles identified and labelled 2 marks Detailed sketches with clear annotation 3 marks Max 1 if no sketches used</p>
(f)	<p><b><i>Discuss the ethical responsibilities for designers of fitness equipment.</i></b> Some issues to consider:</p> <ul style="list-style-type: none"> <li>• Health and fitness applies to all groups in society so the equipment should be accessible to a wide range of people.</li> </ul>		<p><b>Level 1 (0-2 marks)</b> Some issues outlined, bullet points (usually focussed on one issue) no further or very limited explanation, limited</p>

	<ul style="list-style-type: none"> <li>• There is a need to produce fitness products that everyone can afford, otherwise the equipment becomes elitist.</li> <li>• Need to consider accessibility for physically disabled, perhaps by designing special equipment or by using adaptors.</li> <li>• Need to promote the product as just one aspect of a healthy lifestyle.</li> <li>• Need to support the user by issuing other health and diet advice to go alongside the product.</li> <li>• Need to promote social interaction – does a ‘home gym’ defeat this?</li> <li>• There is a danger of over-exercising for unfit people.</li> <li>• The designer should consider health and fitness of children, not just adults.</li> <li>• There is an ethical responsibility for sustainability in the design and production of products.</li> <li>• Energy usage consideration during the manufacture and use of the product.</li> <li>• Disposal of the product after use.</li> </ul> <p>Other relevant ethical issues may be raised and discussed by candidates.</p>	<p><b>[8]</b></p>	<p>use of examples or supporting evidence  <b>Level 2 (3-5 marks)</b>                  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  <b>Level 3 (6-8 marks)</b>                  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><b>Question 7 Total 36</b></p>			

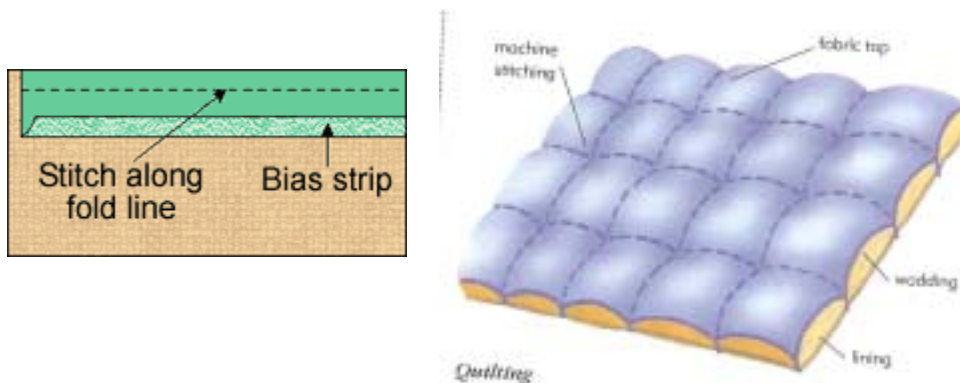
## 8 Textiles

Question	Expected answers	Mark	Additional Guidance
8 (a)	<p><b>Give <u>four</u> justified design requirements for the oven mitt.</b></p> <ul style="list-style-type: none"> <li>• Must fit an average sized adult hand – sold as an adult product, must fit most adults</li> <li>• Must have an adequate layer of wadding to give heat protection for the user</li> <li>• Must extend to cover lower arms – to prevent burns when removing items from the oven</li> <li>• Must be flexible to enable secure grip of pan handles etc</li> <li>• Must be aesthetically pleasing fabric design – to match kitchen environment or décor or contrast between quilted and plain parts</li> <li>• Fabric must be treated with flame proof finish – high risk of catching fire</li> <li>• Must be washable for hygiene purposes</li> <li>• Must have a hanging loop for a named safety reason</li> </ul>	[4]	<p>Clear statement and justification required for a mark</p> <p>Must be related to product – no marks for generic responses</p> <p>Must be a full response – no marks for ‘big enough– to fit hand’</p> <p><b>Four</b> justified design requirements. Give one mark if two valid points given but not justified.</p>
(b)	<p><b>Describe <u>two</u> ways in which the needs of the consumer are considered when designing textile products.</b></p> <ul style="list-style-type: none"> <li>• Broad customer surveys/questionnaires;</li> <li>• user groups profiles/interviews</li> <li>• specific market research eg fashion trends/predications</li> <li>• Evaluation of existing products on market</li> <li>• Sales trends and figures</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described. Allow responses linked to given products.</p>
(c)	<p><b>Describe <u>two</u> ways in which the safety of textile products is ensured.</b></p> <ul style="list-style-type: none"> <li>• Quality control checks eg metal detection for broken needles</li> <li>• Third party testing eg BSI</li> <li>• Specific material testing (child restraints/set belts)</li> <li>• Use of appropriate material properties or finishes eg fire retardant – stab proof</li> <li>• Safety systems set in production eg NACCERAP/ checking for broken needles</li> </ul>	[4]	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> ways clearly described Allow specific reference to given product.</p>

Question	Expected answers	Mark	Additional Guidance
(d)	<p><b>Explain <u>two</u> key stages of the Life Cycle Assessment (LCA) of a textile product.</b></p> <p>Impact caused by:</p> <ul style="list-style-type: none"> <li>• acquisition of materials- fibre production eg Natural v Synthetic fibres/use of pesticides in cotton production</li> <li>• transporting raw materials- global production implications</li> <li>• processing raw materials- dyeing, printing energy use and impact on environment</li> <li>• manufacturing product-production systems, wastage,</li> <li>• using product – washing v dry cleaning</li> <li>• disposal of product- biodegradable cotton/ blends cannot be recycled/ reuse of products/fabrics/fibres</li> </ul>	<b>[4]</b>	<p>Stage 1 mark Impact explained 1 mark</p> <p><b>Two</b> stages clearly explained List of stages – maximum 2 marks.</p>
(e) (i)	<p><b>State a specific suitable fibre/fabric for the oven mitt and give two properties that make the material suitable for this use</b></p> <p><b>Material</b></p> <ul style="list-style-type: none"> <li>• Cotton –sateen/poplin/calico/denim</li> <li>• Cotton/polyester blend</li> </ul> <p><b>Properties</b> include</p> <ul style="list-style-type: none"> <li>• Hard wearing/durable</li> <li>• Washable at high temps (cotton) to remove stains</li> <li>• Easy to print onto or dye</li> <li>• Polycotton blend is easy care</li> <li>• Soft handle/good drape gives flexibility</li> </ul>	<b>[3]</b>	<p>The details of the fabric must be specific Allow any appropriate fabric type. Candidate may name other specific cottons 1x1 mark</p> <p>The property must relate to the fibres in the chosen the fabric 2x1 mark</p>



Question	Expected answers	Mark	Additional Guidance
(ii)	<p><b>Describe, in detail, how the oven glove would be manufactured. Include details of the quilting. Use annotated sketches to support your answer.</b></p> <ul style="list-style-type: none"> <li>Design pattern for mitt. Two parts one to be quilted and the other not quilted but containing wadding with in the construction</li> <li>Quilt the fabric for the quilted part: ( see diagram)               <ul style="list-style-type: none"> <li>Assemble 3 layers- Top layer Wadding Cheaper backing fabric</li> </ul> </li> <li>Secure the 3 layers by tacking, working from the centre to keep it flat</li> <li>Machine parallel rows of stitching to required design to secure. Starting from the centre and working outwards.</li> <li>Cut out the mitt patterns- ensuring that they are cut in pairs quilted parts and two lower parts out of plain fabric</li> <li>Join lower part of mitt to quilted part</li> <li>Fold bias strip and machine together for hanging tab.</li> <li>Pin the hanging tab in place</li> <li>Right sides together machine around the mitt leaving the wrist section raw. Neaten edges by applying binding ( see diagram)</li> <li>Attach bias binding to the edges.</li> </ul> <p>N.B Stages could change depending on the quantity of production.</p>	<p><b>[9]</b></p>	<p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description, no details of how to quilt</p> <p><b>Level 2 (3-4 marks)</b> Key stages outlined, reasonably well described, some detail to application of binding</p> <p><b>Level 3 (5-6 marks)</b> Stages fully described, Full details of quilting, joining and the application of the binding finish. Quality of description and communication</p> <p>Basic sketch with limited annotation 1 mark Good sketches with main details identified and labelled 2 marks Detailed sketches with clear annotation 3 marks Max 1 if no sketches used</p>



Question	Expected answers	Mark	Additional Guidance
(f)	<p><b><i>Discuss the environmental implications of textile production.</i></b>            Issues and examples</p> <ul style="list-style-type: none"> <li>• Use of water/chemicals in fibre production and the printing/dyeing processes - avoid harmful chemicals                - reduce use of water</li> <li>• Use of pesticides in natural fibre production (25% of world usage)                - develop pest resistant strains                - use biological predators</li> <li>• Reduce production of chemical synthetic fibres- uses oil</li> <li>• Encourage re-cycling of textiles – polartec from plastic bottles</li> <li>• Pollution caused by dyeing – use natural colours, develop efficient removal of dyes from effluent</li> <li>• Use bio-degradable materials- cotton/wool/silk/linen/cellulose fibres, use less blended natural/synthetic fibres/fabrics</li> <li>• Reduce use of packaging – recycle coat hangers</li> <li>• Encourage processes such as Lyocell (Tencel )production which is enclosed and all chemicals are contained within the system and reused</li> <li>• Reduce the use of lubricants, dust and noise in production systems</li> <li>• Reduce transportation</li> </ul>	[8]	<p><b>Level 1 (0-2 marks)</b>            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><b>Level 2 (3-5 marks)</b>            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><b>Level 3 (6-8 marks)</b>            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>
<b>Question 8 Total 36</b>			

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