

**GCE**

**Design and Technology**

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

Advanced GCE

**Mark Scheme for June 2017**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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

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

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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Question		Answer / Indicative Content	Mark	Guidance
1	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• The floor must provide a smooth and level surface</li> <li>• The floor must provide stability to the external walls</li> <li>• The floor must resist live or imposed loads eg. furniture, people etc.</li> <li>• The floor must resist dead loads eg. floor finishes, partition walls etc.</li> <li>• The floor must provide an acceptable level of fire resistance</li> <li>• The floor must provide an acceptable level of sound insulation</li> <li>• The floor must provide an acceptable level of heat loss</li> <li>• The floor must provide resistance to damp and condensation</li> <li>•</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
	(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>• JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>• Minimal storage space required for components and completed products</li> </ul>	4	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>

Question	Answer / Indicative Content	Mark	Guidance
(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>• Toothbrush handle, enable good grip with possibly wet hands</li> <li>• Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>• Car pedal – sand blasted for grip</li> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of health product packaging</li> </ul>	4	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>• for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul> <p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>• Early use of nickel-titanium alloys (Nitinol) established that they had a 'memory'.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>• Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p> <p>Brief description/statements</p>

Question	Answer / Indicative Content	Mark	Guidance
	<p>reaction to body temperatures, indicating whether a wound is healing or not.</p> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>• When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.</li> </ul>	<b>4</b>	
(e) (i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Composite laminated planks</li> <li>• Tongue and groove softwood boarding</li> <li>• Particle board (flooring grade)</li> <li>• Plywood (flooring grade)</li> <li>• Wood blocks</li> <li>• Carpet and carpet tiles</li> <li>• Vinyl sheet and tiles</li> <li>• Polished concrete</li> </ul> <p><b>Properties or characteristics</b> (dependant on material)</p> <ul style="list-style-type: none"> <li>• Resistant to wear</li> <li>• Resistant to water</li> <li>• Resistant to indentation and impact</li> <li>• Resistant to chemicals</li> <li>• Resistant to impact sound</li> <li>• Resistant to fire</li> <li>• Appearance</li> <li>• Ease of cleaning</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	Answer / Indicative Content	Mark	Guidance
	<ul style="list-style-type: none"> <li>• Slipperiness</li> <li>• Cost</li> <li>• Warmth</li> </ul>		
	<p><b>(ii)</b> <i>Construction methods could be</i></p> <ul style="list-style-type: none"> <li>• Build the external and internal load-bearing walls to the height of the damp-proof course</li> <li>• This allows the inner face of the walls to be used as permanent formwork</li> <li>• Lay sub-base of 150 mm thick hardcore (stone or rock) and compact with plate compactor or vibrating roller</li> <li>• Fill in any voids in the hardcore with a 50 mm thick layer of sand (blinding) between the stones</li> <li>• Compact the sand layer</li> <li>• Lay 100 to 150 mm thick concrete slab</li> <li>• Tamp wet concrete to remove any air voids</li> <li>• Lay the horizontal damp-proof membrane</li> <li>• Lay rigid insulation</li> <li>• Lay 50 mm concrete screed</li> <li>• Float finish concrete screed</li> </ul> <p>Building Regulation issues</p> <ul style="list-style-type: none"> <li>• fire resistance</li> <li>• sound insulation</li> <li>• heat loss</li> <li>• resistance to dampness</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;">1 mark</span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed sketches/chart with clear annotation marks <span style="float: right;">3</span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

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	Quality issues <ul style="list-style-type: none"> <li>• Components and materials to satisfy relevant Euro Codes, British Standards and/or British Board of Agreement' requirements</li> </ul>	<b>9</b>	
<b>(f)</b>	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</li> </ul>	<b>8</b>	<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><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 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>

2	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>Resist intense heat of cooker</li> <li>Be stable on a cooker</li> <li>Avoid heat transfer to handle</li> <li>Be of a size to comfortably fit standard</li> </ul> <p>Clean easily without scouring</p>		<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p><b>4</b> Give one mark if two valid points given but not fully justified</p>
	(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>if deliveries are late production stops</li> <li>Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>Minimal storage space required for components and completed products</li> </ul>	4	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>
	(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>Toothbrush handle, enable good grip with possibly wet hands</li> <li>Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>Car pedal – sand blasted for grip</li> <li>Soft toy, eg. velvet for tactile response</li> </ul>		<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>



		<ul style="list-style-type: none"> <li>Textured laminates/card for architectural modelling</li> <li>Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>Braille embossing of health product packaging</li> </ul>	4	
	(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul> <p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>Early use of nickel-titanium alloys (Nitinol) established that they had a 'memory'.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p> <p>Brief description/statements</p>

			used as the airbag sensor in a car.	4	
	(e)	(i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>Mild steel (coating or seasoned/oiled finish)</li> <li>Aluminium alloy</li> <li>Copper/brass</li> <li>Stainless steel</li> </ul> <p><b>Properties or characteristics</b> (dependant on material)</p> <ul style="list-style-type: none"> <li>Allow even heat</li> <li>Maintain shape after regular heating/cooling</li> <li>Able to be pressed/formed/spun to shape</li> <li>Easy to clean without scouring</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><i>Manufacturing methods could be</i></p> <ul style="list-style-type: none"> <li>Spinning Circular shape cut Secured on machine Rotated – pressure applied Edge finished</li> <li>Pressing Circular shape cut/stamped Male/female former Pressure applied</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p>

		Edge finished		<p>Basic sketch or chart with limited annotation <b>1 mark</b></p> <p>Good sketches/chart with main features identified and labelled <b>2 marks</b></p> <p>Detailed sketches/chart with clear annotation marks <b>3</b></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>
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			8	

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3	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• Six buns in each pack</li> <li>• Baked in batches of six - joined together / touching</li> <li>• All buns should be identical in size approx 6 cm diameter, depth 5cm</li> <li>• Size of pack of Chelsea buns 18 x 12 x 5 cm</li> <li>• Glazed so that they have a shiny / attractive finish</li> <li>• Must be able to see evidence of the filling - dried fruit</li> <li>• Have a shelf life of three to four days</li> <li>• Soft texture</li> <li>• Sweet dough mixture</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
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	<ul style="list-style-type: none"> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of heath product packaging</li> </ul>	4	
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		material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.	4	
(e)	(i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>Nutrients white and brown flour must be fortified by law include <ul style="list-style-type: none"> <li>✓ Iron</li> <li>✓ Thiamin (Vitamin B1),</li> <li>✓ Nicotinic acid or nicotinamide and</li> <li>✓ Calcium carbonate</li> </ul> </li> <li>The process of milling the wheat normally causes a loss of iron, thiamin and nicotinic acid and the purpose of this requirement is to restore these vitamins and minerals to their original levels.</li> <li>Calcium is added for fortification purposes to improve the nutritional value of flour</li> <li>Fortification is a means of improving the nutritional status of a population .</li> </ul> <p>Fortified foods make an important contribution to diets in the UK.</p>	3	<p>award mark for other appropriate material not listed</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>
	(ii)	<p>Ingredients to include:</p> <ul style="list-style-type: none"> <li>strong plain flour - higher gluten content - more than 10% protein in the bread.</li> <li>yeast - fresh, dried, fast action - raising agent</li> <li>liquid - water or milk (for an enriched dough) heated to 37C - so yeast is activated</li> <li>butter or oil to enrich the dough / improve the keeping quality</li> <li>sugar - to activate the yeast (additional may also be added if enriched dough is used)</li> <li>salt - develop the gluten</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b></p>

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	<ul style="list-style-type: none"> <li>• Filling ingredients - sugar, dried fruit, spices such as cinnamon or mixed spice</li> <li>• Glaze - sugar and water syrup / warmed golden syrup</li> </ul> <p><b>Stages of making</b></p> <p><b>Weighing</b></p> <p>1. Weigh all ingredients accurately for bread dough.</p> <p><b>Rubbing in of fat /addition of oil</b></p> <p>2. Rub fat into the flour and salt or mix oil with warmed milk.</p> <p>3. Add the yeast to the mixture either Fast action - stir into dry ingredients Fresh yeast - mix with the warmed liquid Dried yeast - mix with the warmed liquid</p> <p>The warm liquid causes the yeast to begin to ferment - produces CO<sub>2</sub> which will cause the bread to rise.</p> <p>4. Add the warm liquid to the flour mixture - dry ingredients absorb the liquid - yeast is distributed evenly throughout the mixture. The liquid enables the gluten to be developed in the flour - this is developed further in the kneading process. This will also provide the bread with an even texture.</p> <p><b>Kneading</b></p> <p>5. If kneaded by hand knead for 10 minutes to develop the protein in the flour (gluten) the mixture should be smooth and stretch. This could also be done by machine - with a dough hook - for approximately three minutes.</p> <p>6. Place the dough in a bowl and cover with cling film or</p>	9	<p>Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;">1 mark</span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed sketches/chart with clear annotation <span style="float: right;">3 marks</span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

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	<p>polythene bag - prevents the top of the bread drying out and a skin forming on the bread dough - due to evaporation .</p> <p><b>Rising</b>            7. The bread is left in a warm place to rise- 2 x volume. The rising time depends on the temperature it is left at. The yeast begins to ferment and produce CO<sub>2</sub>. The enzyme diastase in the flour converts the flour into maltose (sugar)..            Yeast produces enzymes - zymase complex which turns the glucose into CO<sub>2</sub> and a little alcohol. These cases cause the dough to rise</p> <p><b>Knocking back</b>            8. The risen dough is kneaded lightly. This breaks down the large bubbles of CO<sub>2</sub> which have developed in the rising and distributes them as small bubbles. This gives the dough an even texture.            Re-kneading the dough exposed the surface of the dough to oxygen which reactivates the yeast for the second rising / proving.</p> <p><b>Shaping</b>            9. The dough is rolled out to a rectangle the filling ingredients are placed on top. It is rolled up like a Swiss roll. The end should be sealed with water so it doesn't not come apart.</p> <p>10. The roll is cut into pieces approximately 3cm wide.</p> <p>11. Buns are placed on a greased baking tray - so they do not stick. Chelsea buns are covered and left to prove till double in size. The temperature at this stage should not exceed 20°C. The yeast ferments in the dough and</p>		



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	<p>produces a fine even dough.</p> <p><b>Baking</b>            12. The Chelsea buns are baked in a hot oven (210°C gas 7) The dough rises rapidly as CO<sub>2</sub> is produced by the yeast and the gases expand.            At 54°C the yeast is killed. This stops further rising.            Starch gelatinises and gluten coagulates forming the framework. Water and alcohol are driven off through the crust. Starch on the surface forms dextrin (a sugar) and this caramelises to give the brown colour to the crust</p> <p>13. Just before the end of cooking a glaze is applied the sugar caramelises and provides a shiny and slightly sticky glaze.</p>		
(f)	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</li> </ul>	<b>8</b>	<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><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 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>

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4	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• Resist damage through spillage</li> <li>• Even balance when carrying</li> <li>• Material/base design comfortably supports four full cups of hot liquid</li> <li>• Comfortable handle – too thin card may chafe skin</li> <li>• Tight/secure location of cups</li> <li>• Flatpack for ease of of delivery/storage</li> <li>• Well-constructed to avoid collapse</li> <li>• Recyclable</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
	(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>• JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>• Minimal storage space required for components and completed products</li> </ul>	4	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>
	(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>• Toothbrush handle, enable good grip with possibly wet hands</li> <li>• Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>• Car pedal – sand blasted for grip</li> </ul>		<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>

Question	Answer / Indicative Content	Mark	Guidance
	<ul style="list-style-type: none"> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of heath product packaging</li> </ul>	4	
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>• for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul> <p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>• Early use of nickel-titanium alloys (Nitinol) established that they had a 'memory'.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>• Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>• When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p> <p>Brief description/statements</p>

Question		Answer / Indicative Content	Mark	Guidance
		material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.	4	
(e)	(i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Corrugated cardboard</li> <li>• Corroflute (polypropylene)</li> <li>• water resistant/coated card</li> <li>• specified weight cardboard</li> <li>• solid white board</li> </ul> <p><b>Properties or characteristics</b> (dependant on material)</p> <ul style="list-style-type: none"> <li>• rigid</li> <li>• not damaged/weakened by liquid spillage</li> <li>• lightweight/tough</li> <li>• Easily cut/stamped/folded to shape</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><i>Manufacturing methods could be – die cut or similar</i></p> <ul style="list-style-type: none"> <li>• Appropriate development showing tabs/connections - possible crash base</li> <li>• Show crease and cut lines</li> <li>• Press form created</li> <li>• Test run then cut/crease</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b></p>

Question	Answer / Indicative Content	Mark	Guidance
			<p>Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <b>1 mark</b></p> <p>Good sketches/chart with main features identified and labelled <b>2 marks</b></p> <p>Detailed sketches/chart with clear annotation marks <b>3</b></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p> <p><b>9</b></p>
(f)	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback</li> </ul>		<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><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 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>8</b></p>

Question			Answer / Indicative Content	Mark	Guidance
			gorillas)		

Question			Answer / Indicative Content	Mark	Guidance
5	(a)		<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• Robust enough to take the effects of pulling and turning</li> <li>• Smooth and comfortable to hold and apply pressure to</li> <li>• Appropriate size for adult/child hand to grip</li> <li>• Enough gap for hand to grip and turn without scraping knuckles</li> <li>• Consideration of aesthetics of any other door furniture -</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
	(b)		<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> </ul>		<p>brief description 1 mark</p> <p>detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>

Question	Answer / Indicative Content	Mark	Guidance
	<ul style="list-style-type: none"> <li>• JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>• Minimal storage space required for components and completed products</li> </ul>	4	
(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>• Toothbrush handle, enable good grip with possibly wet hands</li> <li>• Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>• Car pedal – sand blasted for grip</li> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of health product packaging</li> <li>• Aesthetic texture to attract user</li> </ul>	4	<p>brief description      1 mark detailed description    2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>• for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul> <p><b>Shape memory alloys</b></p>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p>

Question		Answer / Indicative Content	Mark	Guidance
		<ul style="list-style-type: none"> <li>Early use of nickel-titanium alloys (Nitinol) established that they had a 'memory'.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.</li> </ul>	4	Brief description/statements
(e)	(i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>Aluminium alloy</li> <li>Mild steel with appropriate finish</li> <li>Stainless steel</li> <li>Brass</li> <li>ABS</li> <li>Nylon</li> </ul>		award mark for other appropriate material not listed 1x1 mark Award mark for other appropriate property/characteristic 2x1 mark



Question	Answer / Indicative Content	Mark	Guidance
	<p><b>Properties or characteristics</b> (dependant on material)</p> <ul style="list-style-type: none"> <li>• rigid</li> <li>• good aesthetic qualities</li> <li>• Self-finished or takes good finish</li> <li>• Comfortable to grip</li> </ul>	3	
	<p><b>(ii)</b> <i>Manufacturing methods could be</i></p> <p><b>Part A Cover</b></p> <ul style="list-style-type: none"> <li>• Stamped and Pressed</li> <li>• Injection moulded</li> <li>• Coating/finish applied</li> </ul> <p><b>Part B handle</b></p> <ul style="list-style-type: none"> <li>• Die/investment cast</li> <li>• Drop forged - finished</li> <li>• Coating/finish applied</li> <li>•</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;">1 mark</span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed sketches/chart with clear annotation marks <span style="float: right;">3</span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to</p>

Question	Answer / Indicative Content	Mark	Guidance
		9	chosen material.
(f)	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</li> </ul>	8	<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><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 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>

Question		Answer / Indicative Content	Mark	Guidance
6	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• Robust enough to take the weight of the tablet and the user pressing the tablet</li> <li>• Base of product does not damage surface upon which it is placed</li> <li>• Product has some friction resistance so as not to slide around when in use</li> <li>• Must hold a range of tablets from mini to pro size</li> <li>• Tablet must be held reasonably securely so that it does not move or wobble when in use</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
	(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>• JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>• Minimal storage space required for components and completed products</li> </ul>	4	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>
	(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>• Toothbrush handle, enable good grip with possibly wet hands</li> <li>• Screwdriver handle - ribbed to prevent rotation when gripped</li> </ul>		<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>

Question	Answer / Indicative Content	Mark	Guidance
	<ul style="list-style-type: none"> <li>• Car pedal – sand blasted for grip</li> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of heath product packaging</li> </ul>	4	
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>• for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate ‘use by’ dates.</li> </ul> <p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>• Early use of nickel-titanium alloys (Nitinol) established that they had a ‘memory’.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>• Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>• When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p> <p>Brief description/statements</p>

Question		Answer / Indicative Content	Mark	Guidance
		electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.	4	
(e)	(i)	<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Acrylic</li> <li>• ABS</li> <li>• Polypropylene</li> <li>• Aluminium alloy</li> <li>• Copper/brass</li> <li>• Plastic coated mild steel</li> <li>• Beech</li> <li>• Birch (ply)</li> <li>• Maple / sycamore</li> </ul> <p><b>Properties or characteristics</b></p> <ul style="list-style-type: none"> <li>• rigid</li> <li>• good aesthetic qualities</li> <li>• Self-finished or takes good finish</li> <li>• Easily shaped/formed/joined</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><i>Manufacturing methods could be</i></p> <p><b>Acrylic/ABS/polypropylene</b></p> <ul style="list-style-type: none"> <li>• Laser cut shapes – may need additional edge finishing</li> <li>• Heated and formed - 2 different formers</li> </ul>		<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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key</p>

Question	Answer / Indicative Content	Mark	Guidance
	<ul style="list-style-type: none"> <li>• Joined – tensol or other solvent cement/ mechanical fixing</li> </ul> <p><b>Aluminium alloy/mild steel</b></p> <ul style="list-style-type: none"> <li>• Strips cut, guillotine, metal cutting bandsaw,</li> <li>• Shapes cut (drilled, nibbled) edges finished – abraded, buffed</li> <li>• Formed using formers</li> <li>• Joined with rivets, machine screws (brazed/welded on mild steel)</li> </ul> <p><b>Birch/beechn/maple</b></p> <ul style="list-style-type: none"> <li>• Laminated or steam bent</li> <li>• Use of formers/bag press</li> <li>• Cutting/shaping</li> <li>• Appropriate joining – adhesive/ bridle with appropriate thickness</li> <li>• Finish applied</li> </ul>	<b>9</b>	<p>features identified</p> <p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;"><b>1 mark</b></span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;"><b>2 marks</b></span></p> <p>Detailed sketches/chart with clear annotation marks <span style="float: right;"><b>3</b></span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>
<b>(f)</b>	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> </ul>		<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><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>

Question			Answer / Indicative Content	Mark	Guidance
			<ul style="list-style-type: none"> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</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>

Question			Answer / Indicative Content	Mark	Guidance
7	(a)		<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• The fan must have adjustable speeds so that the air flow can be adjusted to suit the climate</li> <li>• The oscillating head function must be able to be switched on/off so the user can choose whether to use it</li> <li>• The angle of the fan must be adjustable so the user can direct the air flow</li> <li>• The unit must be stable so that it cannot easily be knocked over</li> <li>• The fan must be guarded so there is no chance of the user touching the moving blades and becoming injured</li> <li>• The mains cable must be long enough to reach a socket so that the fan can be positioned where needed</li> <li>• The fan must be quiet in use so that it does not cause annoyance to the user</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>

Question	Answer / Indicative Content	Mark	Guidance
(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>• JIT is a very flexible manufacturing system and can react very quickly to changes in consumer demand</li> <li>• Minimal storage space required for components and completed products</li> </ul>	4	<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>
(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>• Toothbrush handle, enable good grip with possibly wet hands</li> <li>• Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>• Car pedal – sand blasted for grip</li> <li>• Soft toy, eg. velvet for tactile response</li> <li>• Textured laminates/card for architectural modelling</li> <li>• Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>• Braille embossing of heath product packaging</li> </ul>	4	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>• for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p>



Question	Answer / Indicative Content	Mark	Guidance
	<p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>• Early use of nickel-titanium alloys (Nitinol) established that they had a 'memory'.</li> </ul> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>• Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>• When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.</li> </ul>	4	<p><b>Level 1 (0 – 2 marks)</b></p> <p>Brief description/statements</p>
(e)	(i)		<p>Mechanism: Crank and slider</p> <p>Diagram</p> <p>Labels providing information (e.g. naming the parts)</p> <p>award mark for other appropriate material not listed</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>

Question	Answer / Indicative Content	Mark	Guidance
		3	
	<p>(ii) Convert either:  <math>1800\text{rpm} = 1800/60 = 30 \text{ revs/sec}</math>                      Or:  <math>1 \text{ rev every } 10 \text{ secs} = 1 \times 6 = 6 \text{ rpm}</math>                      Required reduction ratio = motor speed / output speed  <math>= 30/0.1 \text{ (or } 1800/6)</math>  <math>= 300:1</math></p> <p>Award credit for the candidate achieving this reduction in at least two stages, e.g.                      Stage 1:                      Use a worm and a worm wheel with 60 teeth to provide a 60:1 ratio</p> <p>Stage 2:                      Use a pinion with 12 teeth and a driven gear with 60 teeth to provide a 5:1 ratio</p> <p>Overall ratio = <math>60 \times 5 = 300:1</math></p> <p>Diagram must clearly show input/output shafts and indicate the coupling between stages, e.g. as a compound gear system or with intermediate drive shafts.</p> <p>-----                      Other solutions are possible, including using more stages, e.g.</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><b>Level 2 (3-4 marks)</b>                      Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b>                      Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;">1 mark</span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed sketches/chart with clear annotation <span style="float: right;">3 marks</span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to</p>

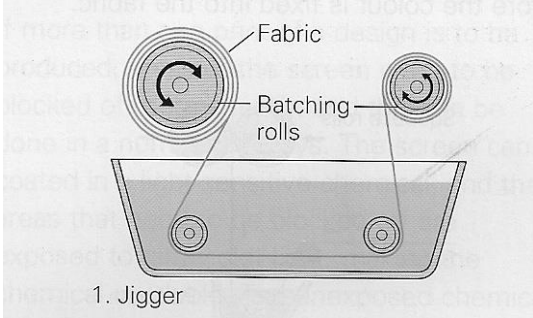
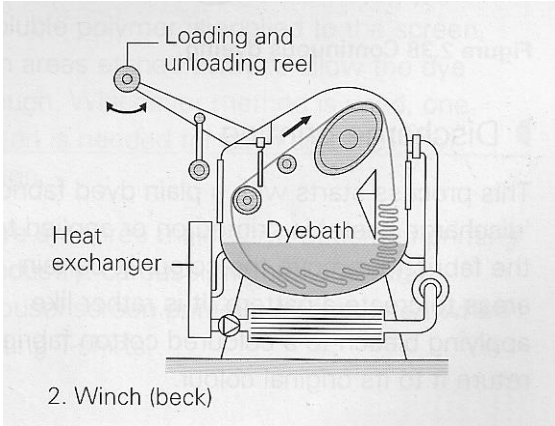
Question	Answer / Indicative Content	Mark	Guidance
	Stage 1: 50t:10t to give 5:1 Stage 2: 50t:10t to give 5:1 Stage 3: 40t:10t to give 4:1 Stage 4: 30t:10t to give 3:1 Overall ratio $5 \times 5 \times 4 \times 3 = 300:1$	9	chosen material.
(f)	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</li> </ul>	8	<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><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 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>

Question		Answer / Indicative Content	Mark	Guidance
8	(a)	<p><i>Justified design requirements could be:</i></p> <ul style="list-style-type: none"> <li>• Hardwearing / durable as will be worn regularly and will need to be robust for manual jobs</li> <li>• Washable as will become dirty quickly and need regular washing. Will preserve the life of the garment.</li> <li>• Resistant to stains as they are intended to protect the wearer and the clothes underneath. Will also make the product last longer.</li> <li>• Fire retardant/resistant to protect the wearer.</li> <li>• Resistant to chemicals / not damaged by chemicals to preserve the life of the garment and offer some protection to the wearer and the clothes underneath.</li> <li>• Loose enough to allow movement when completing manual tasks but not so bi they get caught in machinery. Also large enough to fit over clothes worn underneath.</li> <li>• Pockets for holding small items of tools / equipment for efficiency.</li> <li>• Cuffs / elasticsation at the wrist/ ankle for safety reasons.</li> <li>• Easy to put on and take off as this may need to be done regularly during the working day.</li> </ul>	4	<p>Clear statement and justification required for a mark</p> <p>Must be related to the product – no marks for generic responses</p> <p>Must be a full response – - no marks for identification only.</p> <p><b>Four</b> justified design requirements.</p> <p>Give one mark if two valid points given but not fully justified</p>
	(b)	<p><i>Two features could be:</i></p> <ul style="list-style-type: none"> <li>• The partnerships between the manufacturer, suppliers and distributors is critical</li> <li>• if deliveries are late production stops</li> <li>• Workforce relationships are also very important – staff absence or strike action can halt or delay production.</li> <li>• JIT is a very flexible manufacturing system and can react</li> </ul>		<p>brief description 1 mark detailed description 2 mark</p> <p><b>Two</b> features clearly described 2 x 2</p>

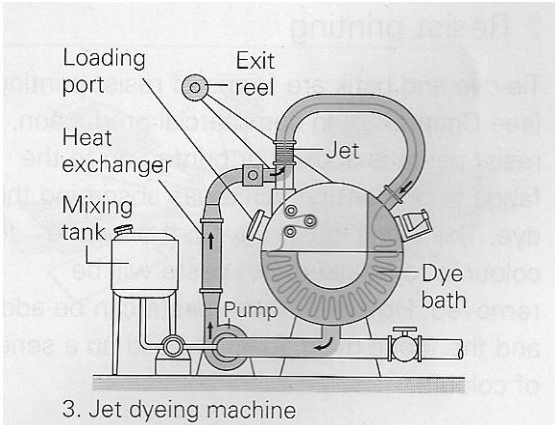
Question	Answer / Indicative Content	Mark	Guidance
	<p>very quickly to changes in consumer demand</p> <ul style="list-style-type: none"> <li>Minimal storage space required for components and completed products</li> </ul>	4	
(c)	<p><i>Products and reasons could be:</i></p> <ul style="list-style-type: none"> <li>Toothbrush handle, enable good grip with possibly wet hands</li> <li>Screwdriver handle - ribbed to prevent rotation when gripped</li> <li>Car pedal – sand blasted for grip</li> <li>Soft toy, eg. velvet for tactile response</li> <li>Textured laminates/card for architectural modelling</li> <li>Embossed surface on packaging eg. card salt containers for aesthetic effect and grip</li> <li>Braille embossing of health product packaging</li> </ul>	4	<p>brief description 1 mark detailed description 2 marks</p> <p><b>Two</b> products/ appropriate reasons clearly described 2 x 2</p>
(d)	<p><i>Examples could be</i></p> <p><b>Intelligent packaging materials</b></p> <ul style="list-style-type: none"> <li>for food can regulate air and moisture movement. Photochromic materials can be used on the packaging to clearly indicate 'use by' dates.</li> </ul> <p><b>Shape memory alloys</b></p> <ul style="list-style-type: none"> <li>Early use of nickel-titanium alloys (Nitinol)</li> </ul>		<p><b>Level 2 (3 - 4 marks)</b></p> <p>Detailed explanation, demonstrating clear understanding of smart materials – that they react to external stimuli, such as light, stress, temperature, moisture, pH, electric or magnetic fields</p> <p><b>Level 1 (0 – 2 marks)</b></p>

Question	Answer / Indicative Content	Mark	Guidance
	<p>established that they had a 'memory'.</p> <p><b>Thermo-chromic materials</b></p> <ul style="list-style-type: none"> <li>Medical plasters can be made using smart fabrics; they can be encapsulated with antiseptic substances to encourage healing. Some plasters or bandages are made from smart fabrics that change colour in reaction to body temperatures, indicating whether a wound is healing or not.</li> </ul> <p><b>Piezoelectric materials</b></p> <ul style="list-style-type: none"> <li>When a piezoelectric material is deformed it gives off a small electrical discharge. Also, when an electrical current is passed through a piezoelectric material, it increases in size by up to a four per cent change in volume. A piezoelectric material is used as the airbag sensor in a car.</li> </ul>	4	Brief description/statements
(e) (i)	<ul style="list-style-type: none"> <li>The seam is stitched twice making it strong.</li> <li>The fabric is doubled over increasing the strength of the join.</li> <li>All of the raw edges of the fabric are enclosed making the fabric less likely to fray and the seam pull apart.</li> <li>The seam is a flat seam - not bulky - making it comfortable to wear.</li> <li>There are no raw edges to neaten, speeding up manufacturing / reducing costs / removing a stage of manufacturing.</li> <li>Adds a design feature – two rows of stitching visible.</li> </ul>		<p>award mark for other appropriate material not listed</p> <p>1x1 mark</p> <p>Award mark for other appropriate property/characteristic</p> <p>2x1 mark</p>

Question	Answer / Indicative Content	Mark	Guidance
		3	
	<p><b>(ii)</b> The process involves:</p> <ul style="list-style-type: none"> <li>• A specific amount (weight) of fabric</li> <li>• A set amount of dyestuff in the machine – determined by the weight of the fabric and the fibre the fabric is made from.</li> <li>• A specified time for the fabric to be in the dyebath</li> <li>• Fixing the dye to the fabric – this may be done in the same machine or as a separate process.</li> </ul> <p>The dyebath is made from a liquid, usually water, which has a pigment and a mordant added.</p> <p>The pigment colours the fabric and the mordant is a chemical that binds the pigment to the fabric and can also affect the final colour of the fabric.</p> <p>Pigments are usually synthetic, based on chemical formulas which can be accurately reproduced enabling the same colour to be produced again.</p> <p>The colour is 'fixed' so that it does not wash out. This can be done by the application of a chemical or heat.</p> <p>Achieving an even application of dye can be done one of three ways:</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><b>Level 2 (3-4 marks)</b> Key stages presented, reasonably well described with key features identified</p> <p><b>Level 1 (0-2 marks)</b> Some stages outlined (up to 2), very limited description</p> <p><b>Quality of description and communication</b></p> <p>Basic sketch or chart with limited annotation <span style="float: right;">1 mark</span></p> <p>Good sketches/chart with main features identified and labelled <span style="float: right;">2 marks</span></p> <p>Detailed sketches/chart with clear annotation <span style="float: right;">3 marks</span></p> <p>Max 1 if no sketch/chart used</p> <p>Award credit where possible if response doesn't link to chosen material.</p>

Question	Answer / Indicative Content	Mark	Guidance
	<p><b>The Jigger system</b>                      This involves passing the flat fabric backwards and forwards through the dyebath from one roller to another. It is used for medium to heavy weight woven fabrics and would be suitable for the type of fabric which the overalls would be made from.</p>  <p>1. Jigger</p> <p><b>The Winch system</b>                      This system pulls the fabric from the front of the dyebath to the back in a circular motion. This is most suitable for lightweight woven fabrics and knitted fabrics – not the sort of fabric which the overalls would be made from.</p>  <p>2. Winch (beck)</p>	<p>9</p>	



Question	Answer / Indicative Content	Mark	Guidance
	<p><b>The Jet Process</b>                      In this process high pressure jets in the dyebath itself move the fabric through the dyebath.</p>  <p>3. Jet dyeing machine</p>		
<p>(f)</p>	<p><i>Issues could be:</i></p> <ul style="list-style-type: none"> <li>• Litter/disposal of products</li> <li>• Depletion of resources/sustainability</li> <li>• Emissions</li> <li>• Life cycle analysis/re-use, repair etc</li> <li>• Increased public awareness</li> <li>• Informed decision making needed/keep up to date</li> </ul> <p><b>Examples</b></p> <ul style="list-style-type: none"> <li>• Cars</li> <li>• aerosol sprays</li> <li>• Shopping bags</li> <li>• Washing machines</li> <li>• mineral mining in Congo- loss of wildlife silverback gorillas)</li> </ul>	<p style="text-align: center;"><b>8</b></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><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 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>

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