



**General Certificate of Secondary Education
June 2012**

**Design and Technology: 45551
Product Design**

(Specification 4555)

Unit 1: Written Paper

Final

Mark Scheme

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Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	a		<p>Contain, Protect, Inform, Display, Preserve. NOT transport as is the example. Any sensible reason appropriate to product selected.</p> <p>Accept other suitable functions e.g. promote, keep secure but NOT 'safe' or product safety.</p>	6	<p>1 mark for function.</p> <p>2 marks for explanation.</p> <p>Function must match explanation and be appropriate to product.</p>
1	b		<p>Appropriate material selected.</p> <p>Any sensible reason appropriate to product selected and related to material.</p>	<p>2 x 1 mark</p> <p>2 x 1 mark</p>	<p>1 mark for material.</p> <p>1 mark for reason.</p> <p>Reason must match product and be appropriate to material.</p>
1	c		<p>A creative packaging solution.</p> <p>Response is fully compatible with fragrance product, is drawn in proportion and would be fully effective. Solution has innovative or commercially recognised features which enhance the perfume product's saleability.</p> <p>Part of response may be effective as packaging for fragrance product but may not be fully drawn or has missing components which result in solution not being appropriate for product. Design may be a simple solution which may not detail innovative or commercial design features and therefore may not enhance the product.</p> <p>Limited response which lacks significant detail as an effective or creative packaging solution.</p>	6	<p>(5 – 6 marks)</p> <p>(3 – 4 marks)</p> <p>(1 – 2 mark)</p>
1	c		<p>How the packaging would be constructed.</p> <p>An accurate and detailed 2D net development of the packaging solution, in proportion with glue tabs correctly positioned and dimensions appropriately labelled and / or a detailed 3D drawing of the packaging solution, in proportion, closure and joins correctly.</p> <p>A sound 2D net development of the packaging solution, in proportion with most glue tabs correctly positioned and dimensions appropriately labelled and / or a sound 3D drawing of the packaging solution, in proportion, closure and/or most joins correctly positioned.</p>	5	<p>(4 – 5 marks)</p> <p>(3 marks)</p>











		<p>A 2D net development of the packaging solution, but may not be in proportion or may not have glue tabs correctly positioned. Dimensions may not be given and / or a 3D drawing of the packaging solution, but may not be in proportion or may not have closure and joins correctly positioned.</p> <p>Basic 2D net development of the packaging solution not in proportion, glue tabs missing or incorrectly positioned and / or a basic 3D drawing of the packaging solution not in proportion, closure/joins missing or incorrectly positioned.</p>		<p>(2 marks)</p> <p>(1 mark)</p>
1	c	<p>Surface decoration including the use of colour.</p> <p>Application of colour used to provide detail of surface decoration; applied to 2D net development and/or 3D drawing, appropriate to product including e.g. logos and conventions such as bar code, contents, safety symbols, image of product etc.</p> <p>Reasonable application of colour to give some detail of the surface decoration; applied to 2D net development and/or 3D drawing, appropriate to product. May not have included e.g. logos and conventions such as bar code, contents, safety symbols, image of product etc. or may be simplistic and lack detail.</p> <p>Basic application of colour to give simplistic detail of surface decoration; may be applied to 2D net or 3D drawing; may not have given detail of logos or packaging conventions.</p>	5	<p>(4-5 marks)</p> <p>(2-3 marks)</p> <p>(1 mark)</p>

1	c	<p>Notes to explain how the packaging performs the functions described in 1(a):</p> <p>Design annotated with well reasoned points clearly linked to the 3 packaging functions previously identified.</p> <p>Design annotated with relevant evaluation but which may not all be linked to the 3 packaging functions previously identified.</p> <p>Simple annotation with simplistic points made.</p> <p>Brief and superficial annotation only.</p>	4	<p>(4 marks)</p> <p>(3 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p> <p>Maximum of 2 marks if no links made to functions identified in 1(a)</p>
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Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a	i		6	Please refer to table and answers below. One mark for each correct answer.

Product	Main material	Source	Renewable?
	Stainless steel Silver	The Earth and rocks, oil etc.	X
	Beech Rubberwood	Plants and trees	✓
	Clay	The Earth and rocks, oil etc.	X
	Card	Plants and trees	✓
	Flour	Plants and trees	✓
	Cotton	Plants and trees	✓
	Polyester wadding	The Earth and rocks, oil etc.	X
	PET Plastic	The Earth and rocks, oil etc.	X
	Cartridge paper	Plants and trees Timber Wood pulp	✓
	Glass Polycarbonate	The Earth and rocks, oil etc.	X
	Cotton Denim	Plants and trees	✓

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a	ii	<p>A suitable property relevant to main material. (1 mark)</p> <p>Explanation shows good understanding of the working properties of the material. (2 marks)</p> <p>Explanation is vague and lacking in understanding of the properties of the materials. (1 mark)</p> <p>Property must match product even if material is incorrect</p>	6	<p>2 x 3 marks</p> <p>Please refer to table below.</p>

 <p>Cutlery</p>	 <p>Spatula</p>	 <p>Vase</p>	 <p>Greetings card</p>	 <p>Bread</p>
<p>Stainless steel: Scratch resistant; corrosion resistant, lustrous, inert – will not react with drink - impervious to water and air;</p> <p>Silver: Lustrous, tarnishes in air</p>	<p>Beech: Midtone colour hardwood with a fine texture. Close even grain, doesn't splinter. Available in planks/boards Can be large sections Planed and unplanned Mouldings</p> <p>Rubberwood: soft wood, pale colour, relatively strong, used for hard board, particle board, door frames, furniture, fibre board</p>	<p>e.g. stoneware clay Accepts glaze; non porous when glazed and fired</p>	<p>White board: Strong, can be printed on, inexpensive, can be die cut or creased.</p>	<p>Flour: Provide starchy carbohydrates and fibre Good source of energy</p>
 <p>Oven Glove</p>	 <p>Food packaging</p>	 <p>Sketchbook</p>	 <p>Wine goblet</p>	 <p>Jeans</p>
<p>Cotton: Lightweight; durable; washable – stains easily removable at low temperature; heat resistant</p> <p>Polyester wadding: Good insulator</p>	<p>PET plastic: Clear – displays product; recyclable; vacuum formed; strong to protect food inside; inert – will not affect food; waterproof; can be incinerated to dispose of.</p>	<p>Cartridge paper: high quality type of heavy paper used for illustration and drawing. Accepts drawing and painting media well.</p>	<p>Glass: Clear; lightweight when blown in thin profile; can be shaped into 3D shapes; inert – will not react with wine; displays wine; easily broken. Recyclable.</p> <p>Polycarbonate: Transparent, shatterproof, lightweight, cast or compression moulded.</p>	<p>Cotton denim: Accepts indigo dye well; hard wearing / durable; available in different weights; can be blended with lycra to make stretch</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	b		<p>Materials are combined (composites) to improve the working properties of one or both materials.</p> <p>E.g. laminates – paper & foil, wood veneers, gortex; pvc coated cotton, mayonnaise (egg acts a emulsifier , binds ingredients together), roux – butter and flour, carbon fibre, alloys, stainless steel, steel (iron & carbon), cement, glass fibre, grp; cotton & polyester</p> <p>Response to include two materials, specifically named and suitable to be combined.</p> <p>Do not accept finishes and coatings, decorative finishes or fabrication.</p> <p>Explanation shows a good understanding of the working properties of the materials and resultant material. Reasons for combining materials fully explained and appropriate example given.</p> <p>Explanation shows a basic understanding of the working properties of the materials and resultant material. A reason for combining materials is given but may be lacking in detail, response may include an appropriate example.</p> <p>Explanation is vague and lacking in understanding of the properties of the materials/resultant material. Appropriate example may not have been given or an example without reason or explanation.</p>	6 marks	<p>(5-6 marks)</p> <p>(3-4 marks)</p> <p>(1-2 marks)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a		<p>Products which are packaged flat to use up less space and then assembled when unpacked. E.g. Ready-to-assemble furniture (RTA), also known as knock-down furniture or flat pack furniture is a form of furniture that is purchased in multiple pieces and requires assembly. This form of furniture generally arrives in a box and contains instructions for the buyer to follow in order to assemble it after purchase. Flat pack furniture designed and packaged to fit in the boot of car so easy to take home.</p>	2	<p>Sound response which makes reference to two of the opposite ideas in brief or one idea in detail. (2 marks)</p> <p>Brief / single word answer with reference to one idea only. (1 mark)</p>
3	b	i	<p>Give two advantages to the user of using assembling furniture with knock down fittings.</p> <p>e.g. Many products use the same fixings so easy to use time and again; Retailer / manufacturer can provide spares if one lost; fixings easy to remove so product can be disassembled and reassembled if move house. Most product assembly uses Allen key and screw driver which are simple to use by everyone and do not require any prior experience or technical knowledge. Assembly is accessible to most end users. Sense of satisfaction when completed. Can purchase 'same' base units / modules to match.</p> <p>Only accept 'cheap', 'easy', if justified.</p>	2	1 mark per advantage identified (2 x 1 mark)
3	b	ii	<p>Give two advantages to the manufacturer of knock down fittings.</p> <p>e.g. Components are made in large quantities by specialist manufacturers to reduce costs and to make product maintenance easier; Components are often made from different materials to the main product and require very different manufacturing systems so it would not be appropriate for one manufacturer to make everything. Some retailers such as IKEA are large enough to have their own manufacturing facility to make fixings so in its interest to use them for lots of its products. Many different products with different functions require the same components which makes the components a product themselves.</p> <p>Only accept 'cheap', 'easy', if justified.</p>	2	1 mark per advantage identified (2 x 1 mark)

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	c	i	<p>Explain how retailers selling flat pack products have changed the way people furnish their homes.</p> <p>Mass produced flat pack furniture which changes in season. E.g. IKEA produce a seasonal catalogue changing colourways and introducing new up to date products which encourages consumers to buy newer versions and update their homes. As mass distributed catalogue direct to homes and large warehouse retail stores situated conveniently at motorway junctions, IKEA is accessible to everyone. Flat pack furniture designed and packaged to fit in the boot of car so easy to take home. The majority of people no longer buy expensive pieces of furniture to hand down through families but instead buy and assemble cheaper mass produced pieces which are replaced when they wear out or go out of fashion.</p> <p>Design development: shapes, modular, minimalism as a response to manufacturing systems. Lower retail cost due to manufacturing methods.</p> <p>A concise and detailed response showing a good understanding of the opposite factors and relating to social change. Response well structured with good use of appropriate design and technology terminology and showing a good grasp of grammar, punctuation and spelling.</p> <p>A sound response showing a basic understanding of the opposite factors and relating to social change. Response fairly well structured with some use of design and technology terminology with small number of errors in grammar, punctuation and spelling.</p> <p>A simplistic statement which mentions one point only. Response poorly structured with little or no use of design and technology terminology and with numerous errors in grammar, punctuation and spelling.</p> <p>No relevant argument presented.</p>	4	<p>(3 – 4 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p> <p>(0 mark)</p>

3	c	ii	<p>What is the impact of these changed on the environment?</p> <p>More resources consumed as furniture is 'throw away' – wears out relatively quickly in comparison with traditional furniture favoured by previous generations. Ends up in landfill as plastics and laminated boards cannot be recycled or reused for other products. Packaging for products – bespoke or handmade furniture is not packaged in the same way as flat pack.</p> <p>Distribution involves pollution and consumption of fuel to warehouse and from warehouse to home whereas people often purchased more locally made products or furniture was handed down through generations and therefore was more sustainable.</p> <p>Accept points in favour or points against if correctly justified.</p> <p>A concise and detailed response showing a good understanding of the opposite factors and relating to how this social change has impacted on the environment. Response well structured with good use of appropriate design and technology terminology and showing a good grasp of grammar, punctuation and spelling.</p> <p>A sound response showing a basic understanding of the opposite factors and relating to how this social change has impacted on the environment. Response fairly well structured with some use of design and technology terminology with small number of errors in grammar, punctuation and spelling.</p> <p>A simplistic statement which mentions one point only. Response poorly structured with little or no use of design and technology terminology and with numerous errors in grammar, punctuation and spelling.</p> <p>No relevant argument presented.</p>	4	<p>(3 – 4 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p> <p>(0 mark)</p>
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Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	a		High quality product well explained. A precise drawing showing high level skills. Developed solution is fully feasible and suitable for manufacture in this quantity.	4	(3 – 4 marks)
			Some parts of the drawing not easy to understand. Developed solution might not be completely feasible or suitable for manufacture in this quantity. Maximum 2 marks if shape not used or developed product not on list.		(1 – 2 marks)
4	b	i	A suitable material that is specifically named. E.g. plywood, MDF, aluminium, pewter, polystyrene, acrylic, felt, clay, card, biscuit mix, pastry etc.	1	
4	b	ii	The reason shows good understanding of the working properties of the material relevant to the scale of production.	2	(2 marks)
			The reason is vague and lacking in understanding of the properties of the materials relevant to the scale of production.		(1 mark)

4	c	<p>CNC/CADCAM, use of jigs, templates, moulds for repeatability. QC visual inspection.</p> <p>A concise and detailed response showing a good understanding of quality assurance system and quality control check(s) appropriate to the developed product solution / its manufacture. 2 relevant points developed in detail or 4 in brief.</p> <p>A good response showing a sound understanding of quality assurance system and quality control check(s) appropriate to the developed product solution / its manufacture. 1 relevant point developed in detail and 1 in brief or 3 in brief.</p> <p>A sound response showing a basic understanding of quality assurance system and quality control check(s) appropriate to the developed product solution / its manufacture. 1 relevant point developed in detail or 2 in brief.</p> <p>A simplistic statement which mentions one point only.</p>	4	<p>(4 marks)</p> <p>(3 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p>
4	d	<p>Correctly named tool or piece of equipment for major stages of manufacture. (1 mark each)</p> <p>Appropriate H&S rule identified and described in sufficient detail. (2 marks each)</p> <p>Appropriate H&S rule identified but may not be sufficiently described. (1 mark)</p> <p>No generic H&S rules e.g. do not run, tie hair back unless relevant to process / tool or equipment.</p> <p>No repetition.</p>	6	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	a	i	<p>Any appropriate modification which will help the deaf user use the telephone more effectively. (1 mark)</p> <p>e.g. light which flashes when the phone is ringing.</p> <p>Do not accept standard phone functions such as volume control, speakerphone and speedial.</p>	3	<p>Modification 1 mark</p> <p>Explanation is relevant to and qualifies modification. (2 marks)</p> <p>Simple statement. (1 mark)</p>
5	a	ii	<p>Any appropriate modification which will help the blind / visually impaired user use the telephone more effectively.</p> <p>e.g. larger screen for visually impaired / remove screen, larger buttons, Braille on buttons.</p> <p>Do not accept standard phone functions such as volume control, speakerphone and speed dial.</p>	3	<p>Modification 1 mark</p> <p>Explanation is relevant to and qualifies modification. (2 marks)</p> <p>Simple statement. (1 mark)</p>
5	b		<p>e.g. lightweight frame so not tiring or difficult to manoeuvre over long periods of time; ergonomically designed seat which can be adjusted so that the user is comfortable when sitting for long periods of time; angled wheels for greater speed and manoeuvrability; suspension to cushion when goes over bumps. Motorised, electric powered, folding frame, more compact frame.</p> <p>Accept modifications to the environment, ramps, automatic / wider doors, lowered light switches. Maximum 2 marks for simplistic responses detailing car park layout.</p> <p>A concise and detailed response showing a good understanding of designing for disabled users including several well reasoned points.</p> <p>A sound response showing a basic understanding of the factors relating to designing for disabled users.</p> <p>A simplistic response which mentions one point only.</p> <p>No relevant argument presented.</p>	6	<p>(5 – 6 marks)</p> <p>(3-4 marks)</p> <p>(1-2 marks)</p> <p>(0 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	a	i	<p>Anthropometrics literally means man (anthro) measurements (metric). It is the measurement of the size and proportions of the human body, as well as parameters such as reach and visual range capabilities. Anthropometrics enables us to properly size items “fit” the user. Reference to 5th, 50th and 95th percentile.</p> <p>Do not accept ergonomics.</p>	2	<p>A sound description of anthropometrics. (2 marks)</p> <p>A simplistic statement. (1 mark)</p>
6	a	ii	<p>Average data for size of adult hand used to style grip, size of buttons, average reach / distance of end of nozzle from head and handle; measurements for length of cable – reach and height of user in relationship to possible positions of power socket. Average data for men and women selected to ensure fully inclusive. Reference to 5th, 50th and 95th percentile.</p> <p>Do not accept ergonomics.</p> <p>A concise and detailed response showing a good understanding of how anthropometrics is used in practice. 2 relevant points developed in detail or 4 in brief.</p> <p>A good response showing a sound understanding of how anthropometrics is used in practice. 2 relevant points developed in detail and 1 in brief or 3 in brief</p> <p>A sound response showing a basic understanding of how anthropometrics is used in practice. 1 relevant point developed in detail or 2 in brief.</p> <p>A simplistic statement which mentions one point only.</p>	4	<p>(4 marks)</p> <p>(3 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p>
6	b	i	<p>Ergonomics is the science of designing the workplace environment and product interface to fit the user. Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long – term disability. Ease of use, comfort.</p>	2	<p>A sound description of ergonomics. (2 marks)</p> <p>A simplistic statement. (1 mark)</p> <p>e.g. ‘when devices and equipment fit the human body’ (1 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	b	ii	<p>Use of materials and styling of handle and grip to be comfortable to use, weight of dryer so doesn't cause discomfort to user / aching arms; hair dryer body insulated so heat doesn't transfer to handle and become hot in use; non slip plastics so doesn't fall out of hand; lightweight materials.</p> <p>A concise and detailed response showing a good understanding of how ergonomics is used in practice. 2 relevant points developed in detail or 4 in brief.</p> <p>A good response showing a sound understanding of how ergonomics is used in practice. 2 relevant points developed in detail and 1 in brief or 3 in brief.</p> <p>A sound response showing a basic understanding of how ergonomics is used in practice. 1 relevant point developed in detail or 2 in brief.</p> <p>A simplistic statement which mentions one point only.</p>	4	<p>(4 marks)</p> <p>(3 marks)</p> <p>(2 marks)</p> <p>(1 mark)</p>
6	c		<p>Conformité Européenne ensures the product meets a minimum standard, to signify conformance with European Union regulations regarding product safety. Self-awarded by manufacturer.</p>	1	No marks for giving the full name.
6	d	i	<p>To conform to legal requirements, to communicate to consumers in all languages using universally recognised symbols.</p> <p>A sound response showing understanding of why symbols are used to communicate information. 1 relevant point developed in detail or 2 in brief.</p> <p>A simplistic statement which mentions one point only.</p>	2	<p>(2 marks)</p> <p>(1 mark)</p>

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	d	ii	Conformité Européenne - benefit to user is product confidence that it is safe to use and of a minimum quality standard similar to other products which show the CE symbol.	2	A sound response showing understanding of CE symbol. 1 relevant point developed in detail or 2 in brief. (2 marks) A simplistic statement which mentions one point only. (1 mark)

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	a		<p>JIT Computers used by retailer to order product either by email or through stock / on line catalogue. JIT products often bespoke e.g.computer products where customer requests specific processor, memory, disk drive etc. Manufacturer disassembles order to select appropriate components to send to assembly line. On demand manufacture. Availability of component parts – parts exactly where needed when needed, no delay.</p> <p>Stock control Bar code on products scanned at till point, updates stock database, computer places order with supplier when stock reaches pre determined level to ensure do not go out of stock. Point of purchase informs distribution. Stock levels and location.</p> <p>A sound response showing understanding of the role of computers in manufacturing function. 1 relevant point developed in detail or 2 in brief.</p> <p>A simplistic statement which mentions one point only.</p>	4	<p>2 x 2 marks</p> <p>(2 marks)</p> <p>(1 mark)</p>

7	b	<p>CAM manufacturing more efficient - accurate and much faster than manufacture by hand. Materials purchased in bulk much cheaper than in smaller quantities. Products nested to make maximum use of material in stock form. Once prototype developed to be suitable for mass manufacture, CAM makes every product the same within pre determined tolerances; hand made products often bespoke to customer requirements, time taken in design of each one off product, hand skills slower than machine. Less people involved in manufacture by CAM – less cost in terms of workforce.</p> <p>Initial cost of machine set up offset by mass quantities of product made.</p> <p>CAM manufacturing not 'quick and easy' unless sufficiently justified.</p> <p>A concise and detailed response showing a good understanding of the opposite factors. Examples of relevant products used to show comparison of two types of manufacture and cost implications. Response well structured with good use of appropriate design and technology terminology and showing a good grasp of grammar, punctuation and spelling.</p> <p>A sound response showing a basic understanding of the opposite factors. Examples of relevant products may be used to show comparison of two types of manufacture and cost implications. Response fairly well structured with some use of design and technology terminology with small number of errors in grammar, punctuation and spelling.</p> <p>A simplistic statement which mentions one point only. Response may not include examples of relevant products or products selected may not be appropriate to argument. Response poorly structured with little or no use of design and technology terminology and with numerous errors in grammar, punctuation and spelling.</p> <p>No relevant argument presented.</p>	8	<p>(6 – 8 marks)</p> <p>(3 – 5 marks)</p> <p>(1 – 2 marks)</p> <p>(0 mark)</p>
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Appendix
Question 4 (d)

Some suggestions to aid markers with H&S consideration for processes:

Apart from good housekeeping rules the following additional safety issues are associated with the processes listed for part (c):

Laser cutting – a fully guarded system. Fire and fume risk:

1. Supervise at all times.
2. Ensure extraction is running.

CNC milling/routing – a fully guarded system:

1. Sharp tools so care needed when placing / removing materials.
2. Dust risk, care needed when removing to avoid eye contact.

Pewter casting – burn risk:

1. Wear gloves and face mask when pouring.
2. Goggles and loose clothing/hair secured when drilling or polishing.

Die – cutting – sharp blades:

1. Handle with care.
2. Keep hands free when using press.

Dye sublimation/transfer printing – burn/fire risk:

1. Keep hands away from heated surfaces.
2. Watch fabric closely to avoid fire risk.

Chocolate moulding – burn risk, hygiene risk:

1. Handle with care.
2. Ensure all surfaces which come in contact with chocolate are clean and sterilised.

Pastry/biscuits – burn risk, hygiene risk:

1. Handle with care. Oven gloves needed.
2. Ensure all surfaces which come in contact with food are clean and sterilised.

Ceramics – burn and toxicity risk:

1. Severe burn risk when emptying kiln, adult supervision needed.
2. Toxic dusts/glazes, keep surfaces clean, wash hands after use.

Injection moulding – burn risk:

1. Handle with care/wear gloves when using hot glue – gun system.
2. Keep knife blade cutting away from you when trimming excess plastic.

CNC turning – a fully guarded system:

1. Sharp tools so care needed when placing/removing materials.
2. Swarf risk, care needed when removing to avoid eye contact, metal swarf can be very sharp.

Printing – toxic materials. Fire/fume risk when using solvent based inks:

1. Use solvent based inks in well ventilated area free from naked flame.
2. Wash hands after use.

Machine embroidery – unguarded system. Danger from moving parts, especially needle:

1. Keep hands clear when machine is in use.
2. Fasten all loose clothing/hair.

UMS conversion calculator www.aqa.org.uk/umsconversion