

# GCE

Edexcel Advanced Subsidiary GCE in  
Design and Technology: Product Design  
(8108/8109/8110)

Edexcel Advanced Subsidiary GCE in  
Design and Technology: Food Design  
(8111)

First examination 2007

Edexcel Advanced GCE in Design and  
Technology: Product Design  
(9108/9109/9110)

Edexcel Advanced GCE in Design and  
Technology: Food Technology (9111)

First examination 2008

June 2005

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Sample assessment  
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# Product Design: Resistant Materials Technology – Unit 2: Knowledge and Understanding of Product Design

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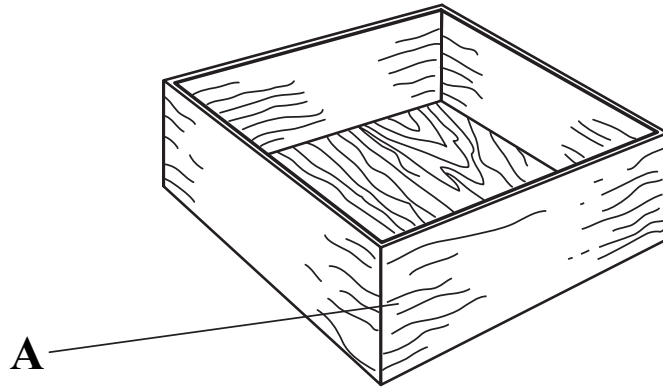
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1. Figure 1 shows a wooden box.

Figure 1



(a) Name and sketch a suitable joint, other than a butt joint, that could be used on the corner 'A' of the box.

(2)

(b) Give **two** advantages of using a hardwood rather than a softwood for the box.

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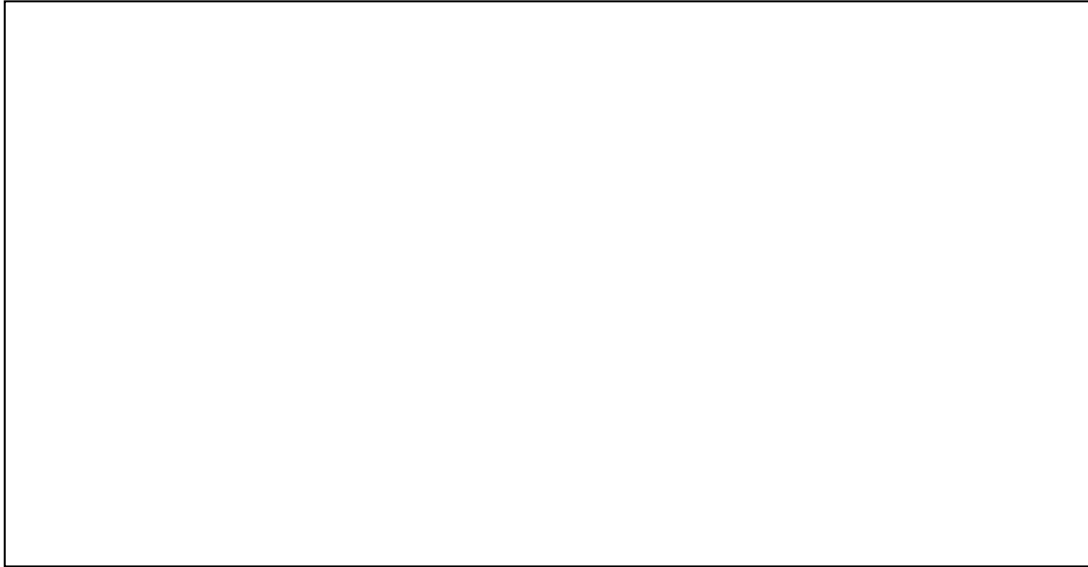
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(2)



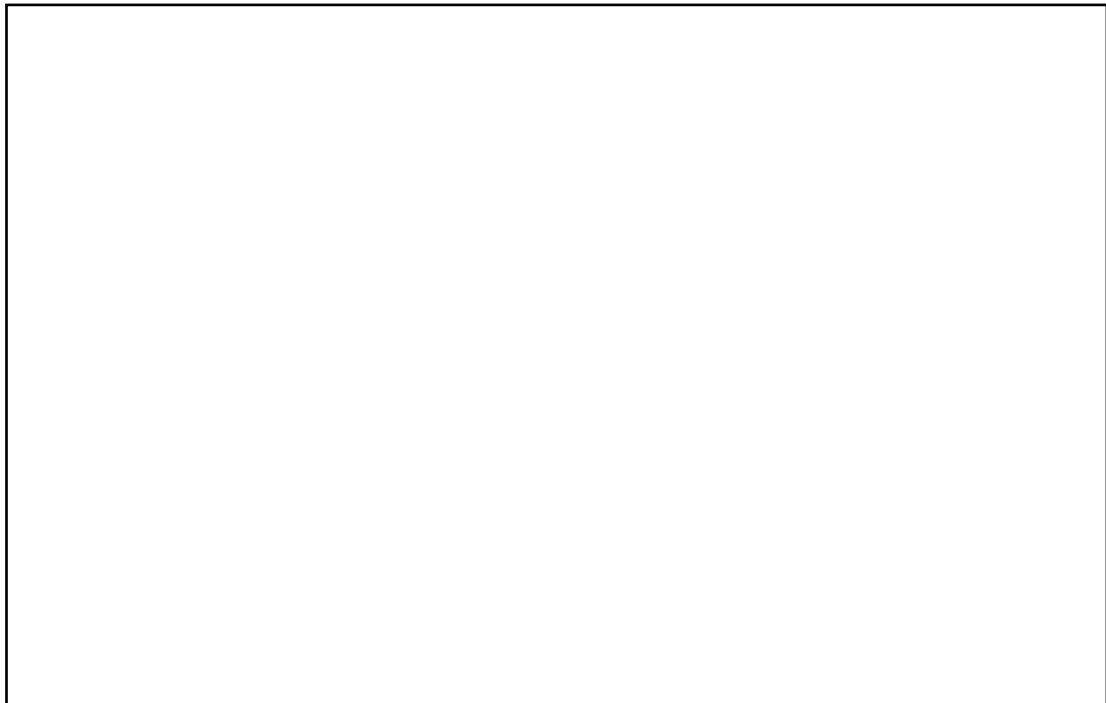
(c) Clearly sketch and label the structure of plywood.



(2)

(d) Describe, using notes and/or sketches, **two** of the following faults often found in natural timber:

- Cupping
- Twisting
- Splitting
- Knots



(4)

**(Total 10 marks)**

Q1

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2. (a) Explain what is meant by the term ‘alloy’.

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(2)

(b) Explain **two** reasons why aluminium alloys are used in the aviation industry.

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(4)

(c) The following are descriptions of the mechanical properties of metal:

- Tensile strength
- Elasticity
- Plasticity
- Ductility
- Hardness
- Malleability

Select **two** of the above and explain their meaning.

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(4)

(Total 10 marks)

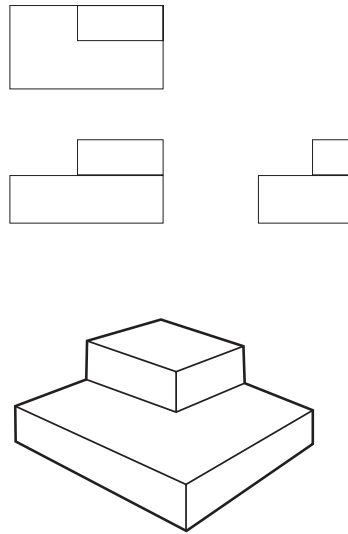
Q2

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3. Figure 2 shows a third angle orthographic drawing and a pictorial drawing of an aluminium component.

**Figure 2**



(a) This component could be manufactured by using the following processes:

- (i) fabricating by hand
- (ii) machining
- (iii) casting

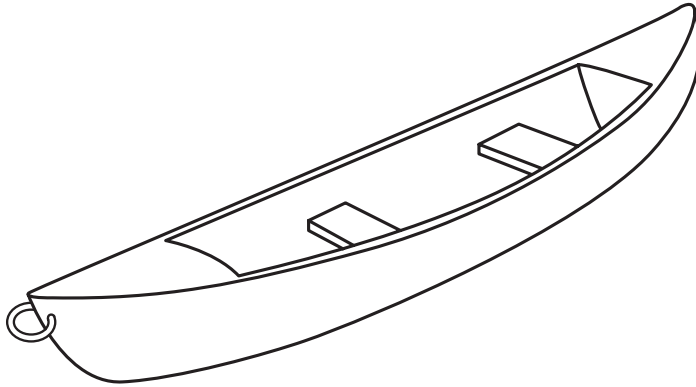
Select **one** of the processes stated above and describe, using notes and/or sketches, how this component could be manufactured.

**(6)**



4. Figure 3 shows an illustration of a plastic canoe manufactured from glass reinforced plastics (GRP).

**Figure 3**



- (a) Describe, using notes and/or sketches, how the canoe was manufactured.

**(6)**

(b) Explain the importance to the designer of having an understanding of the following when designing the canoe.

(i) the application of anthropometric data

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(2)

(ii) the use of standards

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(2)

**(Total 10 marks)**

Q4

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5. (a) Explain what is meant by the following terms.

(i) mass production

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**(2)**

(ii) consumer society

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**(2)**

(b) Discuss the effects on industry of:

(i) CAD in the design stage.

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**(4)**



(ii) CAM in the production stages.

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**(4)**

(c) Describe how the use of high-technology manufacturing has led to the development of **one** innovative product.

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**(4)**

**Q5**

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**(Total 16 marks)**

6. 'Values issues' can have a significant effect on manufacturing at both local and global levels. With regard to these issues, discuss the advantages and disadvantages of:

(i) manufacturing at local level

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**(4)**

(ii) manufacturing at global level

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**(4)**

**(Total 8 marks)**

Q6

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## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.


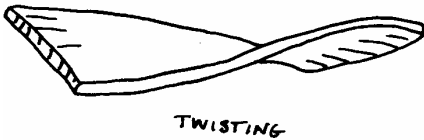
### Mark scheme structure


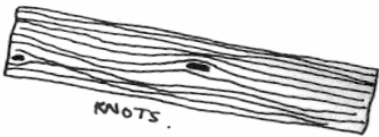
- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.





## Mark scheme

1	(a)	<p>Suitable wood joint</p> <ul style="list-style-type: none"> <li>• Dowel Joint,</li> <li>• Mitre Joint,</li> <li>• Dovetail Joint,</li> <li>• Finger Joint/comb/box,</li> <li>• Rebate/lap</li> <li>• Biscuit</li> </ul> <p>Do not accept Mortice and Tenon Joint</p> <p>Sketch must match name Name x 1 Mark Correct sketch x 1 Mark</p>		
			1 + 1	(2)
	(b)	<p>Advantages of hardwood</p> <ul style="list-style-type: none"> <li>• Does not split as much as a softwood due to closed grain</li> <li>• Can be finished to a higher quality</li> <li>• Or similar</li> </ul> <p>1 mark for each advantage x 2</p>		
			1 x 2	(2)
	(c)	<p>Structure of plywood</p> <p>Sketch and labels to clearly identify key features of structure:</p> <ul style="list-style-type: none"> <li>• odd number of ply (3, 5 or 7)</li> <li>• grain of ply at right angles to each other.</li> </ul> <p>1 mark for each point clearly sketched and labelled x 2</p>		
			1 x 2	(2)
	(d)	<p>Faults in Wood</p> <p>Cupping Warping across the width of the board</p>  <p>Twisting A twist from side to side along the length of the wood</p> 		

		<p><b>Splitting</b> Splits very often develop as timber dries out before seasoning</p>  <p><b>Knots</b> Natural irregularities formed at the junction of a branch</p>  <p>For each of the two faults chosen: correct illustration x 1 mark correct definition x 1 mark</p>		
			2 + 2	(4)
<b>Total 10 marks</b>				

2	(a)	<p><b>Alloy</b> An alloy is a mixture of two or more metals and/or elements to produce a metal with enhanced properties. 2 marks for an explanation x 1</p>		
			2 x 1	(2)
	(b)	<p><b>Aluminium alloys in the aviation industry</b></p> <ul style="list-style-type: none"> <li>Aluminium alloys possess a high strength to weight ratio for components subject to high stresses</li> <li>Aluminium alloys do not contain iron and will not corrode in extreme air conditions</li> <li>Easy to mass produce component parts by casting and machining</li> <li>Or similar</li> </ul> <p>2 marks for each reason x 2</p>		
			2 x 2	(4)
	(c)	<p><b>Tensile Strength:</b> ability to resist stretching or pulling forces</p> <p><b>Elasticity:</b> a materials ability o return to its original shape after being deformed</p> <p><b>Plasticity:</b> the readiness to deform to a stretched state when a load is applied.</p> <p><b>Ductility:</b> ability to be drawn out to reduce cross- section</p> <p><b>Hardness:</b> ability to be scratched</p> <p><b>Malleability:</b> ability of a material to be stretched without fracture</p> <p>2 marks for each explanation x 2</p>		
			2 x 2	(4)
<b>Total 10 marks</b>				

3	(a)	<p>Describe with notes and sketches:</p> <p>(i) <b>Fabricating by hand: Marking out and cutting by hand:</b></p> <ul style="list-style-type: none"> <li>• Make sure that edges are square</li> <li>• Correct marking out tools to include; odd legs, try square, scribe</li> <li>• Marking out blue</li> <li>• Countersink rivets</li> <li>• Epoxy-resin/ Argon welding</li> <li>• Cut to correct shape using hacksaw/ cold chisel</li> <li>• File down with various files</li> <li>• Finish with emery cloth</li> </ul> <p>(ii) <b>Machining:</b></p> <ul style="list-style-type: none"> <li>• Set up on appropriate machine (manual or CNC milling machines)</li> <li>• Correct size of milling cutters selected</li> <li>• Machine safety precautions adhered to</li> <li>• Move backwards and forwards taking shallow cuts</li> <li>• Use of coolant</li> <li>• Alternatively - X-Y axis, tool pathway, machine vice, datum surface, simulated cut, laser cutting.</li> </ul> <p>(iii) <b>Casting:</b></p> <p><b>Sand casting</b></p> <ul style="list-style-type: none"> <li>• Production of pattern</li> <li>• Ensure draft angles are sufficient</li> <li>• Cope and drag</li> <li>• Parting powder</li> <li>• Facing sand, strickling, furnace, crucible, degassing, removal of slag</li> <li>• Backing sand</li> <li>• Second mould</li> <li>• Repeat process but include;</li> <li>• Runners and risers</li> <li>• Gates</li> <li>• Remove pattern</li> <li>• Safety must be casting specific</li> </ul> <p><b>Die casting</b></p> <ul style="list-style-type: none"> <li>• Manufacture of accurate die</li> <li>• Spark erosion</li> <li>• Aluminium introduced into die</li> <li>• Pressure released and unclamped</li> <li>• Part ejected</li> </ul> <p>No marks available for the process selected. 1 mark for each point addressed either in note form and/or annotation x 6</p>		
			1 x 6	(6)

	(b)	<p><b>Advantages of CAD</b></p> <ul style="list-style-type: none"> <li>• Designs can easily be modified on screen without the need for re-drawing</li> <li>• Designs can be stored electronically and easily retrieved</li> <li>• Design data can be directly outputted to printers or CAM equipment</li> <li>• Or similar</li> </ul> <p>2 marks for each explanation x 2</p>		
			2 x 2	(4)
	(c)	<p><b>Computer integrated manufacture (CIM)</b></p> <ul style="list-style-type: none"> <li>• Interlinked network of computers controls flow of information and automated processes</li> <li>• Fully automated manufacturing cells produce different components</li> <li>• Project management software allows manufacturer to create different workflows for different jobs</li> <li>• Use of Just-in-time ordering of stock and materials allows for flexibility</li> <li>• Or similar</li> </ul> <p>2 marks for each point x 2</p>		
			2 x 2	(4)
		<b>Total 14 marks</b>		

4	(a)	<p><b>Glass Reinforced Plastics (GRP) process</b></p> <ul style="list-style-type: none"> <li>• Produce a suitable mould</li> <li>• Coat with release agent</li> <li>• Apply gel coat</li> <li>• Apply Resin + Glass matting</li> <li>• Stipple resin into matting</li> <li>• Trim in green state</li> <li>• Allow to go off</li> <li>• Remove from mould</li> </ul> <div style="text-align: center;"> </div> <p>1 mark for each point addressed either in note form and/or annotation x 6</p>		
			1 x 6	(6)

	(b)	(i)	<p>The application of anthropometric data</p> <ul style="list-style-type: none"> <li>• Can use data about human dimensions to aid design - shape / height / width etc</li> <li>• Can take account of range of sizes of users</li> <li>• Can fit up to 90% population (5th-95th percentile) /best fit</li> <li>• Can match product to user needs</li> </ul> <p>2 marks for an explanation x 1</p>		
				2 x 1	(2)
		(ii)	<p>The use of standards</p> <ul style="list-style-type: none"> <li>• Can meet customer / environmental needs</li> <li>• Can test products against set standards e/g/ BSI/CE</li> <li>• Can develop a quality system e.g. TQM, NACERAP</li> <li>• Product meets specification / quality / safety needs/ labelling requirements</li> <li>• Can apply for a Kite Mark</li> </ul> <p>2 marks for an explanation x 1</p>		
				2 x 1	(2)
			Total 10 marks		

5	(a)	(i)	<p>Mass production</p> <ul style="list-style-type: none"> <li>• Production of low cost high volume identical products</li> <li>• Use of standardised materials / simplified processes</li> <li>• Use of specialist equipment / unskilled labour</li> <li>• Production of low cost high volume identical products</li> <li>• Use of standardised materials / simplified processes</li> <li>• Use of specialist equipment / unskilled labour</li> </ul> <p>2 marks for any one of the explanations above x 1</p>		
				2 x 1	(2)
		(ii)	<p>Consumer society</p> <ul style="list-style-type: none"> <li>• Demand/consumption of products aimed at specific target markets</li> <li>• Cycle of demand fuelled by advertising + marketing</li> <li>• 'Throw-away' culture/buying new products before old wear out</li> </ul> <p>2 marks for any one of the explanations above x 1</p>		
				2 x 1	(2)
	(b)	(i)	<p>CAD in the design stage</p> <ul style="list-style-type: none"> <li>• Reduced need for labour intensive drawing offices</li> <li>• Requires workers with high ICT, visual, creative and problem solving skills</li> <li>• Need for training and constant updating as technology advances</li> <li>• Requires workers to be more flexible in their approach; workers can be 'remote'.</li> </ul> <p>1 mark for each point x 4</p>		
				1 x 4	(4)
		(ii)	<p>CAM in the Production stages</p> <ul style="list-style-type: none"> <li>• Workers need to be multi-skilled and flexible in their approach; able to operate a range of machines as necessary</li> <li>• Retraining as technology develops;</li> <li>• Redundancy due to automation and relocation around the world</li> <li>• 'Hazardous' work done by machines</li> <li>• Rise in use of 'bureau services'</li> <li>• Reduced job satisfaction for 'machine minders'.</li> </ul> <p>1 mark for each point x 4</p>		
				1 x 4	(4)

	(c)	<p><b>High-technology production</b>  E.g Walkman/multi-purpose Swatch/ Internet Swatch/ Dyson cleaner/ 'intelligent clothing'/ 'wearable electronics'</p> <ul style="list-style-type: none"> <li>Advances in microchip technology/ micro-electronics/ miniaturisation/ 'access technology'/ Dyson 'cyclone' technology/ smart materials</li> <li>Use of technology/ multi-purpose products as driving force in design</li> </ul> <p>Not one word answer  Brief description of innovative product x up to 2 marks  Brief outline of high-technology manufacture x up to 2 marks</p>		
			2 + 2	(4)
			<b>Total 16 marks</b>	

6	(i)	<p><b>Manufacturing at local level</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>People can be working for themselves. Greater flexibility in outcome</li> <li>Designs tailored to meet clients and consumer needs</li> <li>Job satisfaction - working for the local community/ working for themselves</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>Reliance on self promotion for continued work</li> <li>Less follow through on H&amp;S issues, for example: less checks on environmental issues</li> <li>Unstable availability of work</li> <li>Difficulties in regulating smaller companies</li> </ul> <p>Must address advantages - 1 mark for each point x 2 and must address disadvantages - 1 mark for each point x 2</p>		
			2 x 2	(4)
	(ii)	<p><b>Manufacturing at global level</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>Assured employment for unskilled workforce</li> <li>Stable jobs in volume production leads to stable economy</li> <li>Political incentives available for relocation.</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>Low paid workforce often working in countries with dubious political issues</li> <li>Mundane, repetitive. Marxist theory - no personal value.</li> <li>Volume production further promotes consumerism therefore waste, pollution etc</li> <li>Short cuts on environmental issues exploited in some countries</li> <li>Low job satisfaction and worker involvement</li> </ul> <p>Must address advantages - 1 mark for each point x 2 and must address disadvantages - 1 mark for each point x 2</p>		
			2 x 2	(4)
			<b>Total 8 marks</b>	

7	(a)	<p><b>Improved aesthetic and functional characteristics</b> Brief description of new material AND general reason for use, eg.</p> <ul style="list-style-type: none"> <li>• Piezo-electric actuators, shape memory alloys, optical fibres, electro-magneto fluids, tinted glass, solar cells, thermo ceramics, silicon chips (ICs), photolithography</li> <li>• Environmentally friendly plastics, thermochromatic dyes, inks, holographs, LCDs, biotechnology, chemical free papers</li> </ul> <p>OR brief description of new process AND general reason for use, eg</p> <ul style="list-style-type: none"> <li>• Coating, laminating, fusion, micro-encapsulation, biostoning, biopolishing, laser cutting, digital printing</li> </ul> <p>Improved aesthetic characteristics e.g look, shape, colour, pattern, texture, drape, handle, weight, styling due to the new material, process with reference to the product example. Improvements in purpose, performance, function with reference to the product example.</p> <p>Not one word answer Brief description of appropriate new material OR process and general reason for use x 2 marks PLUS example of improved characteristics in product - 1 mark for each point x 4</p>		
			2 + (1 x 4)	(6)
	(b)	<p><b>Designer or design movement</b> Colour, eg:</p> <ul style="list-style-type: none"> <li>• colour palette - brights, pastels, primaries, darks</li> <li>• use of paints, dyes, natural colour to enhance work</li> <li>• aesthetics - promote trendy/ fashionable image</li> <li>• impact on marketing, saleability, mood</li> <li>• importance for safety products - bright, luminous, identify people at risk, identify emergency help</li> </ul> <p>Styling, eg:</p> <ul style="list-style-type: none"> <li>• look of product- sleek, sporty, high-tech, casual, classic, streamlined etc.</li> <li>• influence of materials, cultural style</li> <li>• impact on target market - styling to suit, influence consumer to buy, image it gives</li> <li>• impact of product type - meet functional, aesthetic, performance requirements.</li> </ul> <p>Texture, eg:</p> <ul style="list-style-type: none"> <li>• look of product - aesthetics, decorative</li> <li>• surface finish - designed for the product</li> <li>• graphical texture (rendered) surface to enhance finished drawing</li> <li>• feel of product - smooth, rough, soft, hard touch</li> <li>• safety of product - knobs, dials, Braille, non-slip</li> </ul> <p>Shape, eg:</p> <ul style="list-style-type: none"> <li>• form and function issues - shape to suit product</li> <li>• impact on look of product - style, fashion, image</li> <li>• impact on ergonomics - indicates function, control</li> </ul>		

		<p>Decoration, eg:</p> <ul style="list-style-type: none"> <li>• form and function issues - added on or integral to design</li> <li>• embellishment and adornment</li> <li>• impact on look of product - scale, repeat, all-over pattern</li> <li>• non-functional issues - styling, fashion</li> </ul> <p>Answer must relate to a named designer or named design movement</p> <p>Two out of five above selected - 1 mark for each point x 3</p>		
			3 x 2	(6)
			Total 12 marks	
			TOTAL FOR PAPER: 80 MARKS	



# Product Design: Resistant Materials Technology – Unit 3: Further Study of Product Design

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1. (a) In the context of electronic communication, outline the advantages and disadvantages of each of the following:

(i) e-mail

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..... (3)

(ii) ISDN

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..... (3)

(b) Discuss the use of the Internet as a marketing tool from the customer's perspective.

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(4)

Q1

**(Total 10 marks)**

2. (a) Describe and give an example of the use of **two** of the following:

- photo-chromic glass
- thermo ceramics
- shape memory alloys

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**(4)**

(b) Genetic engineering is increasingly focused on the production of timber.

Discuss the potential benefits and problems associated with the genetic engineering of timber.

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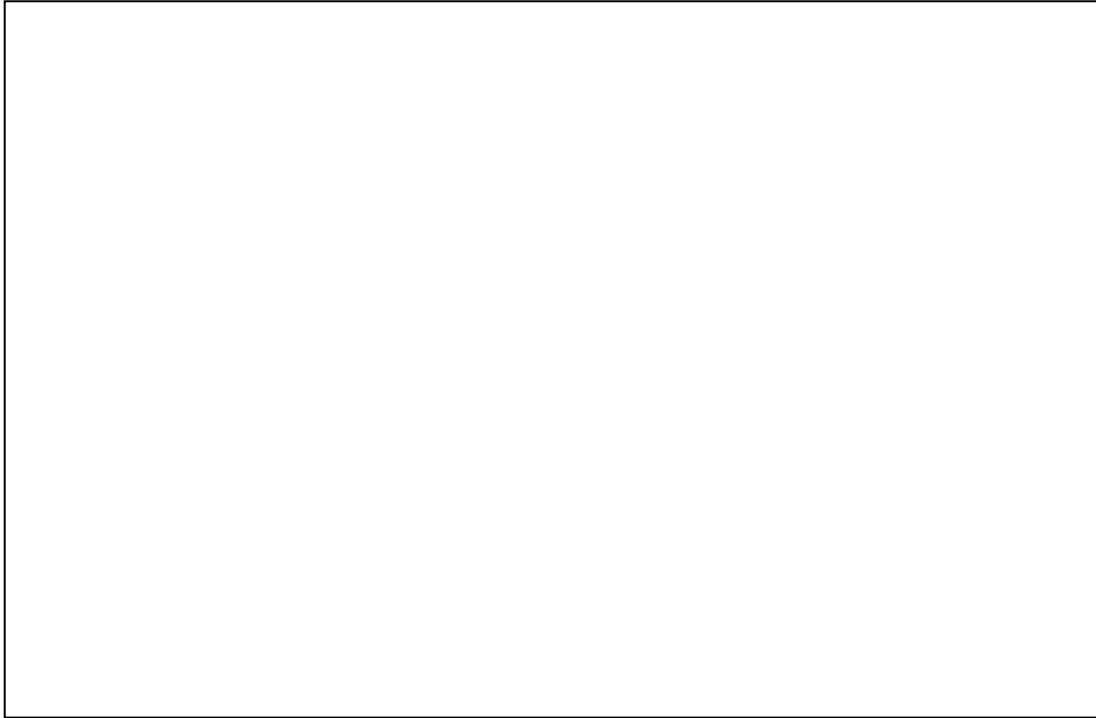
**(Total 10 marks)**

**Q2**

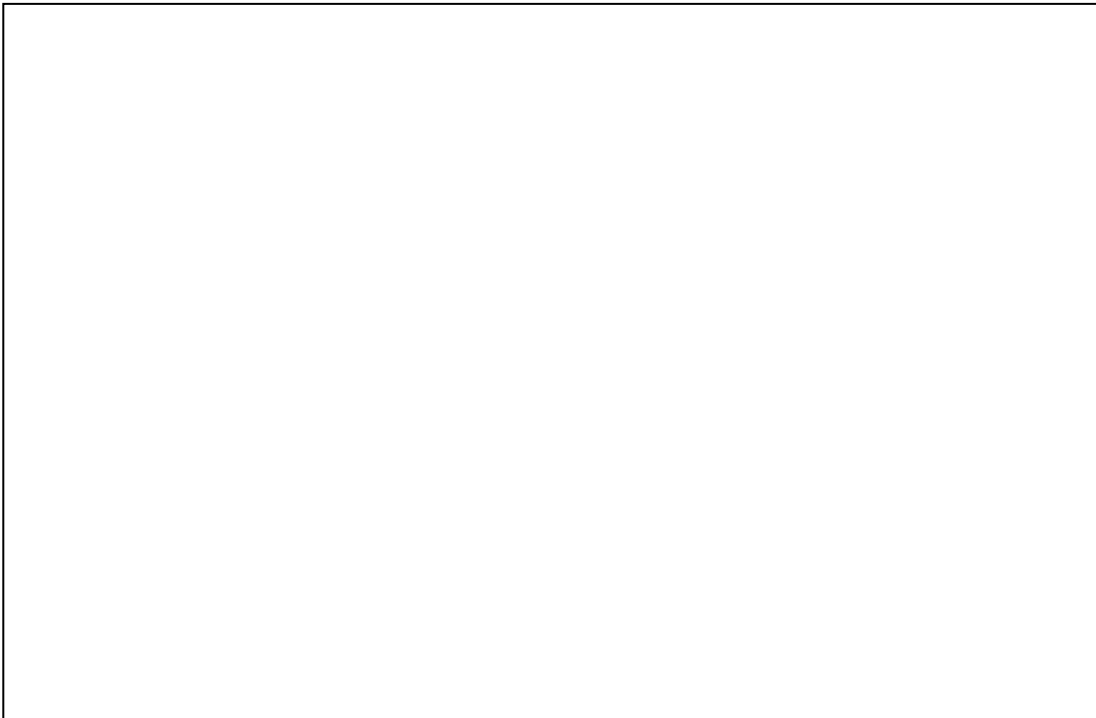
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3. A motorist has discovered that her new car will only just fit into the garage. She is unable to see over the bonnet of the vehicle and ascertain when the bumper is about to hit the end wall of the garage.

(a) With reference to piezo-electronic activators, produce **two** different initial design ideas of a product that would warn the motorist that the car is about to hit the end wall of the garage.



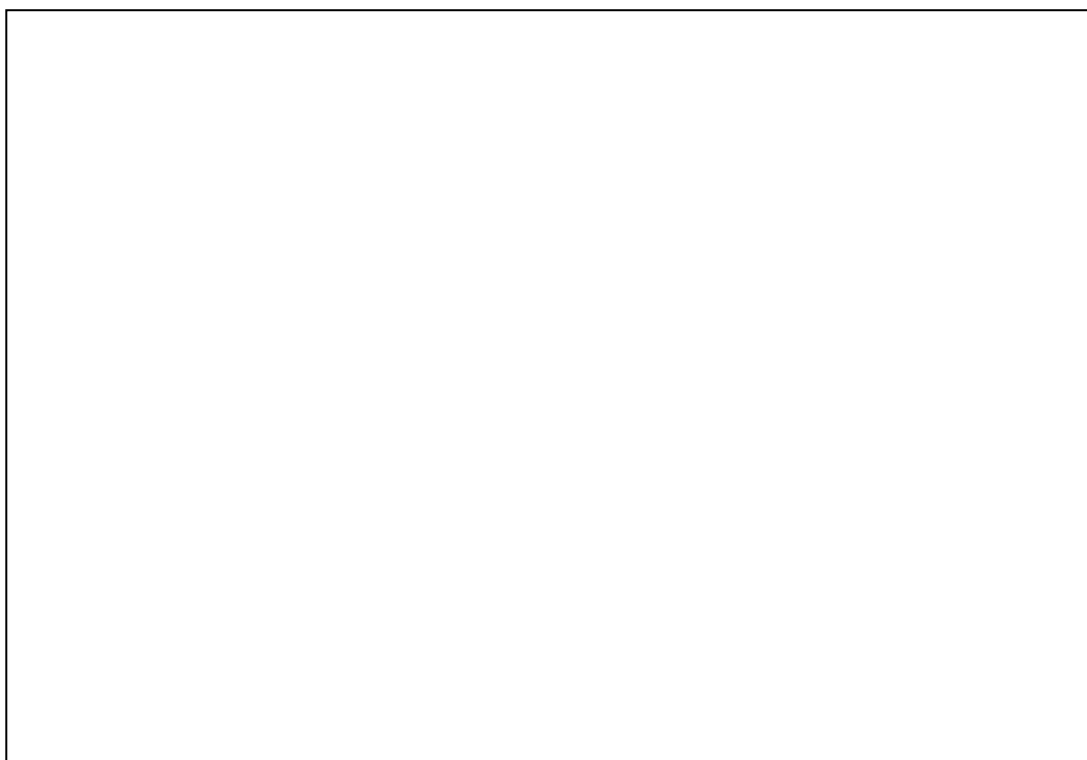
**(3)**



**(3)**

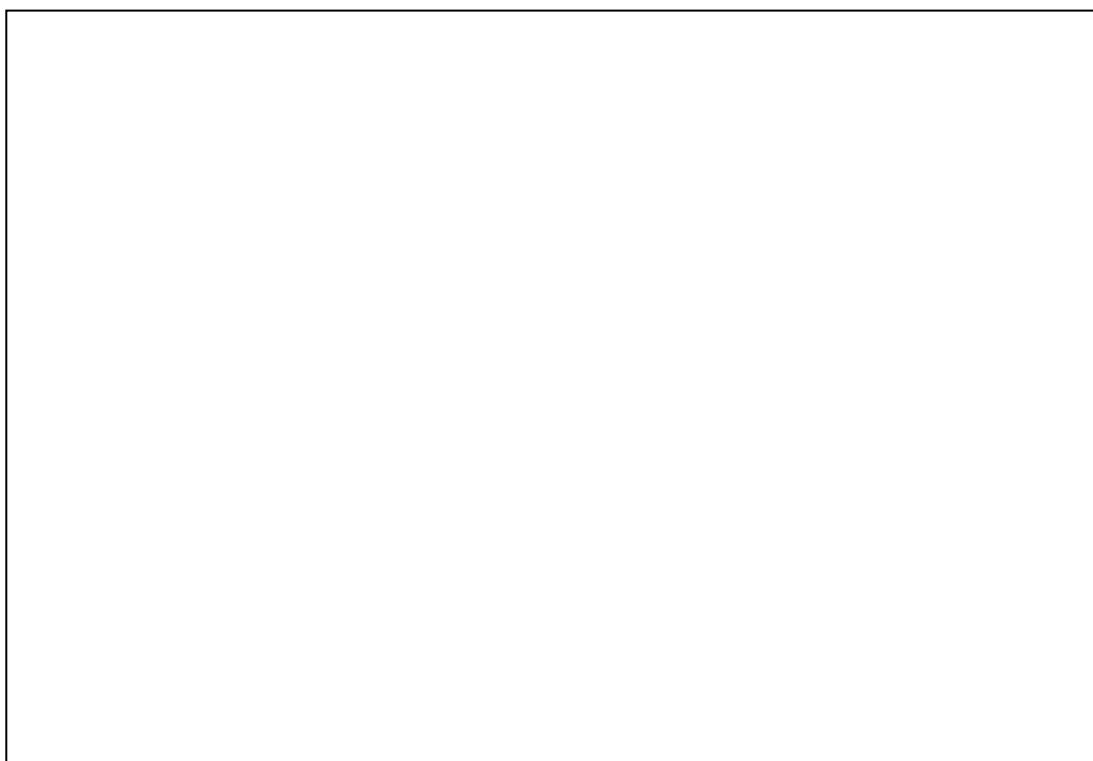


- (b) Select one of the design ideas in (a) and develop it clearly showing how the system is activated and how it will warn the motorist.



**(4)**

- (c) Represent and illustrate your final solution.



**(2)**

**(Total 12 marks)**

**Q3**

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(b) Discuss the importance of 'brand loyalty' and 'market pull' as marketing strategies when launching a new product.

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(4)

**(Total 10 marks)**

**Q4**

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6. (a) Manufacturing companies must take into account many economic factors when manufacturing a product.

Discuss the importance, to the manufacturer, of the following terms:

- economics of scale of production
- production costs

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(b) The use of ICT and control technologies within modern manufacturing are changing the way manufacturing companies are organised and managed.

(i) Explain the meaning of Just in Time (JIT) manufacturing.

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7. (a) Explain the term 'Artificial Intelligence' and describe how it could benefit manufacturing.

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(b) Discuss the effect of Total Quality Management (TQM) within manufacturing.

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**(4)**





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## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
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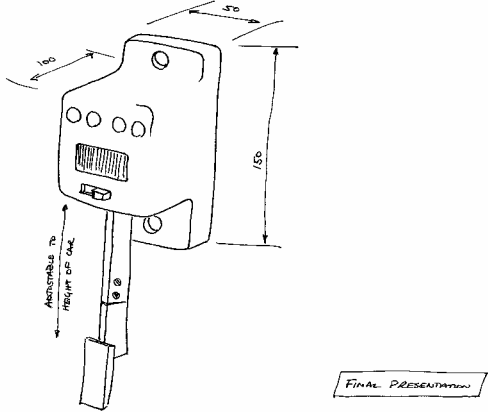
## Mark scheme

1.	(a)	(i)	<p><b>E-mail</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Quick and cost effective method of data transfer compared to post</li> <li>• Convenience of use from home</li> <li>• Can be redirected to mobile phone</li> <li>• Global access is possible</li> <li>• Multiple copies can be sent simultaneously</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Domestic systems tend to be accessed using a modem, which can be slow, if the files being transferred are large eg photographs</li> <li>• Lack of security</li> <li>• Possible virus infection</li> <li>• Data sometimes gets 'lost'</li> <li>• Possibly considered to lack personal touch</li> </ul> <p>1 mark for each advantage and 1 mark for each disadvantage. Must include advantages and disadvantages. Maximum of 2 marks if only advantages or only disadvantages are given</p>		
				3 x 1	(3)
		(ii)	<p><b>ISDN</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• International communication standard for transfer of voice, video and data over digital telephone lines</li> <li>• Provides high speed data transfer – useful for transfer of large files eg CAD drawings; video conferencing (multiple access / use)</li> <li>• Reduces the need to travel to meetings – cost and time implications</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Higher set up costs than email</li> </ul> <p>1 mark for each advantage and 1 mark for each disadvantage. Must include advantages and disadvantages. Maximum of 2 marks if only advantages or only disadvantages are given</p>		
				3 x 1	(3)
	(b)		<p><b>Internet as a marketing tool</b></p> <p><b>Customers perspective</b></p> <ul style="list-style-type: none"> <li>• Ease of use for the customer (from home)</li> <li>• Range of search engines can be used to locate and purchase required products/ services</li> <li>• Facility to browse entire catalogue of products</li> <li>• Access to product reviews/ specifications</li> <li>• Facility for customisation of designs</li> <li>• 3D interactive visual images help customers relate to products on offer</li> </ul>		

		<ul style="list-style-type: none"> <li>• Ease of purchase/ customer support</li> <li>• Internet can be slow to access</li> <li>• Computers can crash</li> <li>• Registration is often required before access is allowed</li> <li>• Security of credit card data</li> <li>• Lacks the personal touch - interaction</li> <li>• Shared mailing lists - junk mail</li> <li>• Difficult navigation of some sites</li> <li>• Pop up advertising is irritating</li> </ul> <p>1 mark for each answer x 4</p>		
			4 x 1	(4)
		Total 10 Marks		

2.	(a)	<p>New technologies – Two of the following:</p> <p>Photo-chromic glass</p> <ul style="list-style-type: none"> <li>• Glass that darkens automatically in strong light, eg to give protection from the sun to office workers in high buildings, sun glasses, silver halide.</li> </ul> <p>Thermo ceramics</p> <ul style="list-style-type: none"> <li>• Hard, stable materials that can withstand very high temperatures used in engines that run very hot thus increasing efficiency. Being experimented on to increase the efficiency of internal combustion engines on cars.</li> </ul> <p>Shape memory alloys (SMA)</p> <ul style="list-style-type: none"> <li>• Materials that can be deformed at certain temperatures. For example glasshouse window openers.</li> </ul> <p>Two points well made and justified x 2 marks. Justification must be present for full marks</p>		
			2 x 2	(4)
	(b)	<p>Genetic engineering of timber</p> <p>Benefits</p> <ul style="list-style-type: none"> <li>• Quicker growing trees</li> <li>• Economic advantages</li> <li>• Properties of colour/texture carefully exploited</li> </ul> <p>Problems</p> <ul style="list-style-type: none"> <li>• Unknown problems of genetic engineering</li> <li>• Contamination of nearby crops</li> <li>• Environmental problems to wildlife</li> <li>• Disposal of genetically modified products</li> </ul> <p>1 mark for each benefit and 1 mark for each problem identified. 2 marks if identified with discussion and justification. Must have at least a benefit and a problem with discussion and justification to gain full marks</p>		
			3 x 2	(6)
		Total 10 Marks		

3.	(a)	<p>Two distinct different solutions - 2 marks Should include factors such as:</p> <ul style="list-style-type: none"> <li>• audio or visual warning</li> <li>• methods of attachment to wall of garage or perhaps to the vehicle</li> <li>• clear indication that Piezo-electric activators are understood</li> <li>• should show that slightest possible movement produces electrical voltage</li> <li>• clear understanding of issues such as clearly audible or clearly visible</li> <li>• any necessary adjustment accounted for.</li> </ul> <p>Example below:</p> <p>1 mark for each point of an initial idea that is clearly understood. Maximum 3 marks available per diagram x 2</p>		
			3 x 2	(6)
	(b)	<p>Selection of one solution should have evidence of development of at least two elements. Example below:</p> <p>Indication of suitable materials x 1 mark. Some indication of suitable method of production x 1 mark. Maximum of 4 marks available</p>		
			4 x 1	(4)

(c)		<p>Representation should be clear and understood.</p> <p>Example below:</p>  <p>Acceptable method of drawing x 1 mark. Indication of sizes/proportions x 1 mark. Maximum of 2 marks available</p>		
			2 x 1	(2)
		Total 12 Marks		



4.	(a)	<p><b>Advantages and Disadvantages of the following Media:</b></p> <p><b>Television</b>  <b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• very wide audience</li> <li>• can cater for different age groups eg target children/ different social groups / football fans</li> <li>• good visual medium eg can use humour / show product in use / best points / USP</li> <li>• adverts can become 'cult' viewing, eg clever use of high tech</li> <li>• can provide natural break for tea!</li> <li>• on continuously for short periods</li> <li>• put ad on at night time for TMG</li> <li>• can use soft sell to create brand loyalty / show aesthetics</li> <li>• remember catch phrases.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• need to attract viewers' attention</li> <li>• viewers may not be in target market</li> <li>• limited time span available</li> <li>• often ignored by viewers / turn off, make tea!</li> <li>• Can annoy audience / flick through channels to avoid</li> <li>• high production costs</li> <li>• audience spread</li> <li>• prime time expensive.</li> </ul> <p><b>Newspapers / magazines</b>  <b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• relatively wide circulation</li> <li>• can deal with specialisms eg computer / fashion magazine</li> <li>• can hard sell with detailed info</li> <li>• can get direct response eg reply / money off coupons</li> <li>• can target older market with spare cash, eg gardeners</li> <li>• use of ICT makes it cost effective</li> <li>• can keep and refer to it</li> <li>• target group using specific paper using T.G Index</li> <li>• easy to co-ordinate product launch with advertising</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• dependent on written word / graphics / colour / images</li> <li>• need to be well designed</li> <li>• often not read, low impact</li> <li>• timing needs to match marketing campaign</li> <li>• may need to spread advertise across range of magazines</li> <li>• won't but magazine with lots of advertisements</li> <li>• competitive</li> <li>• can be very expensive</li> </ul> <p><b>Must address advantages - 1 mark for each answer x 3 and must address disadvantages - 1 mark for each answer x 3</b></p>		
			3 x 2	(6)

	(b)	<p><b>Marketing strategies</b></p> <p>Market pull:</p> <ul style="list-style-type: none"> <li>the need to persuade customers to change brand and new customers need to be attracted in order to expand the companies market share</li> <li>customers need a 'pull' to satisfy their needs</li> </ul> <p>Brand loyalty:</p> <ul style="list-style-type: none"> <li>key marketing tool</li> <li>brand identity for generic product</li> <li>aimed to give consumer confidence</li> <li>might try to give added features to keep customers</li> </ul> <p>1 mark for each point made for the market pull x 2 1 mark for each point made for the brand loyalty x 2</p>		
			2 x 2	(4)
		<b>Total 10 Marks</b>		

5.	(a)	<p><b>Biotechnology - plastics:</b></p> <ul style="list-style-type: none"> <li>production of environmentally friendly plastics/ eco-friendly at point of manufacture/ production</li> <li>Biopol includes a natural polymer which would biodegrade at the end of its useful life</li> <li>some 'green' credit cards now available in Biopol</li> <li>less pollution when degrading on landfill</li> <li>certain plastics are now fully biodegradable</li> </ul> <p>1 mark for each advance x 2</p>		
			2 x 1	(2)
	(b)	<p><b>Recycling automobile components</b></p> <ul style="list-style-type: none"> <li>Need to re-use components rather than dispose</li> <li>Re-use of fluids such as brake fluid</li> <li>Pass non-recyclable parts to certified disposal company.</li> </ul> <p><b>Mention of basic materials:</b></p> <ul style="list-style-type: none"> <li>Steel – mild for panels / heat treated for gears / cast iron blocks</li> <li>Aluminium – cast blocks</li> <li>Glass – laminated front screen / heated rear / mirror in lights</li> <li>Rubber – tyres / re-moulds / grommets / seals</li> <li>Plastic – nylon / PVC / acrylic.</li> <li>Problem associated with combination of materials in one unit</li> <li>Labour intensive to dismantle into like materials</li> <li>Difficulty of separating-out different types of plastics into particular types</li> <li>Plastics present in a variety of forms - textile, foam and rigid form</li> <li>Need to grind glass to remove laminar structure, eject foreign bodies before sending cullet for re-melting</li> <li>Environmental problems</li> <li>Sorting / electromagnet.</li> </ul> <p>1 mark for each point made with legitimate comments and justification x 6</p>		
			6 x 1	(6)
		<b>Total 8 Marks</b>		

6.	(a)		<p><b>Economic Factors</b> Economics of scale of production:</p> <ul style="list-style-type: none"> <li>• average cost are lower in high volume produced products</li> <li>• specialism spreads the cost</li> <li>• lower cost of capital investment interest charged</li> <li>• concentration of industry in one area creates good pool of labour</li> <li>• convenient suppliers</li> <li>• bulk buying.</li> </ul> <p>Production costs:</p> <ul style="list-style-type: none"> <li>• variable costs mention of cost of materials, labour, energy, packaging etc</li> <li>• fixed costs maintenance, rent, rates depreciation of capital machinery etc</li> <li>• ecological costs</li> <li>• marketing costs.</li> </ul> <p>1 mark for each point made with a maximum of 3 marks made for each term x 2</p>		
				3 x 2	(6)
	(b)	(i)	<p><b>Just in Time (JIT)</b></p> <ul style="list-style-type: none"> <li>• JIT manufacturing is all about delivering the right product to the consumer at the right time, with the right quality and minimum of waste.</li> <li>• JIT manufacturing enables a company to streamline its production method and develop strategies for delivery of its product in response to consumer demand - synchronisation. In order to guarantee delivery of components or materials as they are required a complex and highly organised date retrieval system must be put in place.</li> <li>• Factory layout can be production led.</li> <li>• Storage can be minimised.</li> </ul> <p>1 mark per appropriate answer x 4</p>		
				4 x 1	(4)
		(ii)	<p><b>CNC machines</b></p> <ul style="list-style-type: none"> <li>• CNC machines enable the designer to work on their ideas, knowing that simulation is possible and a virtual model available for evaluation, before committing to expensive prototyping.</li> <li>• The designer knows that more complex shapes are possible using CNC technology to manufacture the final product, which allows for more freedom in the design process. The use of ICT enables rapid data transfer, facilitating global manufacturing.</li> <li>• CNC machines allow a company to tool up for production runs of various sizes, making the company more flexible in its approach to varying consumer demands.</li> <li>• Greater machining accuracy is possible.</li> <li>• Waste and energy consumption can be kept to a minimum.</li> <li>• Lead times are reduced.</li> </ul> <p>1 mark per answer x 6</p>		
				6 x 1	(6)
<b>Total 16 Marks</b>					

7	(a)	<p><b>Artificial Intelligence:</b></p> <p>Explanation:</p> <ul style="list-style-type: none"> <li>• a branch of computer science concerned with developing computers that think/ act like humans.</li> <li>• simulation of human behaviour in manufacturing environments</li> </ul> <p>Benefits:</p> <ul style="list-style-type: none"> <li>• intelligent behaviour would allow a machine to respond to unforeseen circumstances and make decisions</li> <li>• intelligent systems should be able to consider large amounts of information simultaneously and process them faster in order to make rational, logical and expert judgements</li> <li>• AI leads to better designed and faster produced products with less errors and shorter lead times</li> <li>• respond to voice command and action a response.</li> </ul> <p>Up to 2 marks for the explanation and 1 mark for each statement on how it could benefit manufacturing</p>		
			2 x 2	(4)
	(b)	<p><b>Total Quality Management (TQM)</b></p> <ul style="list-style-type: none"> <li>• TQM is the development of an all round process for implementing quality. It requires employees to be aware of the need for quality and how to implement it within their manufacturing environment.</li> <li>• It also requires each employee to feel part of a system and to take a pride not only in their own section of the manufacturing process, but the company and its products as a whole. In TQM quality is defined in both the physical outcome and the ‘thinking’ behind the production.</li> <li>• There are several computer based systems which allow employees to deliver a more accurate set of data and disseminate that data around the company ICT can be used to give feedback about quality to employees as well as sending up dated specifications for appropriate action.</li> </ul> <p>Maximum of 2 marks available for each of the above statements x 2</p>		
			2 x 2	(4)
	(c)	<p><b>Flexible Manufacturing Systems (FMS)</b></p> <ul style="list-style-type: none"> <li>• Within a FMS all the information data required, from the planning and design stages, right through the production, to the final release can be stored, reviewed and altered quickly, allowing a change of production.</li> <li>• The need to respond to consumer demand, by expanding/ reducing product diversity and updating products on a regular basis is a primary factor.</li> <li>• A central computer can be used to control manufacturing cells and stock/ material levels. Products can be designed on one site and data transferred to another site for global manufacture.</li> </ul>		

		<p><b>Example:</b></p> <p>A product such as a car is to be updated or remodelled, basic design criteria like safety need to be reconsidered. If this information was not already available in stored electronic format, a large amount of time would be required to re-test and evaluate, whereas the computer can be used to recall current data, work changes and simulate results. These can then be downloaded and manufactured.</p> <p>Maximum 2 marks available for each of the above statements x 3</p>		
			3 x 2	(6)
			Total 14 marks	
			TOTAL FOR PAPER: 80 MARKS	



# Product Design: Graphics with Materials Technology – Unit 2: Knowledge and Understanding of Product Design

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Question paper	61
General guidance on marking	77
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1. (a) Identify the scales of production appropriate to the following products:

(i) A vinyl sign on the side of a van for an individual client.

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(1)

(ii) The manufacture of an aluminium drinks can for an international company, needing 24 hour, 7 day a week production.

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(1)

(b) The scale of production is an important factor when selecting materials and manufacturing processes for a new product.

Explain how **one-off** and **mass** production processes affect materials choice and manufacturing methods.

(i) One-off production

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(ii) Mass production

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(4)

**(Total 10 marks)**

Q1

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2. (a) Complete the table below for two common thermoplastics.

Name of plastic	PET	PP
Property		
End use		

(4)

(b) Glass reinforced plastics (GRP) and medium density fibreboard (MDF) are composite materials.

Describe the structure of each of these materials.

(i) GRP

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(2)

(ii) MDF

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(2)

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(c) Explain the term 'polymerisation'.

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(4)

Q2

**(Total 12 marks)**

3. (a) Mechanical pulp, chemical pulp and waste pulp are used in the manufacture of paper and board. Explain the production of **one** of these pulps.

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(b) Describe the Fourdrinier paper manufacturing process.

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**(Total 8 marks)**

**Q3**

4. Figure 1 shows a packaged novelty pencil sharpener suitable for children.

**Figure 1**



(a) Discuss the quality issues in the production of the novelty pencil sharpener.

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**(4)**

(b) Discuss the quality standards associated with the novelty pencil sharpener.

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**(4)**

**(Total 8 marks)**

**Q4**

5. (a) The exploration and communication of design ideas are often achieved through the use of models.

Explain how block modelling is used for this purpose.

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**(2)**

- (b) A common method of solid modelling used in industry is rapid prototyping (RPT).

Describe this method of modelling.

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- (c) A designer has used computer-aided design (CAD) to develop a virtual architectural interior.

Discuss the benefits of using this process as opposed to traditional modelling methods.

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**(Total 10 marks)**

**Q5**

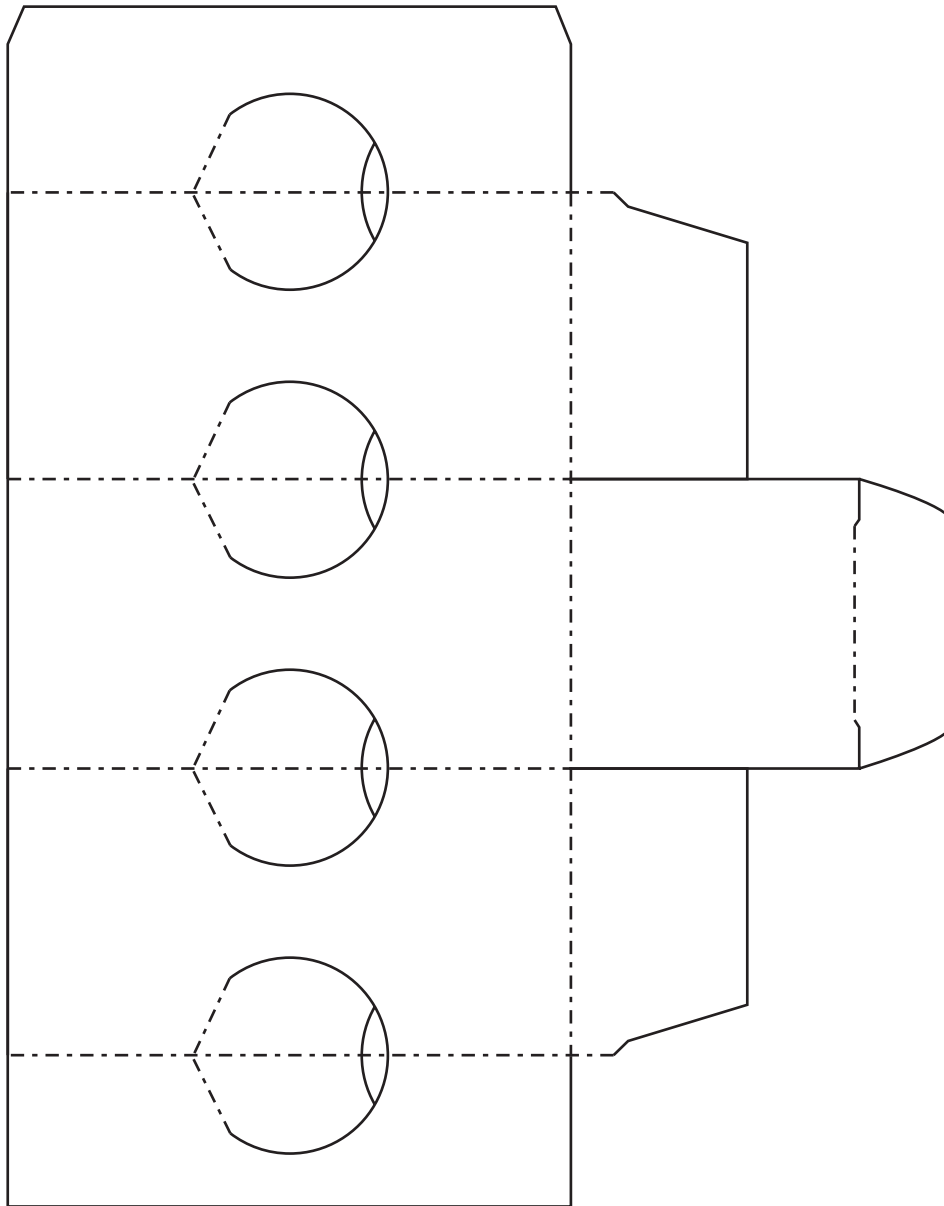
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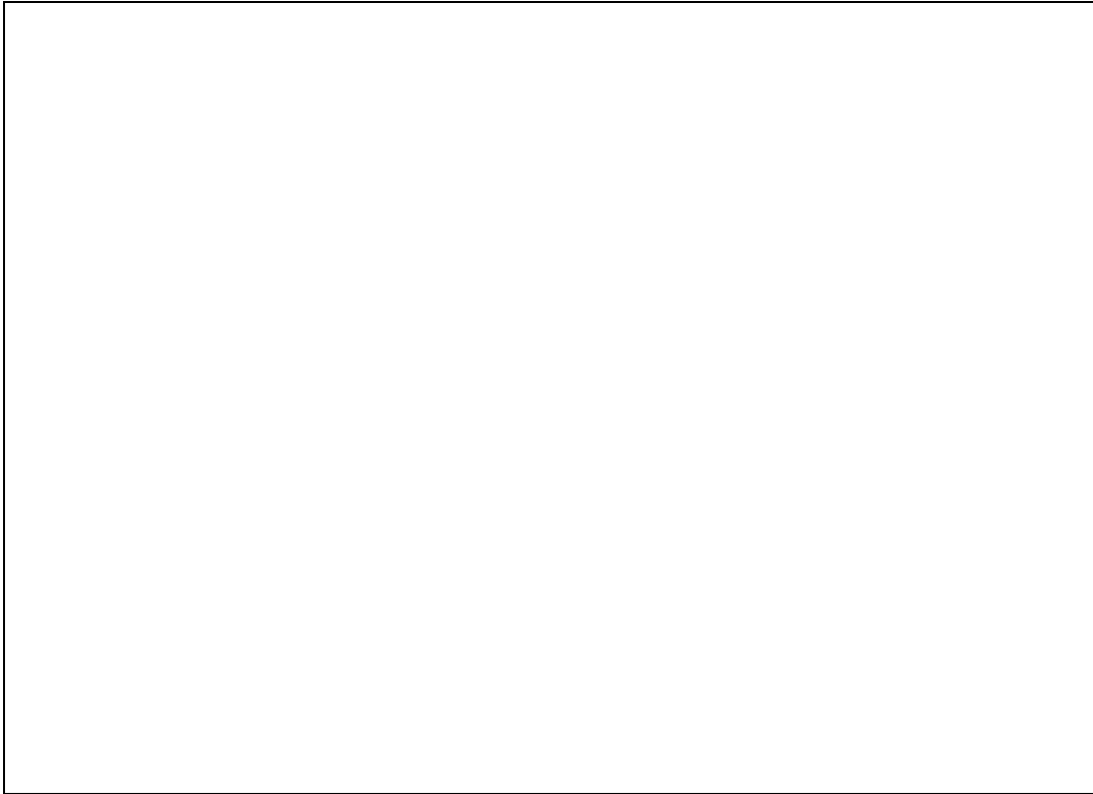
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6. The net shown in Figure 2 is a one-piece storage carton for a single light bulb. Cut lines are shown as full black lines, fold lines are shown as chain lines.

Figure 2



- (a) Sketch a view of the assembled light bulb carton using an appropriate method of 'pictorial' representation. Choose a viewing angle that enables clear visual communication of external and internal features.



(4)

- (b) The net was drawn using traditional drawing methods.

Explain **two** advantages of using a CAD system to produce the net as opposed to traditional drawing methods.

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(4)

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(c) Explain how computer integrated manufacture (CIM) would facilitate the commercial batch production of the net.

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**(4)**

**Q6**

**(Total 12 marks)**

7. 'Values issues' can have a significant effect on manufacturing at both local and global levels. With regard to these issues, discuss the advantages and disadvantages of:

(a) manufacturing at local level

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**(4)**

(b) manufacturing at global level

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**(4)**

**(Total 8 marks)**

Q7

8. Designers often use materials or processes to improve the characteristics of products.

(a) Describe the improved aesthetic and functional characteristics given to products by the use of **one** new material **or** process.

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(b) Using the work of **one** designer **or** design movement, describe the importance of **two** of the following:

- Colour
- Styling
- Texture
- Shape
- Decoration

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**(6)**

**(Total 12 marks)**

**Q8**

**TOTAL FOR PAPER: 80 MARKS**

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- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	(i)	<p>A graphic sign on a van side for an individual client</p> <ul style="list-style-type: none"> <li>• One-off production</li> <li>• Accept 'job' production</li> </ul> <p>1 mark for any one above</p>		
				1 x 1	(1)
		(ii)	<p>Aluminium drinks can - 24hr, 7 day a week production</p> <ul style="list-style-type: none"> <li>• Continual flow</li> <li>• Continuous production</li> <li>• Process production</li> </ul> <p>Do not accept mass or high-volume production</p> <p>1 mark for any one above</p>		
				1 x 1	(1)
	(b)	(i)	<p>One-off production:</p> <ul style="list-style-type: none"> <li>• Higher quality materials used are more expensive, therefore the product is more expensive.</li> <li>• Highly skilled labour required with specialist tools and machinery</li> <li>• Time consuming manufacture due to high detailing and 'craftsmanship' involved</li> <li>• Or similar</li> </ul> <p>2 marks for each explanation x 2</p>		
				2 x 2	(4)
		(ii)	<p>Mass production:</p> <ul style="list-style-type: none"> <li>• Lower cost of materials when buying in bulk, therefore unit costs are low</li> <li>• Low skilled labour used with automated manufacturing processes</li> <li>• Increased production means that high set-up costs are quickly recovered</li> <li>• Or similar</li> </ul> <p>2 marks for each explanation x 2</p>		
				2 x 2	(4)
				<b>Total 10 marks</b>	

2	(a)		<p>PET</p> <p>Property</p> <ul style="list-style-type: none"> <li>• Very tough</li> <li>• High tensile strength</li> <li>• Impact resistant</li> <li>• Good chemical/temperature resistance</li> <li>• Alcohol and oil resistant</li> <li>• Transparent</li> <li>• Good optical qualities</li> <li>• Recyclable</li> </ul> <p>End use</p> <ul style="list-style-type: none"> <li>• Mineral water/soft drinks bottles</li> <li>• Food containers</li> <li>• Microwaveable food trays etc</li> </ul>		
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			<p><b>Polypropylene (PP)</b>  <b>Property</b></p> <ul style="list-style-type: none"> <li>• Lightweight</li> <li>• Rigid</li> <li>• Excellent chemical resistance</li> <li>• Low moisture absorption</li> <li>• Good impact resistance</li> </ul> <p><b>End use</b></p> <ul style="list-style-type: none"> <li>• Yoghurt/ margarine pots, sweet and snack wrappers, stationery - folders etc</li> </ul> <p>1 mark for a property and 1 mark for an end use for each of the two properties</p>		
				2 x 2	(4)
	(b)	(i)	<p><b>GRP</b></p> <ul style="list-style-type: none"> <li>• Loose strand matt/ fibres of glass</li> <li>• A woven string/matt</li> <li>• Held together with a polyester resin (0 marks for resin or plastic)</li> <li>• Has (high tensile) strength/ tough/ rigid</li> <li>• Has high compressive strength</li> <li>• A light/ lightweight, hard-wearing surface</li> <li>• Excellent resistance to corrosion</li> </ul> <p>1 mark for each point above x 2 required.</p>		
				2 x 1	(2)
		(ii)	<p><b>MDF</b></p> <ul style="list-style-type: none"> <li>• Fibres are made from (waste) wood/ particles of wood</li> <li>• Bonded together with a synthetic resin adhesive</li> <li>• Heat or pressure involved in the process</li> <li>• Produces a uniform mixture/fine textured surface</li> <li>• A very stable material</li> <li>• Hard wearing material</li> <li>• A good electrical insulator</li> <li>• Takes paint (and other finishes) well</li> </ul> <p>1 mark for each point above x 2 required.</p>		
				2 x 1	(2)
	(c)		<p><b>Polymerisation</b>  <i>An appropriate description.</i>  Candidates may write about the following 4 points in support of their description:</p> <ul style="list-style-type: none"> <li>• synthetic polymers are produced from gas, coal or oil products</li> <li>• crude oil is refined using a fractional tower</li> <li>• this refining process gives rise to hydrocarbon naphtha</li> <li>• this is further broken down, using heat &amp; pressure, to give ethylene &amp; propylene</li> </ul> <p><i>Key responses</i></p> <ul style="list-style-type: none"> <li>• Large chains of giant molecules are built up by the connection of many base units, (the monomer molecules), to give a polymer (hence polymerisation)</li> <li>• Crosslinks (monomers), in thermoplastics, are held together by mutual attraction (Van der Waals forces)</li> </ul>		

		<ul style="list-style-type: none"> <li>• In thermosetting plastics, the molecules link side by side and end to end, this cross linking is known as covalent bonding</li> <li>• Candidates may write about elastomers, which fall between the two preceding descriptions eg rubber</li> <li>• During polymerisation, as the polymer grows, the melting point increases and it becomes stronger and more rigid</li> <li>• Three main types of polymer structure (which all react in different ways when heated), thermoset, thermoplastic or elastomers</li> </ul> <p>1 mark for each point x 4</p>		
			4 x 1	(4)
Total 12 marks				

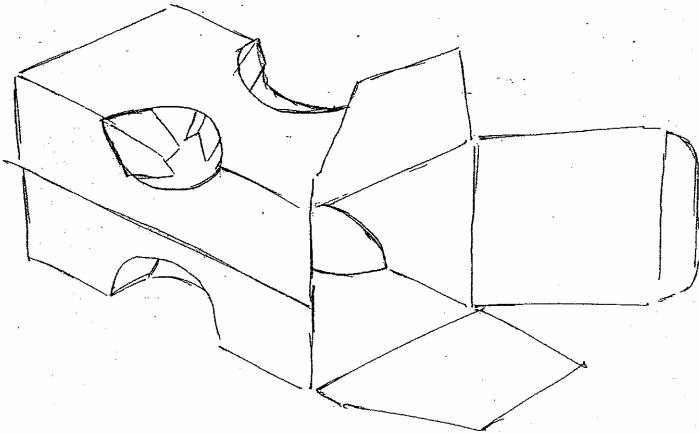
3	(a)	<p>Explain the production of ONE of the following pulps:</p> <p><i>Mechanical Pulp</i></p> <ul style="list-style-type: none"> <li>• Logs (coniferous wood) are saturated with water</li> <li>• Logs are debarked</li> <li>• Logs are ground (using a grindstone) down (to form a pulp)</li> <li>• Pieces of 1-2mm produced (larger pieces are re-circulated)</li> <li>• Pulp is bleached (peroxide or sodium hydroxide)</li> <li>• High yield method</li> <li>• Contains impurities</li> <li>• Used in low-grade paper or packaging material</li> </ul> <p><i>Chemical Pulp</i></p> <ul style="list-style-type: none"> <li>• Logs (hardwood &amp; softwood) are debarked</li> <li>• Logs are cut into 20mm chips (along the grain)</li> <li>• Chips are pounded into fragments ( and screened)</li> <li>• Pulp is treated with acid or alkaline (bleach)</li> <li>• This is done in tanks called 'digesters' (involves heating)</li> <li>• Lignin is dissolved away</li> <li>• Fibres are filtered out then washed</li> <li>• Lower fibre (pulp) yield than mechanical pulp</li> <li>• Fibres are longer/stronger/fewer impurities (than mechanical pulp)</li> </ul> <p><i>Waste Pulp</i></p> <ul style="list-style-type: none"> <li>• Recycled paper/card used</li> <li>• Ground down into a pulp</li> <li>• Used for lower grade paper</li> <li>• Strength/durability/colour of lower quality (lower than MP/CP)</li> <li>• Waste pulp can be mixed with virgin fibres (i.e. from MP/CP processes) this improves quality</li> <li>• Processed with bonding agents/ pigments/ bleach</li> <li>• A sizing agent may be added to improve water resistance/ prevent ink from bleeding (feathering)</li> </ul> <p>Marks awarded from only one pulp. If a candidate write about both of them, mark both and award the highest mark.</p>		
			4 x 1	(4)

	(b)	<p>Describe the Fourdrinier paper manufacturing process</p> <ul style="list-style-type: none"> <li>Cellulose fibres/pulp, diluted with water (99% water approx)</li> <li>Cellulose fibres/pulp, fed onto woven mesh belt/wire frame</li> <li>The belt/frame is vibrated (to drain off water)</li> <li>The vibrating action causes the fibres to interweave</li> <li>The process is assisted via vacuum suction boxes (aids the removal of water)</li> <li>Rollers (some felt faced/some steel) press the fibres closer together (it forms a mat)</li> <li>Heat is used to speed-up the drying process</li> </ul> <p>1 mark for each point x 4</p>		
			4 x 1	(4)
		<b>Total 8 marks</b>		

4	(a)	<p>Quality issues in production:</p> <ul style="list-style-type: none"> <li>Using Quality assurance (QA) systems</li> <li>Using Quality Control (QC) systems involving inspection and testing. For example, quality control in a print run incorporating colour bars and registration marks.</li> <li>Manufacturing to specified tolerances</li> <li>Using Total Quality Management (TQM) systems</li> </ul> <p>1 mark for each point x 4</p>		
			4 x 1	(4)
	(b)	<p>Quality standards:</p> <ul style="list-style-type: none"> <li>Testing against external quality standards - BSI/ ISO/ CE etc</li> <li>Symbols awarded as a result of testing - kite-mark, CE mark etc</li> <li>Meeting product specifications including; aesthetics, performance, pricing etc</li> <li>Any other appropriate point</li> </ul> <p>1 mark for each point x 4</p>		
			4 x 1	(4)
		<b>Total 8 marks</b>		

5	(a)	<p>Exploration/communication of ideas through block modelling:</p> <ul style="list-style-type: none"> <li>These are made (used) to help determine shape (2D/3D), dimensions &amp; surface finish</li> <li>They are accurate representations of the external appearance of the product</li> <li>They show external details (features) such as: screws, joints, surface texture and colour</li> <li>This type of model does not deal with internal detail (such as moving or working parts)</li> </ul> <p>1 mark for each point x 2</p>		
			2 x 1	(2)

(b)		<p>RPT (rapid prototyping) - Describe this method of modelling.</p> <ul style="list-style-type: none"> <li>• A method of creating 3D objects from CAD drawings</li> <li>• Build up layers to form prototypes</li> <li>• This method can be mimicked (in school) using layers of paper (cut on a vinyl cutter)</li> <li>• CAM/ CNC application creates a 3D object/ using lasers</li> <li>• Lasers are used to solidify liquid polymers</li> <li>• The liquid polymer/ starch is 'set' at the point of intersection of 2 laser beams</li> <li>• This process is called 'stereolithography'</li> <li>• In school: (Boxford system) - LOM layer object modelling</li> <li>• CNC vinyl cutter cuts slices of thin sticky backed paper</li> <li>• The layers are built up on a pegged jig (to make a 3D prototype)</li> <li>• Candidates may write about the RPT process called: 'solid ground curing', where the vat moves horizontally as well as vertically/a uv lamp (mercury) is used to flood the chamber, expose and solidify the entire layer at once (instead of using a laser)/ wax is used as a support</li> </ul> <p>1 mark for each point above x 4</p> <p>Alternatively, they may write about: 'SLS' (selective laser sintering), where powders of different materials are used (instead of a liquid polymer)/ the laser sinters selected areas, causing the particles to melt and solidify.</p>		
			4 x 1	(4)
(c)		<p>CAD - virtual architectural interior</p> <ul style="list-style-type: none"> <li>• Useful tool for the visualisation of the design</li> <li>• The building interior can be modelled on screen</li> <li>• Internal/external layout can be shown on screen</li> <li>• Different materials &amp; colour schemes can be readily shown</li> <li>• Different times of the day/year, weather &amp; sun positions can be easily shown</li> <li>• A wide variety of camera (viewing) angles can be explored</li> <li>• The client can 'walk' round &amp; through the building (virtually)</li> <li>• Ready access to import data</li> <li>• Time &amp; cost savings to all involved</li> <li>• Scale of modelling can be easily altered (time/cost savings)</li> <li>• Comment about animation is acceptable</li> </ul> <p>1 mark for each point above x 4</p>		
		Total 10 marks	4 x 1	(4)

6	(a)	<p>Pictorial illustration of light bulb carton</p> <p>Use the following guide when awarding marks:  NB only a single view required.  No annotation required</p> <ul style="list-style-type: none"> <li>• Is the carton shown in proportion 2:1:1 approx - 1 mark</li> <li>• To what extent are the ext./int. features clear? - 2 marks  i.e. are the 4 bulbs support legs clear?  (mark on the basis of 50% + for full marks)</li> <li>• To what extent has the choice of viewing angle aided clear communication of the above? - 1 mark</li> </ul> <p>Example:</p> 		
			4 x 1	(4)
	(b)	<p>Advantages of CAD</p> <ul style="list-style-type: none"> <li>• Designs can easily be modified on screen without the need for re-drawing</li> <li>• Designs can be stored electronically and easily retrieved  Design data can be directly outputted to printers or CAM equipment</li> <li>• Or similar</li> </ul> <p>2 marks for each detailed explanation x 2</p>		
			2 x 2	(4)
	(c)	<p>Computer integrated manufacture (CIM)</p> <ul style="list-style-type: none"> <li>• Interlinked network of computers controls flow of information and automated processes</li> <li>• Fully automated manufacturing cells produce different components</li> <li>• Project management software allows manufacturer to create different workflows for different jobs</li> <li>• Use of Just-in-time ordering of stock and materials allows for flexibility</li> <li>• Or similar</li> </ul> <p>2 marks for each detailed explanation x 2</p>		
		Total 12 marks	2 x 2	(4)



7	(a)	<p>Manufacturing at local level</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• People can be working for themselves. Greater flexibility in outcome</li> <li>• Designs tailored to meet clients and consumer needs</li> <li>• Job satisfaction - working for the local community/ working for themselves</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Reliance on self promotion for continued work</li> <li>• Less follow through on H&amp;S issues, for example: less checks on environmental issues</li> <li>• Unstable availability of work</li> <li>• Difficulties in regulating smaller companies</li> </ul> <p>Must address advantages - 1 mark for each point x 2 and must address disadvantages - 1 mark for each point x 2</p>		
			2 x 2	(4)
	(b)	<p>Manufacturing at global level</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Assured employment for unskilled workforce</li> <li>• Stable jobs in volume production leads to stable economy</li> <li>• Political incentives available for relocation.</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Low paid workforce often working in countries with dubious political issues</li> <li>• Mundane, repetitive. Marxist theory - no personal value.</li> <li>• Volume production further promotes consumerism therefore waste, pollution etc</li> <li>• Short cuts on environmental issues exploited in some countries</li> <li>• Low job satisfaction and worker involvement</li> </ul> <p>Must address advantages - 1 mark for each point x 2 and must address disadvantages - 1 mark for each point x 2</p>		
			2 x 2	(4)
<b>Total 8 marks</b>				
8	(a)	<p>Improved aesthetic and functional characteristics:</p> <p>Brief description of new material AND general reason for use, eg:</p> <ul style="list-style-type: none"> <li>• carbon fibres used in car bodies/boat hulls,</li> <li>• thermochromic liquid crystals used in thermometers</li> <li>• phosphorescent pigments used in displays</li> <li>• Kevlar used in body armour</li> <li>• piezo-electric transducers used in musical greetings cards</li> </ul> <p>OR brief description of new process AND general reason for use, eg:</p> <ul style="list-style-type: none"> <li>• Coating, laminating, fusion, micro-encapsulation, biostoning, biopolishing, laser cutting, digital printing</li> </ul>		

		<p>Improved aesthetic characteristics e.g look, shape, colour, pattern, texture, drape, handle, weight, styling due to the new material, process with reference to the product example. Improvements in purpose, performance, function with reference to the product example.</p> <p>Not one word answer Brief description of appropriate new material OR process and general reason for use x 2 marks PLUS example of improved characteristics in product - 1 mark for each point x 4</p>		
			2 + (4x1)	(6)
	(b)	<p>Designer or design movement Colour, eg:</p> <ul style="list-style-type: none"> <li>• colour palette - brights, pastels, primaries, darks</li> <li>• use of paints, dyes, natural colour to enhance work</li> <li>• aesthetics - promote trendy/ fashionable image</li> <li>• impact on marketing, saleability, mood</li> <li>• importance for safety products - bright, luminous, identify people at risk, identify emergency help</li> </ul> <p>Styling, eg:</p> <ul style="list-style-type: none"> <li>• look of product- sleek, sporty, high-tech, casual, classic, streamlined etc.</li> <li>• influence of materials, cultural style</li> <li>• impact on target market - styling to suit, influence consumer to buy, image it gives</li> <li>• impact of product type - meet functional, aesthetic, performance requirements.</li> </ul> <p>Texture, eg:</p> <ul style="list-style-type: none"> <li>• look of product - aesthetics, decorative</li> <li>• surface finish - designed for the product</li> <li>• graphical texture (rendered) surface to enhance finished drawing</li> <li>• feel of product - smooth, rough, soft, hard touch</li> <li>• safety of product - knobs, dials, Braille, non-slip</li> </ul> <p>Shape, eg:</p> <ul style="list-style-type: none"> <li>• form and function issues - shape to suit product</li> <li>• impact on look of product - style, fashion, image</li> <li>• impact on ergonomics - indicates function, control</li> </ul> <p>Decoration, eg:</p> <ul style="list-style-type: none"> <li>• form and function issues - added on or integral to design.</li> <li>• embellishment and adornment.</li> <li>• impact on look of product - scale, repeat, all-over pattern.</li> <li>• non-functional issues - styling, fashion.</li> </ul> <p>Answer must relate to a named designer or named design movement Two out of five above selected – 1 mark for each point x 3</p>		
			3 x 2	(6)
			Total 12 marks	
			TOTAL FOR PAPER: 80 MARKS	

# Product Design: Graphics with Materials Technology – Unit 3: Further Study of Product Design

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Question paper	89
General guidance on marking	105
Mark scheme	107





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1. (a) Explain the term 'smart' material.

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(2)

(b) Explain the term 'liquid crystal display' (LCD) and give **one** example of its use.

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(3)

(c) Biotechnology is concerned with the modification of existing materials and production of new materials. Discuss the role of biotechnology in the production of:

(i) paper and board

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(3)

(ii) plastics

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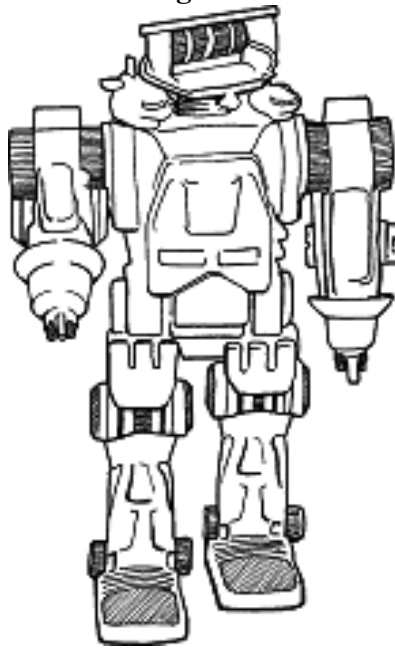
**(Total 10 marks)**

Q1

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2. A toy manufacturer wishes to launch a new toy robot, see figure 1, onto the already crowded children's toy market.

**Figure 1**



- (a) Design **two** different magazine adverts to promote the launch of the new toy robot in the boxes below.

Both adverts must appeal to the 'target market group' and give the manufacturer a 'competitive edge'.

**(3)**





3. (a) Discuss the use of the Internet as a marketing tool from the customer's perspective.

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**(4)**

(b) Explain the term 'video conferencing' and discuss the impact that this technology has had on the design process.

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**(6)**

**(Total 10 marks)**

**Q3**

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(b) Describe how consumer organisations might provide guidance, discrimination and approval for consumers when buying products.

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(4)

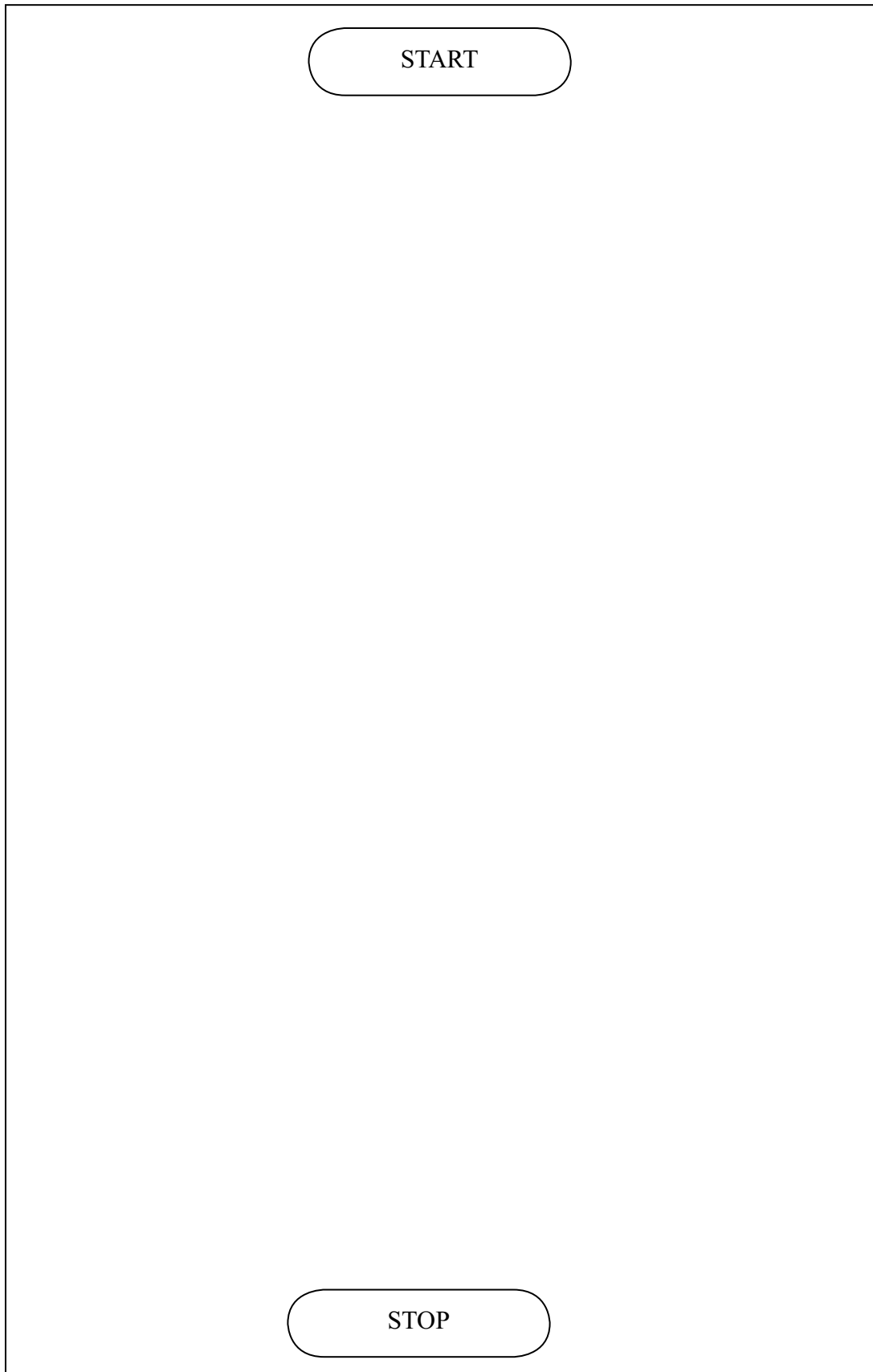
Q4

(Total 10 marks)

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5. (a) Flow diagrams can be used to plan the stages of a manufacturing process.

Draw a flow diagram to represent the injection moulding process.



(6)

(b) Automated material handling, storage and retrieval systems are an integrated part of many manufacturing plants. Describe **two** of the following systems:

- (i) automated guided vehicle (AGV)
- (ii) robotic arm
- (iii) bar coding
- (iv) overhead conveyor

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**(6)**

(c) Explain the term ‘Artificial Intelligence’ and describe how it could benefit manufacturing.

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**(4)**

**(Total 16 marks)**

<b>Q5</b>	
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(b) Many products use materials that come from non-renewable resources.

State a product you are familiar with and discuss how it could be manufactured in such a way as to preserve resources.

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(6)

**(Total 12 marks)**

Q6

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7. (a) Discuss the effect of Total Quality Management (TQM) within manufacturing.

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(b) Evaluate, using examples where appropriate, the use of computers within Flexible Manufacturing Systems (FMS).

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(6)

(Total 10 marks)

**Q7**

**TOTAL FOR PAPER: 80 MARKS**

**END**

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## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	<p>Smart material</p> <p>Smart materials respond to differences in temperature or light and change in some way as a result</p> <p>OR</p> <p>Smart materials appear to ‘think’ and some have a memory as they revert back to their original state.</p> <p>2 marks available for either complete answer</p>		
			2 x 1	(2)
	(b)	<p>LCD</p> <p>Explanation</p> <ul style="list-style-type: none"> <li>• Used as numerical and alpha numerical indicators/ displays</li> <li>• Have replaced LED’s</li> <li>• Require much smaller currents than LED’s</li> <li>• Prolong the life of batteries/ greater energy efficiency</li> <li>• Liquid crystals are organic, carbon based compounds</li> <li>• Liquid crystals exhibit both liquid and solid characteristics</li> <li>• Applied voltage across a cell’s terminals containing liquid crystals will darken (reaction) against a silver background</li> <li>• LCD’s use a 7 segment pattern – giving numbers/ letters</li> </ul> <p>Example</p> <ul style="list-style-type: none"> <li>• Digital displays on clocks, watches, mobile phones etc</li> <li>• High resolution computer screens</li> </ul> <p>2 marks for an explanation and 1 mark for an example</p>		
			(2 x 1) + 1	(3)
	(c)	(i) <p>Biotechnology - paper and board</p> <ul style="list-style-type: none"> <li>• Changes properties</li> <li>• Aids trees resistance to disease</li> <li>• Reduction of lignin in tree growth</li> <li>• Reduces the toxic chemicals used in the paper industry needed to break down lignin</li> <li>• Produces trees with increased growth rate</li> <li>• Reduces deforestation</li> <li>• Trees grown specifically for the paper industry</li> <li>• Enzymes break down timber fibres more effectively</li> <li>• Paper fibres can be more effectively bonded</li> <li>• Treat recycled paper more effectively/ easier</li> <li>• Paper treated to biodegrade more easily and quicker</li> <li>• Efficient production/ made faster.</li> </ul> <p>1 mark for each answer x 3</p>		
			3 x 1	(3)

		(ii)	<b>Biotechnology - plastics</b> <ul style="list-style-type: none"> <li>• Production of environmentally friendly plastics/ eco-friendly at point of manufacture/ production</li> <li>• Biopol includes a natural polymer which would biodegrade at the end of its useful life</li> <li>• Some 'green' credit cards now available in Biopol</li> <li>• Less pollution when degrading on landfill</li> <li>• certain plastics are now fully biodegradable.</li> </ul> 1 mark for each answer x 2		
				2 x 1	(2)
			<b>Total 10 marks</b>		

2	(a)		Different magazine advert designs x 2 <ul style="list-style-type: none"> <li>• Use of 'strap line' outlining the competitive edge, i.e. price, unique selling points, special features etc. (1 mark).</li> <li>• Appropriate use of imagery - science fiction, action etc (2 marks).</li> </ul> 1 mark for appropriate "strap line". 2 marks for appropriate use of imagery. Maximum of 3 marks available for each advert x 2		
				3 x 2	(6)
	(b)		Justification of selected magazine advert Appeal to 'target market group': <ul style="list-style-type: none"> <li>• specifically targets the 'wants' of certain children, predominantly boys</li> <li>• use of science fiction imagery</li> <li>• use of action</li> <li>• or similar.</li> </ul> 'Competitive edge' for manufacturer: <ul style="list-style-type: none"> <li>• product is less expensive in comparison to competition more affordable for children</li> <li>• robot includes special features not present on other toys</li> <li>• higher quality more desirable product.</li> </ul> 1 mark for each point for the target market x 3 1 mark for each point for the competitive edge x 3		
				2 x 3	(6)
			<b>Total 12 marks</b>		



3.	(a)	<p><b>Internet as a marketing tool</b></p> <p>Customers perspective</p> <ul style="list-style-type: none"> <li>• Ease of use for the customer (from home)</li> <li>• Range of search engines can be used to locate and purchase required products/ services</li> <li>• Facility to browse entire catalogue of products</li> <li>• Access to product reviews/ specifications</li> <li>• Facility for customisation of designs</li> <li>• 3D interactive visual images help customers relate to products on offer</li> <li>• Ease of purchase/ customer support</li> <li>• Internet can be slow to access</li> <li>• Computers can crash</li> <li>• Registration is often required before access is allowed</li> <li>• Security of credit card data</li> <li>• Lacks the personal touch - interaction</li> <li>• Shared mailing lists - junk mail</li> <li>• Difficult navigation of some sites</li> <li>• Pop up advertising is irritating.</li> </ul> <p>1 mark for each answer x 4</p>		
			4 x 1	(4)
	(b)	<p><b>Video conferencing explanation</b></p> <ul style="list-style-type: none"> <li>• Desktop VC and multi-point VC</li> <li>• VC is used for; market presentations, corporate training, remote diagnostics/ manufacturing</li> <li>• ISDN/ LAN lines are installed as they cope with large amount of data traffic required</li> <li>• Information discussed at a meeting can be transferred electronically, eg. To a regional office.</li> </ul> <p><b>Impact on the design process</b></p> <ul style="list-style-type: none"> <li>• No face to face personal contact/ interaction</li> <li>• Decreasing cost of hardware has allowed increased use of VC</li> <li>• Conferencing across the globe- face to face contact (on screen) without costs of time/ travel/ accommodation</li> <li>• VC is used for; market presentations, corporate training, remote diagnostics</li> <li>• Remote manufacturing</li> <li>• Faster turn around of ideas</li> <li>• Aids concurrent manufacturing.</li> </ul> <p>1 mark for each defining term x 2 1 mark for each impact on design x 4</p>		
			2 x 1 + 4 x 1	(6)
			<b>Total 10 marks</b>	

4	(a)	<p>Only accept marks from two of the following (i), (ii) or (iii)</p> <p>(i) 'of satisfactory quality':</p> <ul style="list-style-type: none"> <li>• must be according to sales description</li> <li>• looks as described, eg. Correct colour/ style</li> <li>• complies with relevant safety regulations, eg. Fireproof</li> <li>• sold at price stated, eg. RRP/ sale price</li> <li>• performs satisfactorily, eg. Durable/ free from defects</li> </ul> <p>(ii) 'fit for purpose'</p> <ul style="list-style-type: none"> <li>• product must perform as described (not meeting specifications)</li> <li>• eg. Computer game works with stated programme</li> <li>• eg. Stain resistant garment resists stains</li> </ul> <p>(iii) 'as described':</p> <ul style="list-style-type: none"> <li>• must be described on packaging/ sales display/ by seller</li> <li>• eg. 100% cotton shirt must be 100% cotton</li> </ul> <p>2 marks for an explanation plus 1 mark for an example x 2</p>		
				<p>((2 x 1) + 1) x 2</p> <p>(6)</p>
	(b)	<p>Consumer organisations</p> <p>Organisations (not BSI)</p> <ul style="list-style-type: none"> <li>• Consumer association provides objective guidance eg. Product testing, best buys</li> <li>• 'Which' magazine - evaluation of similar products eg. Product ratings</li> <li>• Organisations that test new products eg. Cars - Autotrader/ Topgear</li> <li>• Provides guidance and protects consumer's interests</li> </ul> <p>Method of guidance (not kite-mark or CE mark)</p> <ul style="list-style-type: none"> <li>• Compare features</li> <li>• Select key characteristics</li> <li>• Compare costs/ value for money</li> <li>• Evaluate environmental/ energy costs</li> <li>• Test product function/ performance</li> <li>• Results are objective/ impartial guidance</li> </ul> <p>1 mark for each answer x 4</p>		
				<p>4 x 1</p> <p>(4)</p>
			<b>Total 10 marks</b>	

5	(a)	<p><b>Flow diagram for injection moulding</b>  A suitable systems and control flow diagram including correct use of terminal (terminator) boxes, action boxes, decision boxes and feedback loops. For example:</p> <pre> graph TD     Start([Start]) --&gt; Load[Load plastic granules into hopper]     Load --&gt; Heat[Heat plastic granules until liquid]     Heat --&gt; Force[Force liquid plastic through screw mechanism]     Force --&gt; Motor{Motor control of screw}     Motor --&gt; Inject[Inject liquid plastic into mould]     Inject --&gt; Volume{Control of volume of liquid plastic}     Volume --&gt; Open[Open mould and eject component]     Open --&gt; Timing{Timing control of mould mechanism}     Timing --&gt; Stop([Stop]) </pre> <p>6 marks available for appropriate flow diagram with correct signals</p>		
			6 x 1	(6)

	(b)	<p>Only accept marks from two of the following systems (i), (ii), (iii) or (iv)</p> <p>(i) <b>AGV</b></p> <ul style="list-style-type: none"> <li>• Unmanned vehicle designed to carry materials automatically from one part of the factory to another</li> <li>• Can be guided by a photo-sensor which reads a strip of reflective tape which can easily be moved to create alternative routes</li> <li>• More sophisticated AGVs are controlled by a computer programme which determines the vehicle's destination and controls the performance of the vehicle throughout its operation</li> </ul> <p>(ii) <b>Robotic arm</b></p> <ul style="list-style-type: none"> <li>• The reliability of robots to make consistent repetitive movements is ideally suited to the loading and unloading of CNC machines in manufacturing cells</li> <li>• The combination of CNC machines and robotic arms are used to create flexible manufacturing</li> <li>• Computer controlled machine tools that can be programmed to perform complex tasks</li> <li>• A device that moves and reacts to sensory input, eg. Sound, sight and touch when handling or processing materials</li> <li>• Devices that can work in hazardous/ hostile environments</li> </ul> <p>(iii) <b>Bar coding</b></p> <ul style="list-style-type: none"> <li>• Ensures parts are distributed to where they are required</li> <li>• Used in manufacturing as visual recognition system for component parts</li> <li>• Bar codes (data communication tags) require high reading performance; can be read by small sized low cost laser scanner</li> <li>• Bar codes used to monitor products through whole manufacturing systems using 'real time' production information</li> <li>• Bar code readers attached to work stations provide information about operator performance and the effectiveness of the manufacturing system</li> <li>• On-line order tracking</li> </ul> <p>(iv) <b>Overhead conveyor</b></p> <ul style="list-style-type: none"> <li>• Automatic overhead conveyor systems move components around factory</li> <li>• Computerised OHC enable location and tracking of individual product pieces</li> <li>• Enables reallocation of work in the light of changing resources and jobs</li> <li>• OHC systems offer a fast method of stock loading, retrieval and delivery some can process up to 34,000 different items for shipment to individuals, stores or retail outlets</li> </ul> <p>(1 mark for each answer x 3) x 2 systems selected</p>		
			3 x 2	(6)

	(c)	<p><b>Artificial intelligence (AI)</b>  <b>Explanation</b></p> <ul style="list-style-type: none"> <li>• A branch of computer science concerned with developing computers that think/ act like humans.</li> <li>• Simulation of human behaviour in manufacturing environments</li> </ul> <p><b>Benefits</b></p> <ul style="list-style-type: none"> <li>• Intelligent behaviour would allow a machine to respond to unforeseen circumstances and make decisions</li> <li>• Intelligent systems should be able to consider large amounts of information simultaneously and process them faster in order to make rational, logical and expert judgements</li> <li>• AI leads to better designed and faster produced products with less errors and shorter lead times</li> <li>• Respond to voice command and action a response.</li> </ul> <p>Up to 2 marks for the explanation and 2 marks for a statement on one benefit</p>		
			2 + 2	(4)
<b>Total 16 marks</b>				

6	(a)	<p><b>Renewable sources of energy - only select two sources.</b></p> <p><b>Wind power:</b> uses wind to turn turbines which generate electricity.  <b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Non-polluting</li> <li>• Justification of 'free' power</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Small proportion of energy provided</li> <li>• Unsightly wing turbines</li> </ul> <p><b>Tidal power:</b> reversible turbine blades harness the tides in both directions.  <b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Reversible turbines</li> <li>• Twice daily tides</li> <li>• Clean power</li> <li>• Reliable and regular</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• High set up costs</li> <li>• Restrict passage of ships</li> <li>• Could damage wildlife and natural places - flooding</li> </ul> <p><b>Hydro-electric power:</b> running water turns turbines and generates hydro-electric power (HEP)  <b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Clean and efficient power source</li> <li>• Justification of 'free' power</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• High set up costs</li> <li>• Remote areas</li> <li>• Produces only a small proportion of total power required</li> </ul>		
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		<p>Solar power: hot water and electricity generated via solar cells.</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Hot water and electricity generated</li> <li>• Justification of 'free' power</li> <li>• Non-polluting</li> <li>• Reliable</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Very high cost of photo-voltaic cells</li> <li>• Biggest demand in winter when little direct sunlight</li> </ul> <p>Geothermal power: deep holes in Earth's crust produce steam to generate electricity.</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Produces low cost energy</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Only cost-effective where Earth's crust is thin, eg. Iceland, New Zealand</li> <li>• Difficult to extract</li> </ul> <p>Biomass: burning of wood, plant and waste generates heat</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Low cost</li> <li>• Plentiful supply of wood/ plant/ waste</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Polluting</li> <li>• Potential for deforestation</li> <li>• Dangers of combustible methane</li> </ul> <p>1 mark for each outline of the renewable energy source plus 1 mark for one advantage and 1 mark for one disadvantage. Only two energy sources should be selected</p>		
			3 x 2	(6)
	(b)	<p>Preservation of resources in product manufacture: A sensible product must be stated as one that could be manufactured so as to preserve resources.</p> <p>Key terms</p> <ul style="list-style-type: none"> <li>• Eco-friendly manufacturing processes</li> <li>• Recycling of materials</li> <li>• Reduce materials, packaging and components</li> <li>• Re-use product</li> <li>• Re-design of product</li> <li>• use of CAD/ CAM for efficient manufacture</li> </ul> <p>1 mark for a product plus 1 mark for each key term x 5</p>		
			1 + (1 x 5)	(6)
		Total 12 marks		

7	(a)	<p><b>Total Quality Management (TQM)</b></p> <ul style="list-style-type: none"> <li>• TQM is the development of an all round process for implementing quality. It requires employees to be aware of the need for quality and how to implement it within their manufacturing environment</li> <li>• It also requires each employee to feel part of a system and to take a pride not only in their own section of the manufacturing process, but the company and its products as a whole. In TQM quality is defined in both the physical outcome and the ‘thinking’ behind the production.</li> <li>• There are several computer based systems which allow employees to deliver a more accurate set of data and disseminate that data around the company ICT can be used to give feedback about quality to employees as well as sending up dated specifications for appropriate action</li> </ul> <p>Maximum 2 marks available for each of the above statements x 2</p>		
			2 x 2	(4)
	(b)	<p><b>Flexible Manufacturing Systems (FMS)</b></p> <ul style="list-style-type: none"> <li>• Within a FMS all the information data required, from the planning and design stages, right through the production, to the final release can be stored, reviewed and altered quickly, allowing a change of production</li> <li>• The need to respond to consumer demand, by expanding/ reducing product diversity and updating products on a regular basis is a primary factor</li> <li>• A central computer can be used to control manufacturing cells and stock/ material levels. Products can be designed on one site and data transferred to another site for global manufacture</li> </ul> <p><b>Example</b> A product such as a car is to be updated or remodelled, basic design criteria like safety need to be reconsidered. If this information was not already available in stored electronic format, a large amount of time would be required to re-test and evaluate, whereas the computer can be used to recall current data, work changes and simulate results. These can then be downloaded and manufactured.</p> <p>Maximum 2 marks available for each of the above statements x 3</p>		
			3 x 2	(6)
			<b>Total 10 marks</b>	
			<b>TOTAL FOR PAPER: 80 MARKS</b>	





# Product Design: Textiles Technology – Unit 2: Knowledge and Understanding of Product Design

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Question paper	119
General guidance on marking	135
Mark scheme	137





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1. (a) Define **two** of the following terms related to textile fibres:

- (i) polymer
- (ii) natural polymer
- (iii) synthetic polymer

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(2)

(b) A fibre blend is a combination of two or more different fibres.

Outline **two** benefits of using blended fibres.

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(2)

**(Total 4 marks)**

Q1

2. (a) Elastane fibre is widely used in sports and active wear. Identify **two** benefits of using elastane fibres.

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(2)

(b) Give **two** reasons why polyester is often used for outdoor wear.

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(2)

**(Total 4 marks)**

Q2

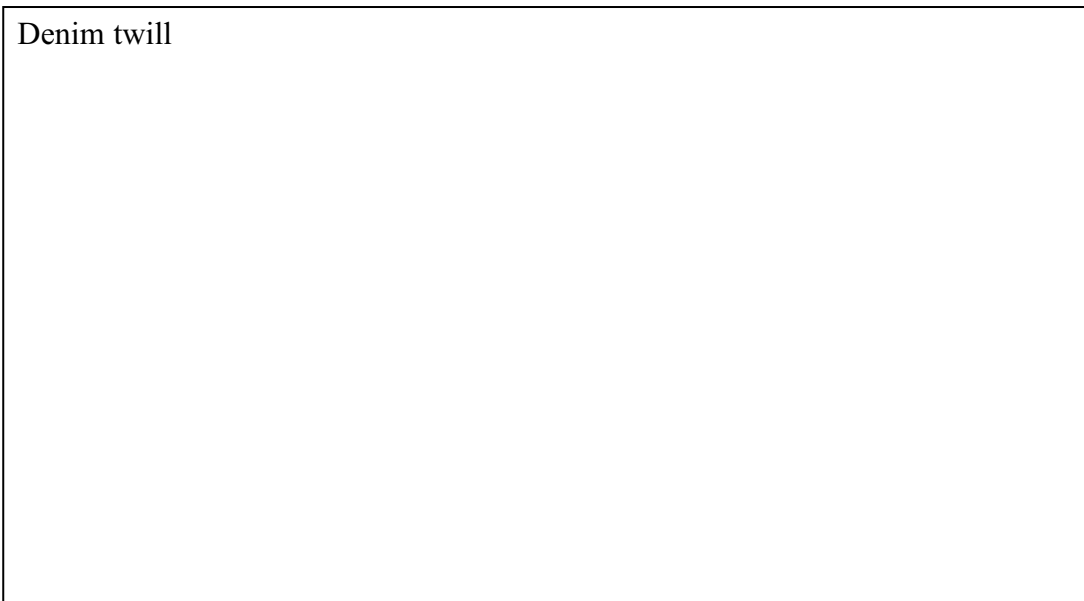
3. (a) Explain the effect created by having alternate sections of 'S' and 'Z' twist yarns in the warp of a self-coloured fabric.

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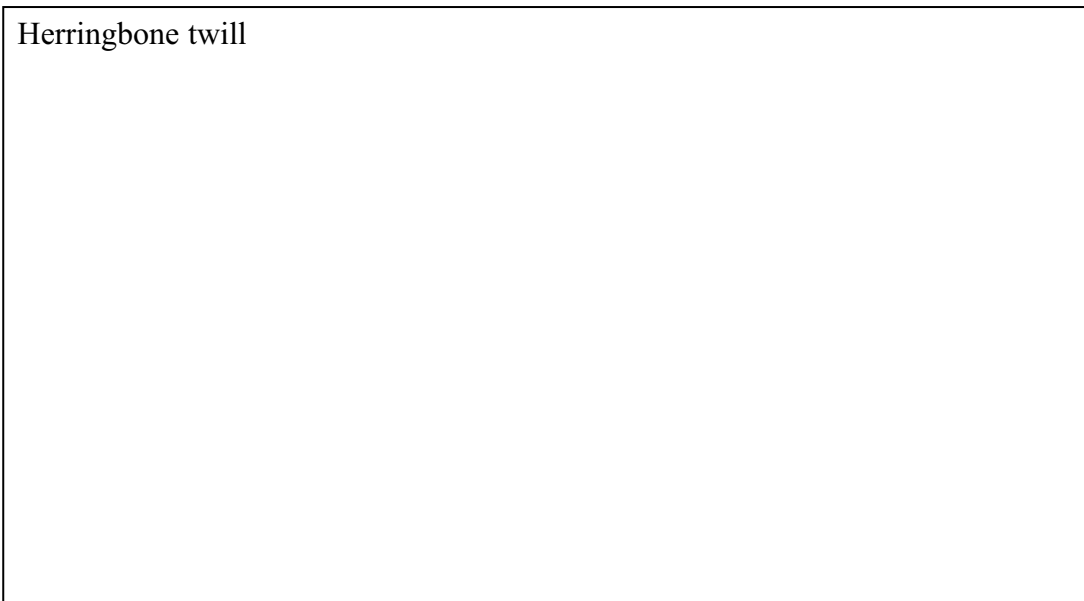
(2)

(b) Using annotated sketches, show the difference in construction between a denim twill and a herringbone twill.

Denim twill



Herringbone twill



(4)

(Total 6 marks)

Q3

4. Textile product designers need to have a good understanding of fabrics.

Explain the following fabric terms:

(a) fabric mixture

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(2)

(b) colour and weave

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(2)

(c) fusible interlining

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(2)

**(Total 6 marks)**

Q4



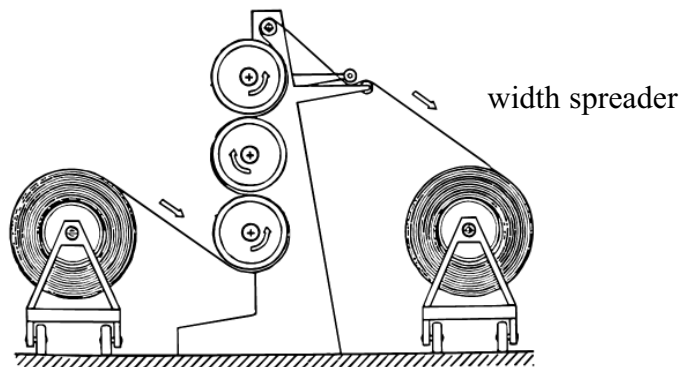
5. (a) Outline **two** reasons why textile finishing processes are used on fabrics.

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(2)

(b) Figure 1 shows the calendering process

Figure 1



Explain the purpose of calendering.

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(2)

(c) Describe **two** fabrics that are finished using the calendering process.

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(4)

(Total 8 marks)

Q5

6. (a) Knitted jumpers can be produced by either fully-fashioned or cut-and-sew methods. Explain the difference between fully-fashioned and cut-and-sew.

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(2)

(b) Discuss the issues related to producing a lay plan for the following types of fabric:

(i) felt

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(3)

(ii) calico

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(3)

(Total 8 marks)

Q6

7. (a) Give the meaning of the term ‘anthropometrics’ and outline how it helps in the design of clothing products.

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**(4)**

(b) The assembly of sewn products often involves fusing.

Describe how and why fusing is used in garment manufacture.

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**(4)**

(c) Product finishing is an important part of the quality assurance process.

Explain why product finishing is important in garment manufacture.

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**(2)**

**(Total 10 marks)**

**Q7**

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8. (a) Figure 2 shows a medium-sized Gola bowling bag. The bag is made from coated 100% PVC fabric and has a lining made from 100% nylon fabric.

**Figure 2**



Justify the use of coated PVC fabric for the bag.

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**(3)**

- (b) Explain **two** processes a manufacturer would use to monitor the quality of the bag during manufacture.

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**(4)**

(c) Discuss the benefits of using CAD modelling as part of the design process for the bag.

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(5)

Q8

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**(Total 12 marks)**

9. (a) Describe how felt is made.

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(3)

(b) Describe how the properties of felt made from a wool/acrylic mix would be suitable for making hats.

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(3)

(c) The sale of fashion products can depend on keeping consumers interested through changes in a product's colour and styling. This may encourage consumers to buy new products and 'throw away' the old. Discuss the issues of this 'throw away' culture.

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(4)

(Total 10 marks)

Q9

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(b) Using the work of **one** designer **or** design movement, describe the importance of **two** of the following:

- Colour
- Styling
- Texture
- Shape
- Decoration

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(6)

**(Total 12 marks)**

Q10

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**TOTAL FOR PAPER: 80 MARKS**

**END**

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## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	(i)	<p>polymer</p> <ul style="list-style-type: none"> <li>• Combination of large molecules made up from chain of smaller repeating molecules (monomers)</li> </ul>		
		(ii)	<p>natural polymer</p> <ul style="list-style-type: none"> <li>• Found in plant cellulose fibres (wood pulp) and animal protein fibres - such as cotton and wool</li> </ul>		
		(iii)	<p>synthetic polymer</p> <ul style="list-style-type: none"> <li>• Manufactured from petrochemicals using process of polymerisation - such as acrylic, polyamide / polyester / regenerated with chemicals</li> </ul>		
			1 mark for each correct point x 2 terms selected		
				2 x 1	(2)
	(b)		<ul style="list-style-type: none"> <li>• Improved properties - from each fibre</li> <li>• Improved performance / comfort / quality - crease-resist / strength etc</li> <li>• Improved aftercare performance - machine wash etc</li> <li>• Improved appearance / aesthetics - colour / texture etc</li> <li>• Cross-dyeing blends - gives different colour effects</li> <li>• Can use in a wider range of products</li> <li>• Lowers cost - adds cheaper fibre</li> </ul>		
			1 mark for each correct benefit x 2		
				2 x 1	(2)
			Total 4 marks		
2	(a)		<ul style="list-style-type: none"> <li>• Stretch up to 7 x original length + recovers - doesn't 'bag'/allows movement gives lively supple fabric / enhanced drape/easy movement</li> <li>• Adds comfort / softness and crease-resist</li> <li>• Improves body-shaping / shape retention/ gives support</li> <li>• Clings to body/ gives aerodynamic shape</li> <li>• Absorbent, dyes well, easy care</li> </ul>		
			1 mark for each correct benefit x 2		
				2 x 1	(2)
	(b)		<ul style="list-style-type: none"> <li>• Can be engineered to provide a wide variety of properties and characteristics - specific examples to be given.</li> <li>• Non-absorbent/hydrophobic/water repellent but can be made breathable. -not breathable on its own</li> <li>• Varies from microfibres to coarse fibres so suitable for different thicknesses of fabric for coats.</li> <li>• Very strong/excellent abrasion resistance/tear resistant/ durable/ hardwearing.</li> <li>• Crease resistant so can be blended with natural fibres to make easy care.</li> <li>• Dyes well so clear colours can be produced.</li> <li>• Resists mildew and fungus so coats that get damp do not go mouldy.</li> <li>• Non-renewable source, can be recycled - makes fleece - gives warmth for outdoor wear.</li> </ul>		
			1 mark for each correct reason x 2		
				2 x 1	(2)
			Total 4 marks		

3	(a)	Striped effect would be produced as the light effect would be reflected differently from each type of yarn.		
			2 x 1	(2)
	(b)	<p>Sketches would have been provided by students showing:</p> <p><b>Denim Twill</b> Warp yarn lifts over three wefts and under one 3/1 warp-faced twill construction forms a continuous diagonal line bottom left to top right.</p> <p><b>Herringbone twill</b> Warp yarn lifts over two and under two wefts. Direction of twill reserves at regular intervals - at reversal twill line is displaced. Pattern can be emphasised by using different colours for warp and weft.</p> <p>2 marks for each correct sketch x 2</p>		
			2 x 2	(4)
<b>Total 6 marks</b>				

4	(a)	<p>Fabric mixture</p> <ul style="list-style-type: none"> <li>• Warp one fibre / weft different fibre</li> <li>• Two or more different yarns</li> </ul> <p>2 marks for a correct answer</p>		
			2 x 1	(2)
	(b)	<p>Colour and weave</p> <ul style="list-style-type: none"> <li>• Coloured warp + weft yarns + construction gives stripes / checks/shot fabric. Not denim</li> </ul> <p>2 marks for a correct answer</p>		
			2 x 1	(2)
	(c)	<p>Fusible interlining</p> <ul style="list-style-type: none"> <li>• non-woven laminated by heat/ adhesive to main fabric i.e. Vilene - reinforces / stabilises top fabric</li> </ul> <p>2 marks for a correct answer</p>		
			2 x 1	(2)
<b>Total 6 marks</b>				

5	(a)	<ul style="list-style-type: none"> <li>• Makes fabric suitable for end-use</li> <li>• Improves aesthetic properties/appearance/colour /drape/handle</li> <li>• Improves functional properties/aftercare/wear properties/irons out creases</li> <li>• Ensures fabric meets quality requirements</li> <li>• Ensures fabric fault-free/clean</li> </ul> <p>1 mark for each correct answer x 2</p>		
			2 x 1	(2)
	(b)	<ul style="list-style-type: none"> <li>• Smooths out surface</li> <li>• Compacts fabric under pressure</li> <li>• Improves lustre/shine</li> <li>• Embosses patterns on surface</li> </ul> <p>1 mark for each correct answer x 2</p>		
			2 x 1	(2)

	(c)	<ul style="list-style-type: none"> <li>Chintz fabrics are given a firm, lustrous, durable finish produced using a synthetic resin</li> <li>Moiré fabrics are given watermarked surface patterns, a durable finish produced using engraved rollers</li> <li>Embossed fabrics are given relief surface patterns, a durable finish for synthetic (thermoplastic) fabrics, produced using heated rollers</li> </ul> <p>2 marks for each correct answer x 2</p>		
			2 x 2	(4)
			Total 8 marks	

6	(a)	<ul style="list-style-type: none"> <li>Fully-fashioned is where individual components of products are knitted to shape and then sewn up into the product</li> <li>Cut-and-sew knitting is where rolls of knitted fabric are produced and then cut to shape and sewn up to make the product</li> </ul> <p>1 mark for each correct answer x 2</p>		
			2 x 1	(2)
	(b)	<p>(i) Felt Fabric is non-woven / no warp or weft thread direction / direction of pattern pieces not important / pattern can be placed in either direction across or along the fabric / can produce economic layplan with little waste</p> <p>(ii) Calico Fabric is woven with warp/weft/selvedge / has no design, grain, nap or pile / direction of pattern is important / pattern can be placed along the length of fabric parallel to selvedge in either direction / must ensure careful pattern placement to reduce waste</p> <p>3 marks for each fabric x 2</p>		
			3 x 2	(6)
			Total 8 marks	

7	(a)	<p>Study of human measurements in relation to products people use for 5<sup>th</sup> to 95<sup>th</sup> percentile (90% population)</p> <p>PLUS any one of the following:</p> <ul style="list-style-type: none"> <li>for height, width, reach, bust, hips etc</li> <li>for average size person to achieve 'best fit'</li> <li>tall/short not catered for, e.g. products may not fit/ be difficult to use</li> <li>most data now out of date/many manufacturers use own data</li> <li>for mass/batch/one off production</li> <li>can collect own data if customising design for bespoke/one-off</li> <li>e.g. in clothing industry use standard sizes for men's/women's/children's wear</li> </ul> <p>1 mark for explanation PLUS maximum of 3 marks available (1 mark for each correct answer) on how it helps in the design of clothing products.</p>		
			4 x 1	(4)

	(b)	<ul style="list-style-type: none"> <li>Used to permanently join two fabrics</li> <li>Uses heat to melt adhesive/resin applied to one of the fabrics</li> <li>Used on garment fronts/collars/cuffs/waistbands/ hems</li> <li>Gives support/strength/enforces/doesn't fray</li> <li>Faster manufacturing time/needs less skill than sewing</li> <li>Can give better quality than sewn-in interlining</li> </ul> <p>1 mark for each correct answer x 4</p>		
			4 x 1	(4)
	(c)	<ul style="list-style-type: none"> <li>Ensures that the product is fault-free, clean and matches specifications - no faults in the fabrics, seams or stitching - good quality</li> <li>Improves the properties of the product - pressing has critical impact on product quality / improves ease of manufacture</li> </ul> <p>1 mark for each correct answer x 2</p>		
			2 x 1	(2)
<b>Total 10 marks</b>				

8	(a)	<ul style="list-style-type: none"> <li>Strong and durable so hard wearing/good lifespan</li> <li>Flexible and lightweight so easy to sew</li> <li>Non-fray so easy to sew</li> <li>Wipe clean and fast drying so easy care</li> <li>Waterproof and weather- resistant so keeps contents dry alternative to leather so synthetics cheaper</li> </ul> <p>1 mark for each correct answer x 3</p>		
			3 x 1	(3)
	(b)	<ul style="list-style-type: none"> <li>Use quality control / work plan - to ensure zero faults / standard sizes</li> <li>Use (BS) testing - for yarns / fabrics / fastenings / processes / aftercare - ensure fault-free</li> <li>Use standard systems / NACERAP - to find / prevent faults</li> <li>Use skilled workers - produce quality product</li> <li>Use tolerance +/- , e.g. for seams / fastenings to ensure product fits together</li> <li>Use of templates - to ensure accurate assembly</li> <li>Check quality of stitching during making - zero faults / high quality</li> <li>Inspection of seams / processes - to ensure meets specification</li> <li>Use of quality indicators - visual / touch</li> <li>Test performance - ensure performs in use / easy care</li> <li>Final visual check against sealed sample - to ensure meets specification / user needs</li> </ul> <p>2 marks for each correct answer x 2</p>		
			2 x 2	(4)
	(c)	<ul style="list-style-type: none"> <li>Designs can be developed, stored and shared electronically</li> <li>Manipulation of image e.g. modify / rotate the image/size/scale</li> <li>Easy handling of complex design</li> <li>Texture mapping of fabrics on products on screen</li> </ul>		



		<ul style="list-style-type: none"> <li>• Testing, evaluation and modification of ideas in 2D before production</li> <li>• Photorealistic model reduces need to produce large number of costly samples</li> <li>• Can show customer a 'realistic' impression of designs / products</li> <li>• Can simulate products / show virtual products on virtual catwalk</li> <li>• Fast turn round of ideas</li> <li>• Leads to fewer errors in production</li> <li>• Leads to reduction on product development time / time to market</li> <li>• Saves resources and costs</li> </ul> <p>1 mark for each correct answer x 5</p>		
			5 x 1	(5)
			<b>Total 12 marks</b>	

9	(a)	<ul style="list-style-type: none"> <li>• Fabric made directly from fibres (wool or 50% wool/ 50% synthetics)</li> <li>• Fibres matted together in felting machine</li> <li>• Fibres milled using moisture, mechanical pressure and heat. (Not glue)</li> <li>• Fibres matted repeatedly until required density / thickness of fabric</li> </ul> <p>1 mark for each correct answer x 3</p>		
			3 x 1	(3)
	(b)	<ul style="list-style-type: none"> <li>• Does not fray – easy to sew</li> <li>• Reacts to moisture/heat – can be steamed into shape</li> <li>• Poor drape/elasticity – fabric retains hat shape</li> <li>• Acrylic improves drape – adapt for different styles</li> <li>• Acrylic reduces shrinkage</li> <li>• Wool shrinks easily</li> <li>• Cheaper to produce as acrylic is cheaper than wool</li> <li>• Warm to wear – winter hats</li> <li>• Acrylic increases durability</li> </ul> <p>1 mark for each correct answer x 3</p>		
			3 x 1	(3)
	(c)	<ul style="list-style-type: none"> <li>• Minor changes in product style/colour to encourage unnecessary consumption/production – waste of energy/materials</li> <li>• Impact of advertising/marketing to encourage sales - pushing unnecessary products on the susceptible</li> <li>• Morality of brand advertising on young/buying the 'in' product</li> <li>• Throwing away old still usable product – morality – environmental concerns.</li> </ul> <p>1 mark for each correct answer x 4</p>		
			4 x 1	(4)
			<b>Total 10 marks</b>	

10	(a)	<p>Improved aesthetic and functional characteristics</p> <p>Brief description of new material AND general reason for use, eg:</p> <ul style="list-style-type: none"> <li>Teflon (PTFE)/Tencel/Kevlar/Nomex/ Carcon fibres/composites/blends</li> </ul> <p>OR brief description of new processed and general reason for use</p> <p>Improved aesthetic characteristics e.g look, shape, colour, pattern, texture, drape, handle, weight, styling due to the new material, process with reference to the product example. Improvements in purpose, performance, function with reference to the product example.</p> <p>Not one word answer Brief description of appropriate new material OR process and general reason for use x 2 marks PLUS example of improved characteristics in product - 1 mark for each point x 4</p>		
			2 + (4x1)	(6)
	(b)	<p>Designer or design movement</p> <p>Answer must relate to a named designer or named design movement</p> <p>Colour, eg:</p> <ul style="list-style-type: none"> <li>Courreges – OP ART, black and white/Schiaparelli – pink/ Mary Quant – black &amp; white/ Chanel – fawn</li> </ul> <p>Styling, eg:</p> <ul style="list-style-type: none"> <li>Mary Quant - mini skirt/Dior - New Look/Vivienne Westwood – Punk, Grunge, Pirates/ Courreges – Moon girl, Space /Yves St Laurent - trousers suits, safari jackets, gipsy/Chanel – Art Deco, flappers/ Armani – shoulder pads, business suits/ Issey Myake – Japanese style</li> </ul> <p>Texture, eg:</p> <ul style="list-style-type: none"> <li>Chanel - jersey, tweed, /Vivienne Westwood - Leather</li> </ul> <p>Shape, eg:</p> <ul style="list-style-type: none"> <li>Dior – A line, New look, Y line/ Mary Quant - ballon shaped dresses, mini, micro-mini/ Yves St Laurent - trousers suits/ Armani – big shoulders</li> </ul> <p>Decoration, eg:</p> <ul style="list-style-type: none"> <li>Vivienne Westwood – Buckles, pins, jewels, chains/ Versace - safety pins/ Issey Miyake - dyed effects</li> </ul> <p>Answer must relate to a named designer or named design movement. Two out of five above selected - 1 mark for each point x 3.</p>		
			3 x 2	(6)
			Total 12 marks	
			TOTAL FOR PAPER 80 MARKS	

# Product Design: Textiles Technology – Unit 3: Further Study of Product Design

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Question paper	145
General guidance on marking	157
Mark scheme	159



Centre No.					Paper Reference						Surname	Initial(s)		
Candidate No.						<b>6</b>	<b>1</b>	<b>5</b>	<b>1</b>	<b>/</b>	<b>0</b>	<b>1</b>	Signature	

Paper Reference(s)

**6151/01**

# Edexcel GCE

## Design and Technology

### Product Design: Textiles Technology

### Advanced

#### Unit 3: Further Study of Product Design

June 2006 – Afternoon

Time: 2 hours

Examiner's use only

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Team Leader's use only

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Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination  
Nil

Items included with question papers  
Nil

### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature. Answer ALL the questions. Write your answers in the spaces provided in this question paper.

### Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). There are seven questions in this question paper. The total mark for this paper is 80. There are 12 pages in this question paper. Any blank pages are indicated.

### Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically.

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*Turn over*

**edexcel**

1. When developing new materials for garments, manufacturers need to consider fibre properties and environmental issues.

(a) Explain why fibre blends are widely used to develop modern materials.

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**(3)**

(b) Using an annotated sketch, explain why the manufacture of Tencel fibre is an environmentally friendly process.



**(3)**

**(Total 6 marks)**

**Q1**

2. Modern technologies are becoming more important in textile manufacture.

(a) Describe and identify an end-use for the textile terms listed below:

(i) biopolymer

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**(3)**

(ii) biotechnology

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**(3)**

(b) Describe the advantages to the manufacturer of producing 3D knitted fabric for upholstery.

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**(4)**

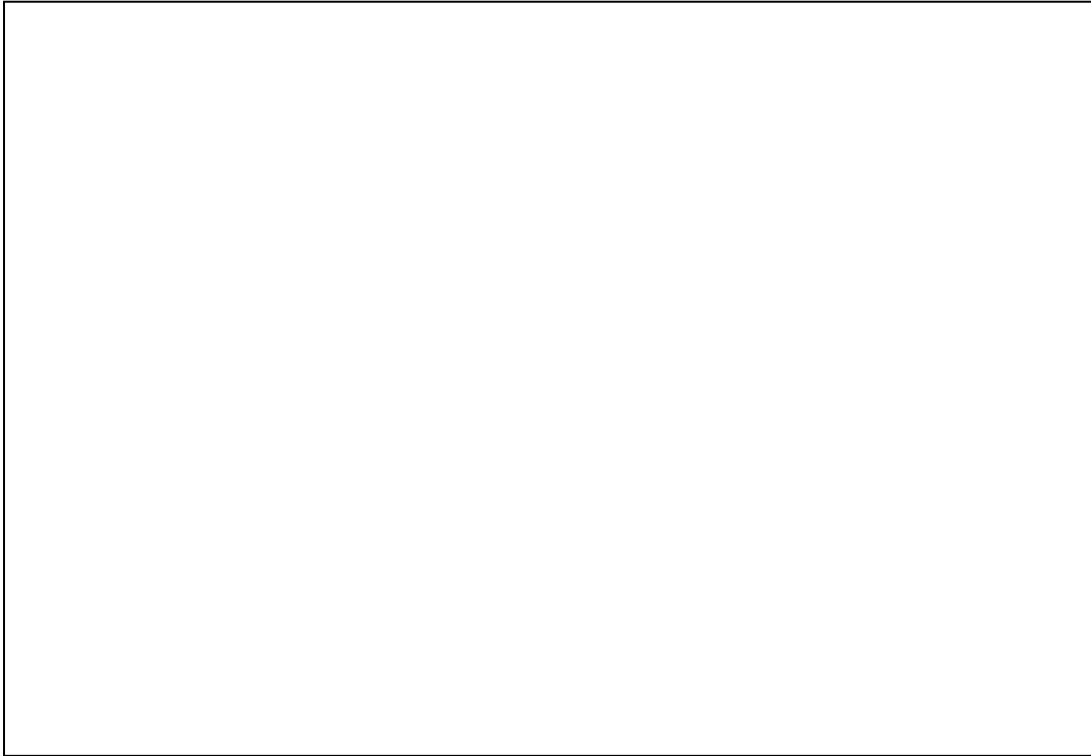
**(Total 10 marks)**

**Q2**

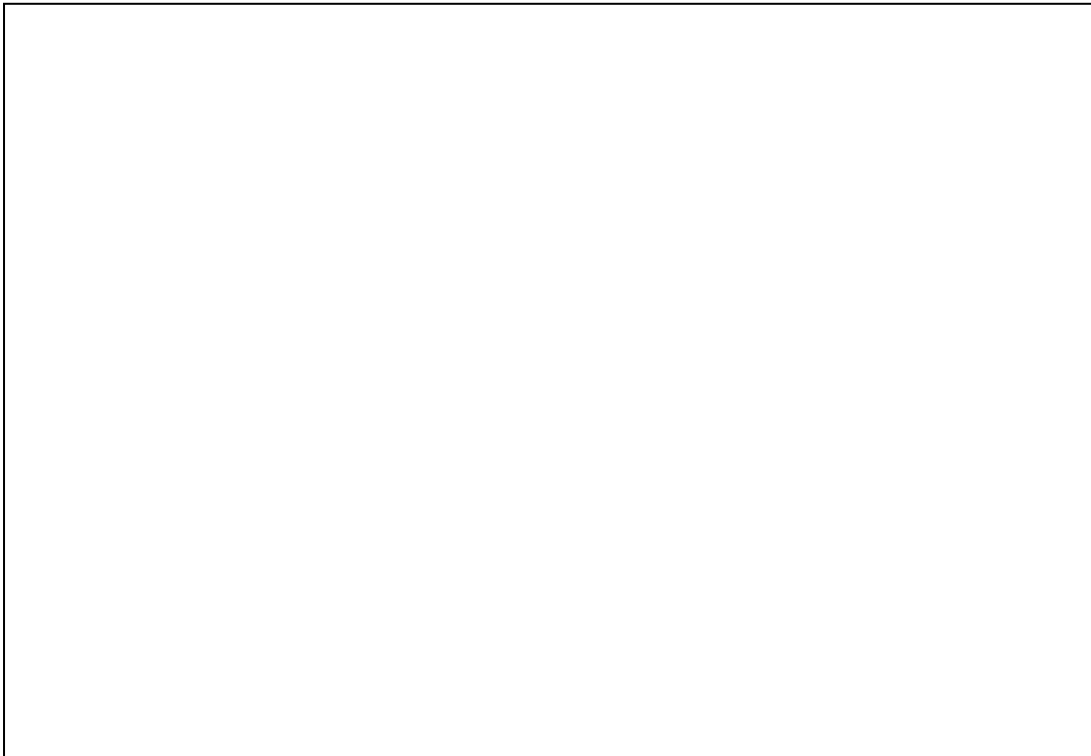
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3. A safety wear manufacturer wants to produce a jacket suitable for people under 16 to wear when cycling on the road. The jacket should provide protection and appeal to the target market group.

(a) Produce **two** different annotated design ideas for the cycling jacket.



**(3)**



**(3)**



(b) Select your best design and justify how the materials used ensure that the jacket appeals to the target market.

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(6)

**(Total 12 marks)**

Q3

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4. (a) In the context of electronic communication, outline the advantages and disadvantages of each of the following:

(i) e-mail

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**(3)**

(ii) ISDN

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**(3)**

(b) Explain the term CIM and evaluate its uses in the various areas of a manufacturing company.

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**(5)**

**(Total 11 marks)**

**Q4**

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5. The use of computers within manufacturing is changing the way it is organised and managed.

(a) Explain the term ‘Artificial Intelligence’ and describe how it could benefit manufacturing.

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**(4)**

(b) Explain the meaning of Just in Time (JIT) manufacturing.

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**(4)**

(c) Modelling is an important stage of the design process. Describe the purpose of modelling and discuss the role of computers in this process.

(i) Describe the purpose of modelling.

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**(2)**

(ii) Discuss the role of computers in this process.

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**(5)**

**(Total 15 marks)**

**Q5**

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6. (a) Describe one piece of legislation which protects the right of the consumer when purchasing goods.

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**(3)**

(b) Discuss some of the factors that should be taken into account when setting up manufacturing facilities in developing countries.

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**(5)**

(c) Many products use materials that come from non-renewable sources. State a textiles product you are familiar with and discuss how it could be manufactured in such a way as to preserve resources.

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**(6)**

**(Total 14 marks)**

**Q6**

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7. (a) Pricing is a very important factor in marketing. How much a consumer is prepared to pay depends on how much that product is valued. Discuss ways in which a manufacturer might justify higher prices for their product.

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(4)

(b) Explain the term ‘sustainable development’ and describe its key concepts.

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(8)

(Total 12 marks)

Q7

**TOTAL FOR PAPER: 80 MARKS**

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## General guidance on marking

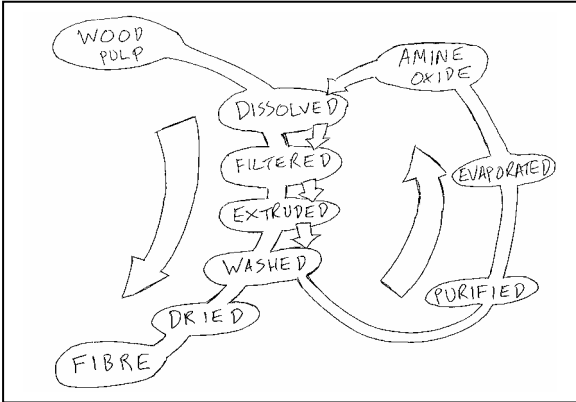
Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	<p><b>Fibre blends</b></p> <ul style="list-style-type: none"> <li>• Lowers cost of an expensive fibre</li> <li>• Produces fabric to meet a price point</li> <li>• Improves ease of manufacture of yarn</li> <li>• Improves fabric performance in use (function)</li> <li>• Improves aesthetics / comfort properties of fabric</li> <li>• Widens option of using different fabric finishes.</li> </ul> <p>1 mark for each answer x 3</p>		
			3 x 1	(3)
	(b)	<p><b>Manufacture of Tencel:</b></p>  <pre> graph TD     WP(WOOD PULP) --&gt; D(DISSOLVED)     AO(AMINE OXIDE) --&gt; D     D --&gt; F(FILTERED)     F --&gt; E(EXTRUDED)     E --&gt; W(WASHED)     W --&gt; DR(DRIED)     DR --&gt; FI(FIBRE)     AO --&gt; EV(EVAPORATED)     EV --&gt; PU(PURIFIED)     PU --&gt; AO     </pre> <ul style="list-style-type: none"> <li>• Made from renewable wood pulp/regenerated cellulose from managed forests</li> <li>• Made using non-toxic chemical amine oxide</li> <li>• Chemical recycled during manufacturing process</li> <li>• Biodegrades in landfill or can be recycled.</li> </ul> <p>3 marks available by either appropriate sketches or annotation.</p>		
			3 x 1	(3)
<b>Total 6 marks</b>				
2	(a)	<p>(i) <b>Biopolymer</b> <b>Biopol</b></p> <ul style="list-style-type: none"> <li>• ‘Natural’ polyester produced by bacterial fermentation of plant sugar (glucose converted into PHB)</li> <li>• End use – compatible with human body, used in medical fabrics</li> <li>• End use – biodegradable, used for fishing nets/plastic bags /bottles.</li> </ul>		

		<p>OR</p> <p>Ingeo</p> <ul style="list-style-type: none"> <li>Made from natural dextrose sugars from plants (corn/ wheat/beets/ rice) fermented to produce lactic acid (PLA/ polylactic acid)</li> <li>End use – Ingeo recyclable/biodegradable/dyes at lower temperatures than PET, used in garment textiles for short-term products</li> </ul> <p>Appropriate description for one of the above x 2 marks plus 1 mark for end use</p>		
			(2 x 1) + 1	(3)
	(ii)	<p><b>Biotechnology</b></p> <p><b>DNA</b></p> <ul style="list-style-type: none"> <li>Manipulation of DNA in plants / animals to produce new fibres with new performance characteristics</li> <li>Spider silk gene carried by dairy goats to produce BioSteel silk proteins in milk, spun into fibres</li> <li>End use - bio-compatible / very high strength, to be used in microsurgery / cables / pneumatics / bullet-proof vests</li> </ul> <p>OR</p> <p><b>Enzymes</b></p> <ul style="list-style-type: none"> <li>Natural enzymes used to create new or improved processes eg for fibres / finishing / aftercare</li> <li>Environmentally-friendly process reduces pollution</li> <li>End use – in ‘biological’ washing powder / remove size from fabrics</li> <li>End use – to biostone denim / biopolish cellulose fabrics</li> </ul> <p>Appropriate description for one of the above x 2 marks plus 1 mark for end use</p>		
			(2 x 1) + 1	(3)
	(b)	<p><b>3D knitted fabric for upholstery</b></p> <ul style="list-style-type: none"> <li>Faster knitting time than flat knitting separate pieces</li> <li>Faster time to market than cut and sew</li> <li>No need to cut and sew to join separate parts</li> <li>Faster/easier to make upholstery - only one piece</li> <li>Made to order - use Quick Response to demand</li> <li>Made to order so no cost of keeping products in stock</li> <li>Can use CAD for bespoke designs - selling point</li> </ul> <p>One mark for each appropriate advantage x 4 marks</p>		
			4 x 1	(4)
			Total 10 marks	

3	(a)		<p>Two different annotated solutions</p> <p>Should include such factors as:</p> <ul style="list-style-type: none"> <li>• safety implications of being seen, e.g. high visibility</li> <li>• provides protection, e.g. from rain / wind / sun</li> <li>• use of taped + heat-sealed / welded seams so waterproof</li> <li>• suitability for cycling, e.g. breathable comfort, flexible, lightweight, strong seams, aerodynamic</li> <li>• special features that make jacket suitable for cycling, e.g. pockets, fastenings</li> <li>• size/ergonomic needs related to under 16's</li> <li>• market trends in colour / style / fabrics / fastenings</li> <li>• requirement of safety products sold in Europe to carry the CE symbol relating to performance and quality</li> </ul> <p>3 marks each for each different annotated solutions x 2</p>		
				3 x 2	(6)
	(b)		<p>Justify how the materials used ensure that the jacket appeals to the target market, e.g:</p> <ul style="list-style-type: none"> <li>• understanding of relationship between performance of chosen materials and suitability of product style for under 16's</li> <li>• suitable materials, e.g. Gore-Tex, PET microfibre, Ripstop nylon, Tactel micro + reflective / fluorescent materials</li> <li>• understanding of functional properties, e.g. stretch and recovery, reflective, water-repellent coating, strong, durable, lightweight, easy care</li> <li>• aesthetic properties like handle, colour, non-bulky, how meets cyclists' image needs / brand issues</li> <li>• components / fastenings, e.g. easy to undo or similar</li> </ul> <p>Suitability of chosen materials and properties - Maximum 2 marks. Aesthetic and functional aspects - Maximum 2 marks. Relevant clear justification with good use of technical language - Maximum 2 marks.</p>		
				2 x 3	(6)
			Total 12 marks		

4.	(a)	(i)	<p>E-mail</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Quick and cost effective method of data transfer compared to post</li> <li>• Convenience of use from home</li> <li>• Can be redirected to mobile phone</li> <li>• Global access is possible</li> <li>• Multiple copies can be sent simultaneously</li> </ul>		
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		<p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Domestic systems tend to be accessed using a modem, which can be slow, if the files being transferred are large eg photographs</li> <li>• Lack of security</li> <li>• Possible virus infection</li> <li>• Data sometimes gets 'lost'</li> <li>• Possibly considered to lack personal touch.</li> </ul> <p>1 mark for each advantage and 1 mark for each disadvantage. Must include advantages and disadvantages. Maximum of 2 marks if only advantages or only disadvantages are given.</p>		
			3 x 1	(3)
	(ii)	<p><b>ISDN</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• International communication standard for transfer of voice, video and data over digital telephone lines</li> <li>• Provides high speed data transfer – useful for transfer of large files eg CAD drawings; video conferencing (multiple access / use)</li> <li>• Reduces the need to travel to meetings – cost and time implications</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Higher set up costs than email</li> </ul> <p>1 mark for each advantage and 1 mark for each disadvantage. Must include advantages and disadvantages. Maximum of 2 marks if only advantages or only disadvantages are given.</p>		
			3 x 1	(3)
	(b)	<p><b>CIM</b></p> <ul style="list-style-type: none"> <li>• All aspects of a company's operations must be integrated in order to share information and communicate</li> <li>• Use of computers to integrate production and business information with manufacturing</li> <li>• CIM will involve; designing components, planning effective production workflow, controlling machine operations, business functions eg stock and material ordering and customer invoicing</li> <li>• Computers are used to control material and component transfers to required point on production line; quality control; feedback</li> <li>• Allows for more flexible manufacturing system</li> <li>• Evaluation of its users</li> </ul> <p>One mark for each appropriate answer x 5</p>		
			5 x 1	(5)
		<b>Total 11 marks</b>		

5	(a)	<p><b>Artificial Intelligence</b></p> <p><b>Explanation</b></p> <ul style="list-style-type: none"> <li>• A branch of computer science concerned with developing computers that think/ act like humans.</li> <li>• Simulation of human behaviour in manufacturing environments</li> </ul> <p><b>Benefits</b></p> <ul style="list-style-type: none"> <li>• Intelligent behaviour would allow a machine to respond to unforeseen circumstances and make decisions</li> <li>• Intelligent systems should be able to consider large amounts of information simultaneously and process them faster in order to make rational, logical and expert judgements</li> <li>• AI leads to better designed and faster produced products with less errors and shorter lead times</li> <li>• Respond to voice command and action a response</li> </ul> <p>Up to 2 marks for the explanation and 1 mark for each statement on how it could benefit manufacturing x 2</p>		
			2 + 2	(4)
	(b)	<p><b>JIT manufacturing</b></p> <ul style="list-style-type: none"> <li>• JIT manufacturing is all about delivering the right product to the right consumer at the right time, with the right quantity and minimum of waste.</li> <li>• JIT enables a company to streamline its production methods and develop strategies for delivery of its product in response to consumer demand - synchronisation</li> <li>• In order to guarantee delivery of components or materials as they are required, a complex and highly organised data retrieval system must be put in place</li> <li>• Factory layout can be production led</li> <li>• JIT relies on computer systems / ICT to function successfully - materials and components ordered and delivered just before needed for production</li> <li>• In the clothing industry JIT system called 'the Toyota Sewing System' - uses just in time ordering of materials and teamworking ('modular manufacturing')</li> <li>• JIT is used in combination with QR to reduce raw materials stocks / reduces storage space / cuts costs of stock</li> </ul> <p>One mark for each appropriate answer x 4</p>		
			4 x 1	(4)

	(c)	(i)	<p><b>Modelling</b></p> <p>Modelling is important for several reasons:</p> <ul style="list-style-type: none"> <li>• visual inspection</li> <li>• aesthetic appearance</li> <li>• ergonomic assessment</li> <li>• suitability for manufacture</li> </ul> <p>1 mark for an appropriate modelling answer, 2 marks for suitably expanded detail.</p>		
				2 x 1	(2)
		(ii)	<p><b>The role of computers in the modelling process</b></p> <ul style="list-style-type: none"> <li>• Increased communications technology has led to CAD models being transferred directly to the manufacturing stage from the PC</li> <li>• Remote manufacturing</li> <li>• RPT allows rapid production of physical models, leading to reduced lead time</li> <li>• Digital data is used to create a 3D physical object</li> <li>• Virtual reality modelling eg walk-through environments</li> <li>• Kinematics</li> <li>• Customer can see options quickly / easily / cheaply</li> <li>• VRML allows internet viewing to world-wide market</li> </ul> <p>1 mark for each appropriate role of computers x 5 marks</p>		
				5 x 1	(5)
			<b>Total 15 marks</b>		

6	(a)		<p><b>Legislation</b></p> <p>Legislation which protects the rights of the consumer when purchasing goods.</p> <ul style="list-style-type: none"> <li>• The Trade Descriptions Act (1988) - eg cannot say that products are waterproof, if they are not</li> <li>• The Textiles Products (Indication of Fibre Content) Regulation (1986) - the fibre content must be indicated, although there is a tolerance of 3% + 5% other fibres</li> <li>• The Weights and Measures Acts (1985 &amp; 1987) - sizing must be accurate</li> <li>• The Consumer Protection Act (1987) - if things go wrong, the onus of proof is on the consumer</li> </ul> <p><b>Toxicity</b></p> <ul style="list-style-type: none"> <li>• After the year 2000 AZO dyestuffs are banned</li> <li>• Body piercing had increased intolerance to nickel - anything in contact with the body must be nickel-free</li> </ul> <p><b>Flammability</b></p> <ul style="list-style-type: none"> <li>• Children's nightwear must comply with BS 5722</li> </ul>		
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		<p><b>Children's clothing</b></p> <ul style="list-style-type: none"> <li>• Cords and ribbons must not be accessible to the child's mouth - choking hazard</li> <li>• No cords in hoods - there must be press studs to hold the hood at the front and a 90 Newton pull strength button on the back</li> <li>• Fastenings must not imitate food - eg no strawberry shaped buttons</li> <li>• No ties or zips for boys under 5 years old</li> </ul> <p>One mark for appropriate piece of legislation. Up to 2 marks for appropriate application/explanation of legislation.</p>		
			1 + (2 x 1)	(3)
	(b)	<p><b>Setting up manufacturing facilities in developing countries</b></p> <p>Pressure to manufacture off-shore</p> <ul style="list-style-type: none"> <li>• High labour costs in developed countries - low in developing countries</li> <li>• Customers want quality and value for money - shareholders want profits and dividends</li> <li>• Developing countries want new manufacturing technology - manufacturers provide it but get cheap labour</li> <li>• Developing countries want jobs - but developed countries lose jobs</li> </ul> <p>Setting up costs</p> <ul style="list-style-type: none"> <li>• Very high setting up costs - need good water supply / drainage / roads / infrastructure / communications - often local government grants</li> <li>• Small companies can't fund global manufacturing - may go to the wall</li> <li>• Small companies could manufacture in developed countries to supply 'niche-markets' / high quality products</li> </ul> <p>Offshore working conditions</p> <ul style="list-style-type: none"> <li>• Responsibility of manufacturers for H&amp;S or local governments / is offshore unionised?</li> <li>• Moral / ethical issues - reports in media / image of company</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>• Rapid industrialisation part of global warming problem - pollution from processes / waste disposal / deforestation</li> <li>• Can developed countries deny developing countries opportunity for employment and increasing economic benefits?</li> <li>• Cost to developing countries of clean technology - who pays cost, manufacturer or government?</li> </ul> <p>1 mark for each relevant factor x 5</p>		
			5 x 1	(5)

(c)		<p><b>Manufacturing to preserve resources</b></p> <p><b>Product</b></p> <ul style="list-style-type: none"> <li>• Garment / household textiles</li> </ul> <p><b>Management of waste to preserve resources</b></p> <ul style="list-style-type: none"> <li>• Generation of solid waste (fabric, threads, trimmings, yarn, plastic, cardboard, paper waste)</li> <li>• Reduce, re-use, recycle materials</li> <li>• Fabric waste - re-spinning of natural / synthetic fibres / felt manufacture/household textiles and toys (ie wadding, dish cloths, dusters, toy stuffing)/fertiliser ('shoddy manure')/ geotextiles/car industry (ie upholstery made from recycled polyester).</li> </ul> <p><b>Recycling of natural fibres</b></p> <ul style="list-style-type: none"> <li>• Problem in recycling fibre blends</li> <li>• Company 'Evergreen' recycles cotton / cashmere / synthetics into yarns / fabrics / garments</li> <li>• Reduces energy use / less waste</li> <li>• Buy raw materials from charity shops / factories / rag merchants - sort into single-colour materials / tear into 'shoddy' / blend / card / spin / knit or weave into new fabrics</li> </ul> <p><b>Recycling of synthetic textiles</b></p> <ul style="list-style-type: none"> <li>• Problem in recycling fibre blends</li> <li>• Recycling PVC / PET bottles - thermoplastic properties convert into new synthetic fibres / new bottles / food packaging</li> <li>• Company 'Patagonia' manufactures recycled fleece garments ('Synchilla') - uses left over scrap fabrics to make infant clothing</li> </ul> <p><b>Recycling Latex in carpet manufacture</b></p> <ul style="list-style-type: none"> <li>• System for recycling latex used for coating back of carpets to retain the tuft</li> <li>• Old system resulted in 5-10% waste of daily latex use</li> <li>• New system for pumping the leftover latex mix to an airtight overnight storage tank</li> <li>• The leftover mix recycled by mixing with the next day's mix</li> <li>• Annual reduction of around 45% in waste latex and reduction of latex use by 5%</li> </ul> <p><b>Suitable product x 1 mark</b>  <b>1 mark for each appropriate answer on how it can preserve resources x 5</b></p>		
			1 + (5 x 1)	(6)
		<b>Total 14 marks</b>		

7	(a)	<p><b>Why manufacturers might justify higher prices</b></p> <ul style="list-style-type: none"> <li>• Product's extra features / Unique Selling Point</li> <li>• Innovative design / exclusivity</li> <li>• Perceived quality of the product eg cost v quality / value for money issues</li> <li>• Reputation of manufacturer / brand image eg Nike / Dyson</li> <li>• Possibility of credit - justify higher cost</li> <li>• Guarantee of delivery date</li> <li>• Easy access to product - mail order / Internet</li> <li>• Recognition of BSI Kitemark</li> <li>• Perceived demand</li> <li>• Spending power of the target market group</li> <li>• Environmentally friendly product</li> </ul> <p>One mark for each appropriate justification x 4</p>		
			4 x 1	(4)
	(b)	<p><b>Sustainable Development</b></p> <ul style="list-style-type: none"> <li>• Development that meets the needs of the present BUT</li> <li>• Doesn't compromise ability of future generations to meet their own needs</li> <li>• Environment seen as an asset/stock of available wealth</li> <li>• If each generation spends assets with no investment in future, world will run out of resources</li> </ul> <p><b>Key concepts</b></p> <ul style="list-style-type: none"> <li>• Priority given to world's poor</li> <li>• Must meet essential needs for jobs/energy/water/sanitation</li> <li>• Ensure sustainable world population</li> <li>• Conserve resources</li> <li>• Take account of environment and economics</li> <li>• Making industrial development more inclusive</li> </ul> <p>1 mark for each point x 4 PLUS 1 mark for each key concept x 4</p>		
			4 x 2	(8)
			<b>Total 12 marks</b>	
			<b>TOTAL FOR PAPER: 80 MARKS</b>	



# Food Technology – Unit 2: Knowledge and Understanding of Food Materials, Products and Processing

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Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						6	1	5	4	/	0	1	Signature	

Paper Reference(s)

**6154/01**

**Edexcel GCE**  
**Design and Technology**  
**Food Technology**  
**Advanced Subsidiary**

**Unit 2: Knowledge and Understanding of**  
**Food Materials, Products and**  
**Processing**

**June 2005 – Morning**

**Time: 2 hours**

Examiner's use only

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Team Leader's use only

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Question Number	Leave Blank
1	
2	
3	
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10	
<b>Total</b>	

**Materials required for examination**  
 Nil

**Items included with question papers**  
 Nil

**Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname and initials, and your signature.  
 Answer ALL questions in this paper. Write your answers in the spaces provided in this question paper.

**Information for Candidates**

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).  
 There are 10 questions in this question paper. The total mark for this paper is 80.  
 There are 12 pages in this question paper. Any blank pages are indicated.

**Advice to Candidates**

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically.

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**Turn over**



1. (a) Name **two** methods by which food raw materials can be sorted.

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.....

(2)

(b) Describe the differences between the processes of sorting and grading.

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.....  
.....

(2)

**(Total 4 marks)**

Q1



2. (a) Give **two** reasons for blanching vegetables prior to further processing.

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(2)

(b) Describe **one** industrial method for blanching vegetables.

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(2)

**(Total 4 marks)**

Q2

3. Texture modification is necessary in many food products.

(a) Give **three** examples of substances which modify the texture of foods.

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**(3)**

(b) Give **three** reasons for the use of textured modifiers in food manufacture.

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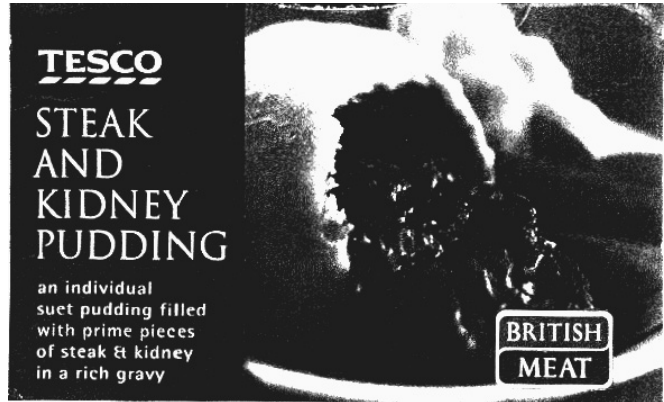
**(3)**

**(Total 6 marks)**

**Q3**

4. Figure 1 shows a steak and kidney pudding.

Figure 1



Justify the use of the following in the steak and kidney pudding.

(i) wheat flour

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.....  
.....  
.....  
..... (2)

(ii) Modified maize starch

.....  
.....  
.....  
..... (2)

(iii) yeast extract

.....  
.....  
.....  
..... (2)

(Total 6 marks)

Q4

5. (a) Name **two** naturally occurring colours in foods.

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(2)

(b) State **two** problems associated with the use of natural colours in food manufacture.

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(2)

(c) Describe **two** methods used to add a natural food colour to a food product.

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(2)

(d) Describe how the colour may vary with changes in pH for **one** of the substances named in part (a).

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(2)

(Total 8 marks)

Q5

6. (a) Describe the structure of triglyceride.

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(2)

(b) Describe the main structural difference between **two** general types of fatty acids.

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(4)

(c) Describe **two** ways in which antioxidants prevent rancidity.

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(2)

**(Total 8 marks)**

Q6





9. Many different factors affect which food items are bought and eaten by the consumer.

(a) Identify **two** factors affecting food purchase and consumption.

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**(2)**

(b) Give **two** examples of each type of factor identified in part (a).

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**(4)**

(c) Select **one** example from those given in part (b) and explain in detail the likely impact on product choice. Support your arguments with examples of food products that would likely be purchased.

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**(6)**

**(Total 12 marks)**

**Q9**

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**10.** Discuss **three** types of bacteria known to cause food poisoning. For each indicate:

- (i) typical sources of contamination/means of spread;
- (ii) how the food poisoning is caused;
- (iii) typical foods associated with illness.

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**(12)**

**(Total 12 marks)**

**Q10**

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**TOTAL FOR PAPER: 80 MARKS**

**END**

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## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	<p>Foods sorted by:</p> <ul style="list-style-type: none"> <li>• weight</li> <li>• size</li> <li>• colour</li> <li>• shape</li> </ul> <p>1 mark for each answer x 2</p>		
			2 x 1	(2)
	(b)	<p>Sorting separation by one category eg. weight, grading is quality separation and involves several parameters in determining the quality of a product.</p> <p>2 marks for a description</p>		
			2 x 1	(2)
		<b>Total 4 marks</b>		
2	(a)	<p>Two reasons for blanching:</p> <ul style="list-style-type: none"> <li>• inactivation of enzymes</li> <li>• to shrink the product</li> </ul> <p>1 mark for each answer x 2</p>		
			2 x 1	(2)
	(b)	<p>Industrial process: steam is used for a few minutes usually on a continual basis within a tunnel, or hot water, or microwave.</p> <p>2 marks for a description</p>		
			2 x 1	(2)
		<b>Total 4 marks</b>		
3	(a)	<p>Substances used:</p> <ul style="list-style-type: none"> <li>• starches</li> <li>• alginates (or cellulose, carageenans xantham gum)</li> <li>• gelatin</li> </ul> <p>1 mark for each answer x 3</p>		
			3 x 1	(3)
	(b)	<p>Three reasons for modifying texture:</p> <ul style="list-style-type: none"> <li>• absorption of water</li> <li>• to gel a product</li> <li>• prevent separation</li> </ul> <p>1 mark for each answer x 3</p>		
			3 x 1	(3)
		<b>Total 6 marks</b>		

4		(i)	Wheat flour used to make pastry casing 2 mark for a justification		
				2 x 1	(2)
		(ii)	Modified maize starch – thicken gravy, will not separate (no synneresis) 2 mark for a justification		
				2 x 1	(2)
		(iii)	Yeast extract – to boost flavour in beef stock 2 mark for a justification		
				2 x 1	(2)
			Total 6 marks		

5	(a)		Naturally occurring colours, for example: <ul style="list-style-type: none"> <li>• Anthocyanins</li> <li>• Chlorophylls</li> <li>• Carotenoids</li> <li>• Haemoglobin</li> <li>• Myoglobin</li> <li>• Xanthophylls</li> </ul> 1 mark for each answer x 2		
				2 x 1	(2)
	(b)		<ul style="list-style-type: none"> <li>• Variable in quality or intensity</li> <li>• Often seasonal availability problems</li> </ul> 1 mark for each answer x 2		
				2 x 1	(2)
	(c)		Added as powder or on liquid carrier. 2 marks for a description		
				2 x 1	(2)
	(d)		Effect on pH – one of: <ul style="list-style-type: none"> <li>• eg anthocyanins - red is acid, blue is alkaline</li> <li>• chlorophylls loss of green in acid, brighter green in alkaline</li> <li>• carotoids little effect</li> </ul> 1 mark for each answer x 2		
				2 x 1	(2)
			Total 8 marks		

6	(a)		<ul style="list-style-type: none"> <li>3 fatty acids joined to glycerol</li> </ul> <p>2 marks for a description</p>		
				2 x 1	(2)
	(b)		<ul style="list-style-type: none"> <li>Saturated fatty acids have single bonds between each carbon atom</li> <li>Unsaturated have one or more double bonds</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>Cis</li> <li>Trans</li> <li>Different location of hydrogen atoms either side of the double bond</li> </ul> <p>2 marks for each description of a fatty acid x 2</p>		
				2 x 2	(4)
	(c)		<ul style="list-style-type: none"> <li>Form stable free radicals</li> <li>Absorb/remove oxygen</li> </ul> <p>2 marks for a description</p>		
				2 x 1	(2)
			<b>Total 8 marks</b>		

7	(a)	(i) Monosaccharides (ii) Sucrose, maltose or lactose (iii) Simple polysaccharides (iv) Complex polysaccharides (v) Pectin, gums	1 mark for each answer x 5		
				5 x 1	(5)
	(b)	<ul style="list-style-type: none"> <li>Fructose (170) is the sweetest sugar</li> <li>Sweeter than Fructose</li> <li>Glucose (50) is only half as sweet as Fructose</li> <li>Lactose and maltose (30) are not very sweet by comparison</li> <li>An extra mark can be given if at least two numerical values are given for sweetness levels of if invert sugar is referred to. Invert sugar is sweeter than sucrose, but less sweet than fructose</li> </ul> <p>1 mark for each answer x 5</p>			
				5 x 1	(5)
			<b>Total 10 marks</b>		

8		<p>Primary</p> <ul style="list-style-type: none"> <li>Chain of amino acids</li> <li>Joined by peptide bonds</li> </ul> <p>Secondary</p> <ul style="list-style-type: none"> <li>Due to further linking forms a spiral/helix structure</li> <li>Hydrogen bonds</li> <li>Disulphide bridges where amino acids contain sulphur</li> <li>Electrostatic bonds between amino and carboxyl groups</li> </ul> <p>Tertiary</p> <ul style="list-style-type: none"> <li>Further folding into a globule maintained by cross links described above</li> </ul> <p>1 mark for each stage identified x 3 (clear indication of point on a diagram may also be awarded the mark) PLUS 1 mark for each cross link involved x 7</p>		
			(3 x 1) + (7 x 1)	(10)
<b>Total 10 marks</b>				

9	(a)	<p>Types of factors include:</p> <ul style="list-style-type: none"> <li>cultural</li> <li>physiological</li> <li>political</li> <li>psychographic</li> <li>technical</li> <li>economic</li> <li>marketing</li> <li>social</li> <li>contextual</li> </ul> <p>1 mark for each answer x 2</p>		
			2 x 1	(2)
	(b)	<p>Examples might be:</p> <ul style="list-style-type: none"> <li>economic – disposable income, price range of products</li> <li>marketing – promotion, product portfolio</li> <li>social – social class, family life cycle stage</li> <li>cultural – religion, time poverty (core structural trend)</li> <li>physiological – taste, allergy</li> <li>political – food policy, EU legislation</li> <li>psychographic – lifestyle, attitudes</li> <li>technical – packaging, storage requirements</li> <li>contextual – accessibility of shopping, car ownership, weather, time available to shop, store atmospherics, availability of products</li> <li>other – seasonality, perishability, portability</li> </ul> <p>1 mark for each example given to the factors identified in part (a) x 2</p>		
			2 x 2	(4)



(c)	<p>Only one explanation needed – three examples are given:</p> <p style="text-align: center;">Social ⇓ Family life cycle stage ⇓</p> <p>Is likely to determine household size and composition. For example a young ‘full nest’ family (2 adults and 2 children) would be interested in purchasing family sized packs, products targeted at young children and multipacks (maybe with different sized portions of the same item for different family members of varying appetites). Own brands would be likely to be selected, both for economy and because, lacking the comparison offered by alternatives, children would not be offered the opportunity to differentiate between brands, if needed they were able to do so. Depending on income, value conscious budget lines might be selected. Innovative, fun or ‘entertainment’ products would be likely to be purchased to appeal to the children, (Frubes, Cheese Strings, Lunchables, green Heinz Tomato Ketchup) whilst distinctly ‘adult foods’ (curries and highly spiced dishes, complex - Paella - or subtle - Elderflower cordial - flavours and indulgence foods - tiramisu or premium quality ice creams) could be favoured for eating occasions which did not include the children.</p> <p style="text-align: center;">OR</p> <p style="text-align: center;">Cultural ⇓ Time poverty ⇓</p> <p>The core cultural contemporary trend of “time poverty” is typical of many consumers with busy and hectic lifestyles. Although this can apply to many consumer segments (children, teens, adults, the employed, shift workers, business travellers etc...) it is typically most acutely felt by those responsible for balancing multiple sets of responsibilities (e.g. managing work, domestic and social life in the case of full-time, working mothers). The likely impact on product choice is that time and labour-saving options will be preferred such as pre-prepared meals, part meals or ingredients; microwaveable, fresh chilled or frozen products; portable ready-to-eat and snack items (for lunch boxes) and food-on-the-move.</p> <p>Often consumers in this segment have relatively large disposable incomes and therefore pre-packed, processed and value-added lines are likely to be purchased to reduce time and effort in product selection, preparation, heating/cooking and clearing away. (Paying for convenience). Products with integral plates/bowls, cups and eating implements are also likely to be favoured (e.g. supermarket “salad bowl meals”, pot noodle).</p> <p>Key products include ready meals, sandwiches, pizzas, salads, frozen vegetables and nutritious and filling snacks.</p>	
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			<p style="text-align: center;">OR</p> <p style="text-align: center;">Technical</p> <p style="text-align: center;">⇓</p> <p style="text-align: center;">Packaging</p> <p style="text-align: center;">⇓</p> <p>Packaging is acknowledged to be an increasingly important factor in determining consumers food product choices. Its role goes way beyond the necessary “functional” aspects of protecting the product (both in transit and during storage - e.g. to stop it breaking into pieces) and keeping the product safe to eat (preventing spoilage) and includes:</p> <ul style="list-style-type: none"> <li>• an informational aspect (labelling)</li> <li>• a promotional aspect (visual and tactile appeal)</li> <li>• a novelty aspect (fun or entertainment appeal)</li> <li>• post usage aspect (is it reusable for the same purpose [refillable spouted water bottle] or recyclable [tubs as children’s paint pots etc...]).</li> </ul> <p>Depending on what type of consumer is buying the product all of these factors may be more or less relevant to product choice. Issues such as:</p> <ul style="list-style-type: none"> <li>• consumer dexterity (e.g. to open fiddly or difficult fasteners)</li> <li>• consumer attitudes (is the consumer ecologically minded [will therefore choose natural materials paper, glass instead of plastics])</li> <li>• consumers propensity to impulse purchase (to what extent is the consumer seduced by the image rather than the substance of the product [i.e. promotions/marketing package]) are all relevant</li> </ul> <p>Food products that would be likely to be purchased by consumers influenced by packaging are those which are:</p> <ul style="list-style-type: none"> <li>• novel (e.g. Schwartz Sholtz “Pyramid” seasonings)</li> <li>• fun (e.g. Frubes, Winders, Pringles)</li> <li>• outstandingly attractive (for a variety of reasons) (e.g. dips/tapas in their own authentic glass/pottery bowls)</li> </ul> <p>1 mark for each detailed explanation from the example stated in part (b) x 6</p>		
			Total 12 marks	6 x 1	(6)

10			<p>Specific detail required for any three from:</p> <p><b>Staphylococcus aureus</b></p> <ul style="list-style-type: none"> <li>• Human skin, nose, boils spread by poor food handling</li> <li>• Produces a toxin released into food</li> <li>• Cooked meat, milk, cream</li> </ul>		
----	--	--	---	--	--

		<p><b>Clostridium botulinum</b></p> <ul style="list-style-type: none"> <li>• Found in soil, heat resistant spores</li> <li>• Produces toxin in food</li> <li>• Canned, vacuum packed, bottled foods (no oxygen)</li> </ul> <p><b>Salmonella</b></p> <ul style="list-style-type: none"> <li>• Contaminated by animal or human carriers</li> <li>• Bacteria themselves infect the person</li> <li>• Eggs, poultry, meats, creams</li> </ul> <p><b>Clostridium perfringens</b></p> <ul style="list-style-type: none"> <li>• Carried in human and animal intestines – raw meat/food handling</li> <li>• Infection by bacteria which release toxin</li> <li>• Cold &amp; reheated meats</li> </ul> <p><b>Bacillus cereus</b></p> <ul style="list-style-type: none"> <li>• Soil, dust, water</li> <li>• Produces toxin in food</li> <li>• Cereals and rice</li> </ul> <p><b>Escherichia coli</b></p> <ul style="list-style-type: none"> <li>• Widespread in gut – 0157 is harmful strain</li> <li>• Infection by small number of cells</li> <li>• Cook-chill foods, burgers, soft cheese</li> </ul> <p><b>Listeria Monocytogenes</b></p> <ul style="list-style-type: none"> <li>• Wide spread in water/soil/animals</li> <li>• Causes listeriosis - toxin (enzyme) produced by bacteria in the body</li> <li>• Mainly raw chicken, meat, salads and soft cheese</li> </ul> <p><b>Campylobacter jejuni</b></p> <ul style="list-style-type: none"> <li>• Pets and birds (pecking milk)</li> <li>• Gastroenteritis or stomach upset by infection</li> <li>• Poultry, meat, shell fish and milk</li> </ul> <p>NB Note that no mark to be given for cross contamination or poor hygiene – they need to explain ‘how’ this would occur for the particular example to score the mark.</p> <p>1 mark to be given for each of the three named bacteria (main name ok) plus a discussion into each bacteria which must address the three following points x 1 mark for each point x 3 bacteria:</p> <p>(i) typical sources of contamination/means of spread  (ii) how the food poisoning is caused  (iii) the typical foods associated with illness.</p>		
			(3 x 1) + (3 x 3)	(12)
			Total 12 marks	
			TOTAL FOR PAPER: 80 MARKS	



## Food Technology – Unit 3: Further Study of Food Materials, Products and Processing

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Question paper	195
General guidance on marking	207
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Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						6	1	5	5	/	0	1	Signature	

Paper Reference(s)

**6155/01**

**Edexcel GCE**  
**Design and Technology**  
**Food Technology**  
**Advanced**

**Unit 3: Further Study of Food Materials,  
Products and Processing**

**June 2006 – Afternoon**

**Time: 2 hours**

Examiner's use only

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Team Leader's use only

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Question Number	Leave Blank
1	
2	
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9	
Total	

Materials required for examination

Nil

Items included with question papers

Nil

**Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname and initials, and signature.

Answer ALL the questions. Write your answers in the spaces provided in this question paper.

**Information for Candidates**

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).

There are nine questions in this question paper. The total mark for this paper is 80.

There are 12 pages in this question paper. Any blank pages are indicated.

**Advice to Candidates**

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically.

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*Turn over*



1. (a) Describe the special properties needed in thickeners for frozen meals containing gravy.

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(2)

(b) Describe the special properties needed in thickeners for instant desserts.

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(2)

**(Total 4 marks)**

Q1

2. (a) Explain how the prevention of liquid from pie fillings from soaking into pastry can be achieved commercially in a food product.

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(2)

(b) Explain how the formation of large ice crystals in ice cream can be prevented commercially in the food product.

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(2)

**(Total 4 marks)**

Q2



3. (a) Explain why some liquid products need to be thickened quickly.

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(3)

(b) Describe the role of starches, which have delayed thickening properties, in the canning process.

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(3)

**(Total 6 marks)**

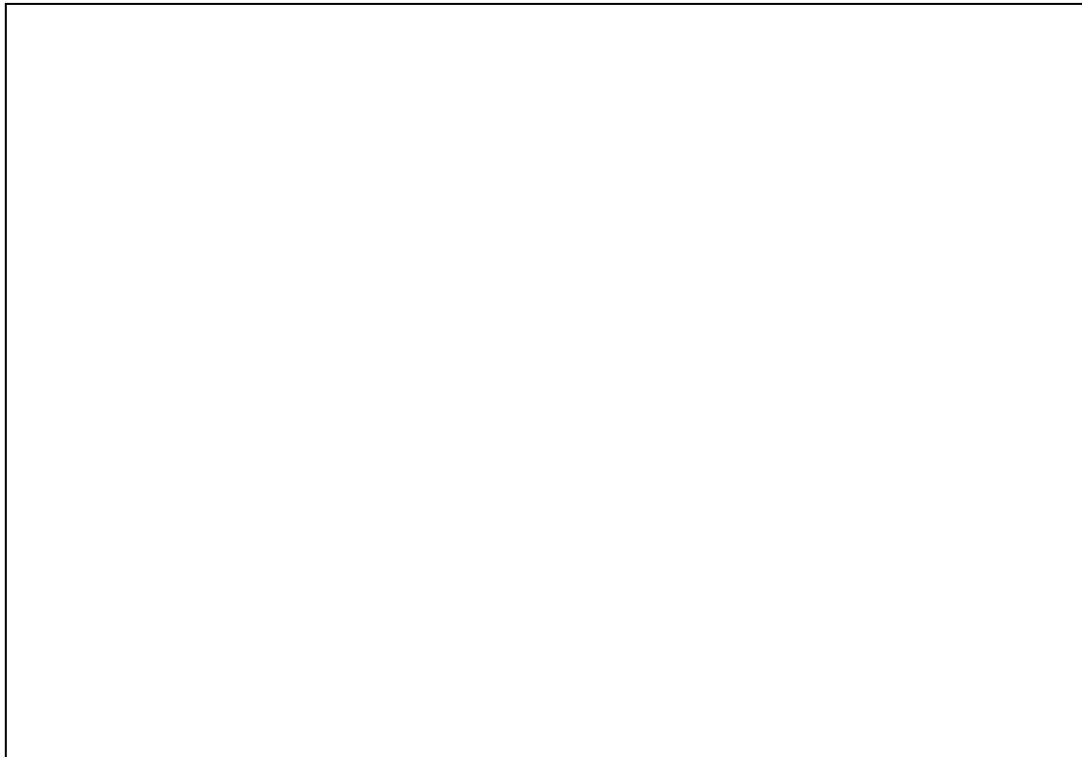
**Q3**

4. Instant or quick-cook dessert products are used widely, and are usually dried products that are mixed with milk or water.

(a) Produce **two** different initial ideas for instant desserts, stating the nature of the products and why they are 'instant desserts'.

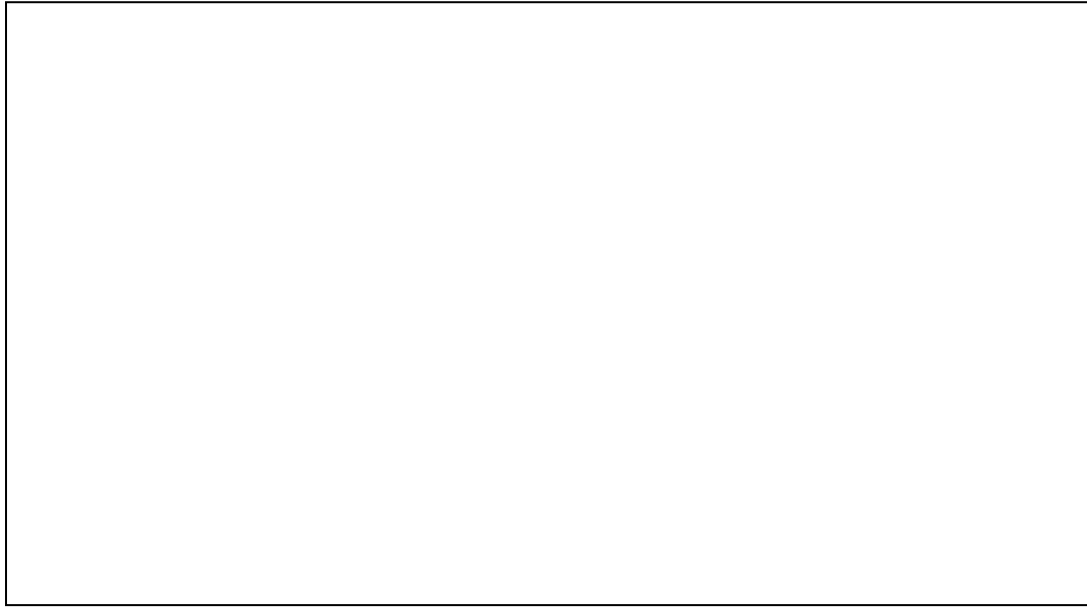


**(3)**



**(3)**

(b) Develop **one** of the ideas in part (a) clearly showing its basic composition.



(3)

(c) Name the ingredients or additives that can perform the following in the product:

(i) thickening or gelling

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(ii) emulsification

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(iii) flavouring

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(3)

Q4

**(Total 12 marks)**

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5. Discuss the pros and the cons of milk and milk products in the UK diet.

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**(Total 8 marks)**

**Q5**

6. (a) Describe **three** main features of a cereal grain.

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(b) Explain why different types of wheat are used in the production of bread, cakes and pasta.

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**(3)**

(c) The moisture content of cereal grain is key to its shelf life. State the optimum moisture content range for cereal grain and describe the process of deterioration at higher moisture levels.

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**(4)**

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(d) Name **one** food or beverage that contains malt. Outline the process by which malt is obtained.

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(4)

**(Total 14 marks)**

Q6

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7. (a) Describe the structure of muscle tissue in meat.

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(b) Outline the changes that result in the conversion of muscle tissue into meat.

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(7)

**(Total 10 marks)**

**Q7**

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**8.** (a) Describe the changes occurring during the ripening of a climacteric fruit.

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**(8)**

(b) Describe **two** techniques used to inhibit ripening during the storage of fruit and vegetables.

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**(4)**

**(Total 12 marks)**

Q8

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9. Continual new product development is a cornerstone of success in a fast moving consumer goods sector such as the food industry.

(a) Explain **four** key market factors affecting new product development, using one example of a product to illustrate each factor.

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(4)

(b) Describe the **three** stages of the consumer behaviour process. Illustrate each stage with an appropriate example of how consumers evaluate products.

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(6)

(Total 10 marks)

Q9

**TOTAL FOR PAPER: 80 MARKS**

**END**

## General guidance on marking

Markers should look for qualities to reward rather than faults to penalise. This does not mean giving credit for incorrect or inadequate answers, but it does mean allowing students to be rewarded for answers showing correct application of principles and knowledge. Markers should therefore read carefully and consider every response; even if it is not what is expected it may be worthy of credit.

### Mark scheme structure

- 1 The first three columns identify the number/part of the question.
- 2 The fourth column identifies the expected answers to the question. The expected answers are not necessarily exhaustive and so professional judgement should be applied by the marker.
- 3 For some of the expected answers, example answers may have been supplied to give additional guidance, particularly where the question allows for a wide range of response from the student.
- 4 The last two columns identify how the marks should be awarded.
- 5 The total mark for each question is in bold at the bottom of each full question.
- 6 Information in bold which appears in the bottom of the second column for that question gives guidance on how to award a range of marks and must be followed for that specific question.



## Mark scheme

1	(a)	<p>Frozen meals containing gravy Thickening must show freeze-thaw stability. Must not show any liquid separation on thawing i.e. prevent syneresis/separation/leakage</p> <p>2 marks for a detailed description</p>		
			2 x 1	(2)
	(b)	<p>Instant desserts Rapid thickening required. Use pregelatinised starch. No heating necessary to thicken product</p> <p>2 marks for a detailed description</p>		
			2 x 1	(2)
		<b>Total 4 marks</b>		

2	(a)	<p>Pies Rapid increase in viscosity of liquid using suitable quick-thickening starch or gum/coating the pastry or other gelling agent or stabilisers</p> <p>2 marks for a detailed explanation</p>		
			2 x 1	(2)
	(b)	<p>Ice cream Use of stabiliser which absorbs and retains water, e.g. alginates thus preventing ice crystal growth</p> <p>2 marks for a detailed explanation</p>		
			2 x 1	(2)
		<b>Total 4 marks</b>		

3	(a)	<p>Liquid food products Rapid thickening of liquid product usually carried out to prevent separation of solid components during processing and filling into containers, instant products</p> <p>3 marks for a detailed explanation</p>		
			3 x 1	(3)
	(b)	<p>The role of starches Delayed thickening in canned foods allows more rapid heat transfer into product and therefore shorter heat processing times</p> <p>3 marks for a detailed description</p>		
			3 x 1	(3)
		<b>Total 6 marks</b>		

4	(a)	<p>Two ideas with:</p> <ul style="list-style-type: none"> <li>• basic formulation</li> <li>• how product works</li> <li>• outline of composition</li> </ul> <p>Maximum 3 marks for each idea x 2</p>		
			3 x 2	(6)
	(b)	<p>One idea clearly developed from (a) with details of:</p> <ul style="list-style-type: none"> <li>• gelling</li> <li>• thickening mechanism</li> <li>• use</li> </ul> <p>Maximum 3 marks for an idea</p>		
			3 x 1	(3)
	(c)	<p>(i) Thickening, name thickeners, eg pre-gelatinised starches. OR Gelling agents such as gums or phosphate/casein systems.</p> <p>(ii) Emulsification, name emulsifiers such as lecithin.</p> <p>(iii) Flavouring, use of dried flavours, such as spray dried natural flavours.</p> <p>1 marks for the name of an ingredient or additive x 3</p>		
			3 x 1	(3)
		Total 12 marks		

5		<p>Nutritional contribution of milk to the UK diet</p> <ul style="list-style-type: none"> <li>• Important / good source of protein</li> <li>• Providing all indispensable amino acids</li> <li>• Important source of vitamins and minerals especially –</li> <li>• Calcium (provides nearly 50% of UK intake)</li> <li>• Riboflavin and niacin and vitamin A</li> <li>• Contains very little vitamin C and iron</li> <li>• Small amount of carbohydrate – sugar – non milk extrinsic sugar not shown to contribute to tooth decay</li> <li>• Small amount of fat which is mainly saturated</li> <li>• Skimmed milks are lower in fat and are useful to reduce saturated fat content of diet but not suitable for infants due to low energy / vitamin A content</li> </ul> <p>1 mark for each appropriate point, but must contain pros and cons to gain full marks x 8</p>		
			8 x 1	(8)
		Total 8 Marks		

6	(a)	<p>Three main features of a cereal grain</p> <ul style="list-style-type: none"> <li>• Embryo / germ - from which root / sprout originates</li> <li>• Endosperm - main store of starch</li> <li>• Bran - outer layers of grain</li> </ul> <p>1 mark for each description x 3</p>		
			3 x 1	(3)
	(b)	<p>Types of wheat in production</p> <ul style="list-style-type: none"> <li>• Strong wheats with high protein content required for breadmaking</li> <li>• Weaker - lower protein content for cakes etc</li> <li>• Pasta made from semolina of Durham wheat harder endosperm less drying</li> </ul> <p>1 mark for each explanation x 3</p>		
			3 x 1	(3)
	(c)	<p>Moisture content for cereal grains</p> <ul style="list-style-type: none"> <li>• 10 – 14%</li> <li>• Higher moisture conditions induce germination</li> <li>• Leads to conversion of starch to sugar as grain uses up its food store</li> <li>• As water availability increases bacteria and moulds are able to multiply begin to rot the grain</li> </ul> <p>1 mark for range for moisture content plus 1 mark for each description of the processed for deterioration x 3</p>		
			1 + (3 x 1)	(4)
	(d)	<p>Malt</p> <ul style="list-style-type: none"> <li>• Malt whiskey, malt vinegar, beer, marmite or other appropriate product</li> <li>• Barley</li> <li>• Exposed to moist and warm conditions to bring about sprouting/germination</li> <li>• Enzyme – amylases break down starch to maltose</li> </ul> <p>1 mark for product that contains malt plus 1 mark for each point made on the processes of obtaining malt</p>		
			1 + (3 x 1)	(4)
		<b>Total 14 Marks</b>		

7	(a)	<p>Structure of muscle tissue in meat</p> <ul style="list-style-type: none"> <li>• Myofibrils made of actin and myosin</li> <li>• Surrounded by a sheath form a muscle fibre</li> <li>• Bundles of fibres surrounded by connective tissue.</li> </ul> <p>1 mark for each point x 3</p>		
			3 x 1	(3)

	(b)	<p>Conversion of muscle tissue in meat</p> <ul style="list-style-type: none"> <li>• Carcass stiffens - known as rigor mortis</li> <li>• Residual glycogen converted to lactic acid (absence of oxygen)</li> <li>• Lower pH causes muscles to contract</li> <li>• After few hours – ageing or conditioning</li> <li>• Carcass softens – important for texture of meat</li> <li>• Enzymes breakdown proteins and lipids</li> <li>• Important in development of flavour of cooked meat</li> </ul> <p>1 mark for each point x 7</p>		
			7 x 1	(7)
		Total 10 marks		

8	(a)	<p>Ripening of a climacteric fruit</p> <ul style="list-style-type: none"> <li>• Ethylene production activates enzymes responsible for ripening processes</li> <li>• Becomes sweeter due to breakdown of starch and production of sugars and decrease in acids</li> <li>• Additional mark for naming sugars – glucose/fructose/sucrose and/or acids – malic/citric/tartaric</li> <li>• Cell wall polysaccharides break down softening the texture</li> <li>• Progressive break down of pectin softening the fruit further</li> <li>• Change in colour – chlorophyll pigment breaks down revealing other pigments e.g. carotenoids</li> <li>• Some pigments are synthesised during ripening e.g. anthocyanins</li> </ul> <p>NB no marks to be gained for low level information eg changes colour, gets softer and changes flavour.</p> <p>1 mark for each point in the correct order x 8</p>		
			8 x 1	(8)
	(b)	<p>Techniques used to inhibit ripening</p> <ul style="list-style-type: none"> <li>• Reduction of temperature to decrease rate of respiration due to slowing/deactivation of enzymes</li> <li>• Controlled atmosphere storage – lower oxygen/increase CO<sub>2</sub> to slow rate of respiration</li> <li>• Hypobaric/low pressure storage – lowers oxygen and causes ethylene to diffuse out and thus delays ripening</li> <li>• Special coating e.g. waxing/prolong – allows oxygen in but not carbon dioxide out reducing rate of respiration</li> <li>• Irradiation – gamma rays destroy enzymes inhibiting sprouting/ripening</li> </ul> <p>1 mark for technique and 1 mark for explaining why it works x 2</p>		
			2 x 2	(4)
		Total 12 marks		



9	(a)	<p>Four key market factors affecting new product development</p> <ul style="list-style-type: none"> <li>• Business confidence - governs financial climate in which all business activity takes place</li> <li>• Legislation - sets the legal framework and so the constraints on production and marketing communications</li> <li>• Political factors - can determine the supply, cost and availability of ingredients e.g. oversupply through CAP has forced prices down, government action / policies / control mechanisms on Foot and Mouth disease raised prices to the consumer due to imports</li> <li>• Competition - market (number of players/ pace of entrants etc) and product (degree of differentiation / fragmentation) structures important in setting the operating environment for production and selling</li> <li>• Technology - new production machinery / procedures, ie computerised production lines, robotics and automation</li> </ul> <p>1 mark for each point x 4</p>		
			4 x 1	(4)
	(b)	<p>Consumer behaviour process</p> <p>The stages/examples of product evaluation are:</p> <ul style="list-style-type: none"> <li>• acquisition [pre/at purchase] – weight-conscious consumer rejects product as nutritional information reveals high fat content</li> <li>• consumption [in use] – consumer evaluates product negatively as the packet is difficult to open and this creates a critical mind-set</li> <li>• disposition [disposal/handing on] – consumer realises that a significant proportion of the cost of the product are being thrown away as packaging waste</li> </ul> <p>1 mark for a description of each stage plus 1 mark for giving an example of a product evaluation relevant to that stage x 3</p>		
			3 x 2	(6)
			Total 10 marks	
			TOTAL FOR PAPER: 80 MARKS	

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