



## **General Certificate of Secondary Education**

# **Design and Technology: Product Design 3544/F**

**Foundation Tier**

## **Mark Scheme**

*2007 examination - June series*

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**Question 1**

(a) Specifically named materials such as:

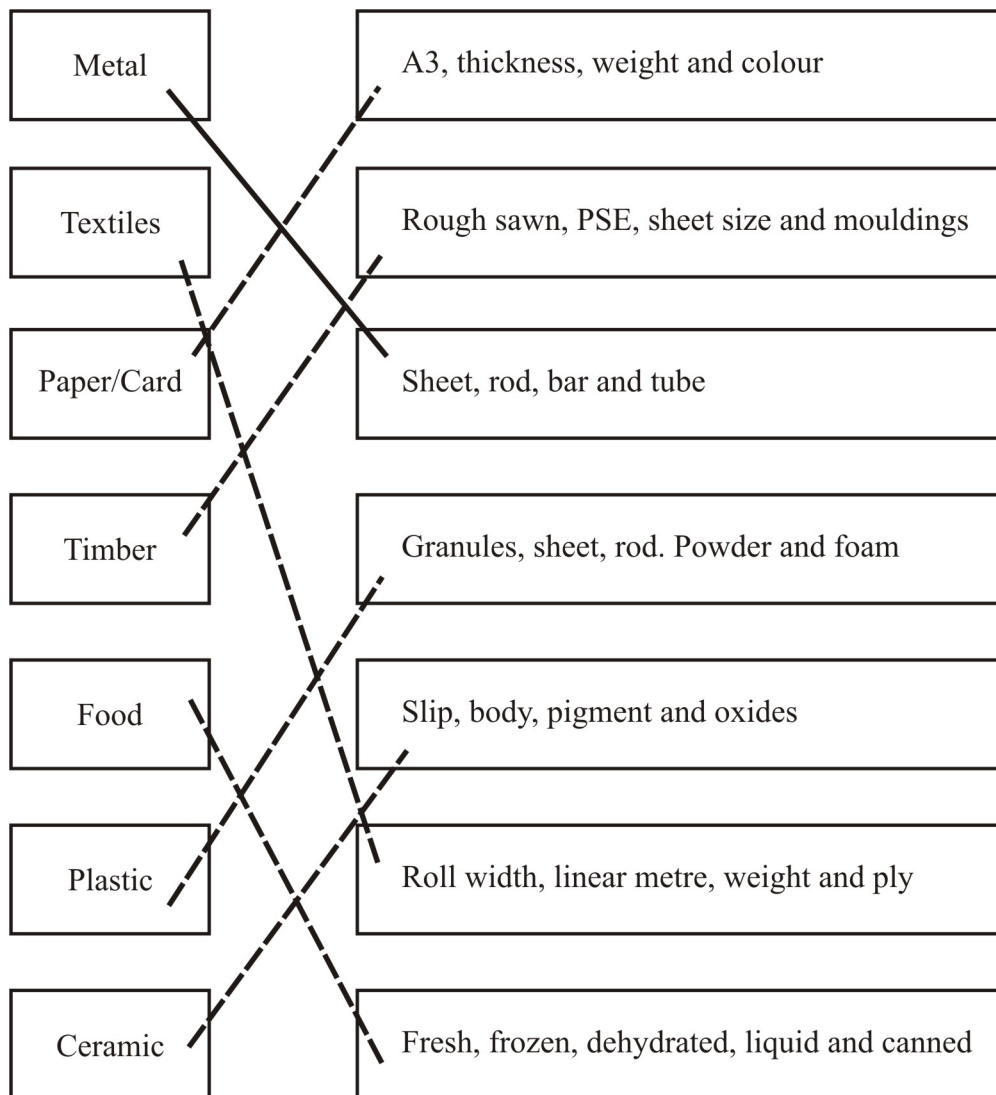
<b>Type of Material</b>		Material name possible responses
<b>Paper Card</b>	⇒	Sugar paper, Cartridge paper, Tracing paper, Corrugated card, and Mounting board, Solid white board, layout paper, foil lined board, tissue paper, crepe paper, carton board.
<b>Timber</b>	⇒	Beech, Ash, Cedar, Yew, Teak, MDF, Plywood, Pine and Mahogany, MDF, chipboard, plywood, hardboard, blockboard, Laminboard, Parana pine, Scots pine (red deal). Any named timber.
<b>Metal</b>	⇒	Aluminium, Brass, Lead, Mild Steel, Cast Iron and High Carbon steel, Stainless steel, High speed steel, Tool steel, Tin, Zinc, pewter, casting alloy (LM4), Guilding metal, Bronze.
<b>Plastic</b>	⇒	Acrylic, PVC, PET, ABS, Vinyl, Polythene, Melamine, Formaldehyde, Polystyrene, Urea Formaldehyde, Polypropylene, Polyester resin, PETE, HIPS, GRP, HDPE, LDPE, PF, UF, Polyurethane (PU), fibreglass, epoxy resin, nylon.
<b>Ceramic</b>	⇒	Porcelain, Bone china, Plaster of Paris, Terracotta and Earthenware, Slip, oxides, concrete, cement.
<b>Food</b>	⇒	Cheese, Fruit, Fish, Vegetables, Pasta and Meat, Potatoes, milk and dairy products, fats, sugar, eggs, bread.
<b>Textiles</b>	⇒	Silk, cotton, Nylon, Elastane, Polyester and Linen, Acetate, polyamide (nylon), Acrylic, Aramid (Kevlar), felt, Tactel.

If candidates have completed the whole table the two rows with the highest number of correct answers will be taken.

*(6 × 1 mark)*

**Question 1**

(b) If candidates have correctly connected the correct material with the descriptions.



If the whole table has been completed or more than the requested two materials have been given, any two correct responses should be accepted.

*(2 × 1 mark)*

Total marks: 8

## Question 2

- (a) (i) Rudimentary drawing lacking in detail with little or no link to natural forms.  
(1 – 2 marks)

The drawing of the product has some detail and natural forms can be identified.  
(3 – 4 marks)

A well drawn product, clear and detailed based on natural forms  
(5 – 6 marks)

A very well drawn product, clear and detailed with natural forms imaginatively incorporated into the design.  
(7 – 8 marks)

**Maximum of half marks if product selected is not from list**

*(8 marks)*

- (ii) Little or no apparent reason for the choice of colours, no tonal effect, no textured surfaces, poor application of colour.  
(1 – 2 marks)

Appropriate colours chosen, some tonal effect applied, little or no textured finishes, colours applied with reasonable care.  
(3 – 4 marks)

Good/relevant choice of colours, appropriate use of tonal effect, textures enhance the presentation of the product, colours applied with care and sensitivity.  
(5 – 6 marks)  
*(6 marks)*

- (b) Vague, incoherent or irrelevant reasons given as to why particular features have been included in the design of the product.  
(1 mark)







Some reasons given as to why particular features have been incorporated into the design of the product.  
(2 marks)

A clear and detailed response as to why particular features have been incorporated into the design of the product.  
(3 marks)  
*(3 marks)*

Total marks: 17

**Question 3**

Mark any 3 best symbols with an explanation and product response.

<p>The Woolmark Symbol</p> 	<p>Explanation - The product is made from new pure wool. (1 mark)</p> <p>Product - Blanket, gloves jumper, etc. (1 mark)</p>
<p>The British Standards Institute Kite Mark Symbol</p> 	<p>Explanation – The product has been independently tested by BSI and meets the standards to gain the Kite mark. (1 mark)</p> <p>Product – Vacuum cleaner, ladder, gas cooker, etc. (1 mark)</p>
<p>Hazardous waste Symbol</p> 	<p>Explanation - The product must not be put out with the domestic waste but must be disposed of through a recycling centre. (1 mark)</p> <p>Product – Computer, batteries, sealed torches, television, any chemical waste, etc. (1 mark)</p>
<p>The Mobus Loop Symbol</p> 	<p>Explanation – The product is suitable for recycling. (1 mark)</p> <p>Product – Cardboard boxes, plastic milk bottles, drink cans etc. (1 mark)</p>
<p>Handle with care symbol</p> 	<p>Explanation – The product must be handled carefully i.e. not dropped. Knocked. Squashed etc. (1 mark)</p> <p>Product – Boxed items such as scientific instruments, glassware, cameras, etc. (1 mark)</p>
<p>The Freeze Symbol</p> 	<p>Explanation - this item is <b>suitable</b> for freezing. (1 mark)</p> <p>Product – Lasagne, pies, pizzas, meatballs, shepherds pie, etc (1 mark).</p>

(3 × 2 marks)

If more than three have been completed then award the marks for the best three responses.

Total marks: 6

# **Question 4**

- (a) (i)** Only one advantage mentioned.

(1 mark)

Two advantages stated.

(2 marks)

Three or more advantages mentioned

**or** two advantages well explained

(3 marks)

Possible responses relating to:

No batteries required, vibrating brush head, effective cleaning teeth/gums, more than one person could use it by changing the head, smaller head, consistent action, when head is worn only this part of the unit needs replacement, hygienic materials used.

(3 marks)

- (ii)** Only one disadvantage mentioned.

(1 mark)

Two disadvantages stated.

(2 marks)

Three or more disadvantages mentioned

**or** two disadvantages well explained

(3 marks)

Possible responses relating to:

Requires recharging, heavier than a normal toothbrush, expensive to replace if damaged, could run out of power when in use, bulky, storage problems.

(3 marks)

- (b)** Stage 1 – Reasonable diagram but does not clearly illustrate the action required.

(1 mark)

Diagram clearly illustrates the actions required

(2 marks)

(2 marks)

Stage 2 – Reasonable diagram but does not clearly illustrate the action required.

(1 mark)

Diagram clearly illustrates the actions required

(2 marks)

(2 marks)

Stage 3 – Reasonable diagram but does not clearly illustrate the action required.

(1 mark)

Diagram clearly illustrates the actions required

(2 marks)

(2 marks)

- (c)** A method of hanging the package has been incorporated into the design.  
(1 mark)

An effective/practical method of hanging the package has been incorporated into the design.  
(2 marks)  
(2 marks)

An area where the company name and logo will be printed can be identified within the design.  
(1 mark)

An area where the instructions will be printed is large enough and has been identified within the design.  
(1 mark)

Some mention of specialist materials in general terms e.g. "See through plastic window".  
(1 mark)

Specific specialist materials mentioned e.g. clear rigid polystyrene. Window materials might include Acetate, PVC, PET.  
(2 marks)  
(2 marks)

Unclear sketch / notes explaining how the heads will be visible.  
(1 mark)

Clear sketch / notes explaining how the heads will be visible, e.g vacuum formed blister or window bonded onto card.  
(2 marks)  
(2 marks)

Note: Markers should refer to part (d) for evidence of achievement in part (c) and reward accordingly.

- (d)** An effective sealing method adequately illustrated. (1 mark)

A recognised printing method given e.g. flexography, gravure, lithography. (1 mark)

The cutting method described would not be suitable for large scale production e.g. Craft knife, lasers and safety rule.  
(1 mark)

The cutting method describes industrial methods of cutting using dies or stamps.  
(2 marks)  
(2 marks)

Note: Markers should refer to part (c) for evidence of achievement in part (d) and reward accordingly.

Total Marks: 24



## Question 5

Choose any two items of footwear.

**(a) A – Wellington boot**

Type of consumer:

Male or female age range 3 to 80 plus years. Works or walks outdoors in wet and possibly muddy conditions.

*(2 marks)*

Reason:

Functional footwear to keep the feet and bottom of the leg dry, the heavy tread helps to prevent slipping.

*(2 marks)*

**B - Beach shoe**

Type of consumer:

Female 3-60 plus years enjoys going to the beach to swim and sunbathe.

*(2 marks)*

Reason:

The shoe is lightweight, easy to slip on and off, any water will easily drain off, materials suitable for wet conditions.

*(2 marks)*

**C - Evening shoe**

Type of consumer:

Female, age range 12+ years enjoys dances, clubbing, looking trendy.

*(2 marks)*

Reason;

More of a fashion statement, elegant and eye catching rather than a functional item.

*(2 marks)*

**D - Sports shoe**

Type of consumer:

Male or female styles would vary depending on gender, 10-30 years, sporty and fashion conscious.

*(2 marks)*

Reasons:

The shoe is both a fashionable item that also has support, grip and comfort when participating in sporting activities.

*(2 marks)*

**Mark Breakdown**

Type of consumer:

A simple consumer profile e.g. gardener, holiday maker, clubber, or sportswomen.  
(1 mark)

A consumer profile identifying two or more specific areas e.g. gender, age range, interests, environment.  
(2 marks)

No marks awarded for choice and name of each item of footwear.

Reasons

One reason given.  
(1 mark)

Two or more reasons  
(2 marks)

- (b)** Product changes that could be mentioned:  
Shape/height of heel, colour, texture, additional materials/ features, changes to the main body of the product, fastenings, materials.

e.g. Product Wellington boot.

New consumer group: Children between the ages of 3 and 9.

Product changes:

Change the colour of the boot to bright green, mould frogs' eyes into the toes of the boots, get rid of the tie at the top of the boot.

Identifying a consumer group  
(1 mark)

Product changes limited to one area poorly explained.  
(1 mark)

Product changes that identify two or more areas adequately explained.  
**or** one product change well explained.  
(2 marks)

(2 marks)

Total marks: 11

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**Question 6**

- (a)** A basic shape drawn

(1 mark)

A shape adequately drawn, with a hole in an appropriate place.

(2 marks)

The shape is well drawn and is in proportion to the two other shapes with a hole in an appropriate place.

(3 marks)

*(3 marks)*

- (b)** (i) A suitable material that is specifically named. E.g. plywood, MDF, aluminium, polystyrene, acrylic, felt, clay, card, biscuit mix, pastry etc.

*(1 mark)*

- (ii) The reason is vague and lacking in understanding of the properties or the materials.

(1 mark)

The reason shows a good understanding of the working properties of the chosen material.

(2 marks)

*(2 marks)*

- (c)** Some suggestions to aid makers with processes are shown at appendix A.

- (i) Some stages of production identified with little explanation.

(1 mark)

The most important stages identified with some explanation

(2 marks)

Most of the stages of production have been identified and are adequately explained.

(3 marks)

Every stage of production has been identified and fully explained.

(4 marks)

*(4 marks)*

- (ii) The list of tools and equipment contains few items some of which are incorrectly named or would not be required.

(1 mark)

The list does not contain all the necessary tools and equipment but those that are, are correctly named and appropriate.

(2 marks)

The list of tools and equipment is complete and correctly named.

(3 marks)

*(3 marks)*

- (iii) Appropriate decoration techniques might include:

Printing, painting, engraving, icing, should be suitable for the chosen material or process.

Surface decoration is indicated in the sketches but no explanation on how it has been achieved given.

(1 mark)

Surface decoration present in the sketches and some explanation on how it has been achieved in the notes.

(2 marks)

Surface decoration is clearly indicated on the sketches and a full explanation on how it has been achieved given.

(3 marks)

*(3 marks)*

- (iv) The sketches and or notes are difficult to follow or understand and do not convey all the necessary information.

(1 mark)

The sketches and notes convey most of the information required but are unclear in places.

(2 marks)

The sketches and notes are well presented and convey all the necessary information in a clear coherent manner.

(3 marks)

*(2 marks)*

- (d) The notes and or sketches show an adequate solution to the problem but with no explanation.  
(1 mark)

The notes and sketches shows an appropriate solution to the problem but not explained in any great detail.

(2 marks)

The notes and sketches display a good solution to the problem and are clear and well explained.

(3 marks)

*(3 marks)*

- (e) Needs to be references to tests e.g. check that materials are not flammable.  
Credit should be given to a simple test which is very detailed e.g. use a gauge to check that each decoration could not be swallowed by a child.
- An explanation that is vague and does not mention a specific danger.  
(1 mark)
- A simple explanation with one or more clearly identified danger e.g. toxicity  
(2 marks)
- An explanation with two or more clearly identified dangers with explanations e.g. no small parts/ children could choke on them, non-toxic/ children would not be poisoned.  
(3 marks)
- (3 marks)*
- (f) Safety rule 1 given e.g. wear goggles/ put guards on machines in place, wash hands thoroughly, dust extraction unit switched on etc.  
(1 mark)
- Reasons 1 given relevant to the rule e.g. to prevent damage to eyes, to prevent food poisoning, breathing problems prevented etc.  
(1 mark)
- Safety rule - 2 as above  
(1 mark)
- Reason 2 – as above  
(1 mark)
- (4 marks)*

Total marks: 29

**Question 7**

**(a) (i) Special features:**

Difficult to open by children

Moisture proof

Clearly labelled

Tough construction

One special feature stated. (1 mark)

Two special features stated. (2 marks)

Three special features stated. (3 marks)

*(3 marks)*

**(ii) Possible responses**

Young children have small hands and do not have the strength as adults.

Older people may have arthritis or rheumatism with weaker or restricted movement.

People may be physically disabled and lack the coordination to open the lid e.g. people who have cerebral palsy.

A general explanation that is vague and lacking in detail, e.g. child proof lid.  
(1 mark)

An identified group e.g. older people with arthritis but poorly explained.  
(2 marks)

An identified group or people with a clear explanation of the difficulties they would have opening the lid, which is designed with child safety in mind.  
(3 marks)

*(3 marks)*

- (b)** Possible products: items with small detachable parts (children under 3), craft knife blades, bleach, motor cars, electric lawnmower, electric shaver, plastic bags.

(i) Appropriate product named (check if qualified by (ii)) *(1 mark)*

(ii) Safety issue identified e.g. toxic chemical. *(1 mark)*

(iii) An explanation that does not fully explain all of the features of the product.

*(1 mark)*

An explanation that identifies all of the features of the product e.g. (Bleach) The product is packaged in a tough plastic bottle that is difficult to open and is clearly labelled both with text and brail (for the partially sighted or blind) that the contents are caustic/toxic.

*(2 marks)*

*(2 marks)*

- (c)** (i) Possible products: Skateboards, mobile phone, BBQ, radio, roller boots, radio controlled cars/planes, fireworks etc.

An appropriate named product. *(1 mark)*

(ii) The nuisance issue identified, e.g. physical injury *(1 mark)*

(iii) A limited explanation of how the situation could be improved

e.g. bring in new laws

*(1 mark)*

An explanation that fully explains how the situation could be improved.

e.g. skateboard – Provide a skateboard park with exciting/interesting aspects to it away from the general public that would be free and open during daylight hours.

*(2 marks)*

*(2 marks)*

Total marks: 14

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**Question 8**

- (a)** Possible features that could be listed:

Bag-less, see through plastic bin, cyclone technology used, contemporary styling/colour, good product back-up, extensive use of plastic mouldings, slick advertising. Include innovative use of materials/technologies/manufacturing techniques which other manufacturers have copied. Tools carried around with the cleaner. Key components identified by different colour. Storage and easily maintained

One feature identified (1 mark)

Two features identified (2 marks)

Three features identified (3 marks)

*(3 marks)*

- (b)** A vague explanation with little understanding of why the feature is important.

(1 mark)

A simple explanation displaying some understanding of why the feature is important.

(2 marks)

A detailed explanation that fully displays a sound understanding of why the particular feature is important to the product.

(3 marks)

*(3 marks)*

- (c)** A simple non-technical statement on how CAD could be used when developing a design.

(1 mark)

A detailed non-technical explanation.

(2 marks)

An explanation that displays a good understanding of how CAD can be used to develop a design with some technical vocabulary used.

(3 marks)

*(3 marks)*



- (d)** A simple statement e.g. “The vacuum cleaner is stylish and works well”  
(1 mark)

An explanation that shows some insight into why manufactures may have been influenced e. g. The extensive use of plastic mouldings may have made other manufacturers look at their use of materials and processes.

(2 marks)

An explanation that shows a good understanding e.g. Innovative use of technology, manufacturing methods, and contemporary styling use of colour has ensured that the Dyson products are in demand by consumers.

(3 marks)

*(3 marks)*

- (e)** Possible products: Swiss Army knife, Levi jeans, London underground map, Rolex watch, anglepoised lamp, AGA cooker, Monopoly, Cats eye, Doc Martins boots, Fender Stratocaster guitar, I pod etc.

- (i) Suitable product named. *(1 mark)*

- (ii) A vague explanation such as “it looks good”

(1 mark)

An explanation that identifies at least one feature e.g. The single uncluttered layout of the map, (the London underground map).

(2 marks)

A explanation that refers to style, materials, simple lines, type face, etc. and displays a good understanding of why some products are called “design classics”

(3 marks)

*(3 marks)*

Total marks: 16

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**TOTAL MARKS FOR PAPER = 125**

## Appendix A

**Laser cutting** - Draw in suitable software (Corel, 2D Design Tools, ProDESKTOP), nominate different colours for cutting and engraving (typically red for cut, black for engrave but do vary), place material in laser and adjust setting. Send single design to print so that quality can be checked. If ok, copy and paste ensuring maximum use of material (nesting). Send to print, replace material until required number achieved. Unlikely any edge finishing is required in most materials.

**Milling/routing** – Draw in suitable software (Corel, 2D Design Tools, ProDESKTOP), nominate different colours for different size cutters or, place material in machine and adjust setting (typically referred to as offsets, may include feeds and speeds relative to material). Send single design to plot so that quality can be checked. If ok, copy and paste ensuring maximum use of material (nesting). Send to plot, replace material until required number achieved. Edges are likely to be rough so some form of sanding and polishing/painting/varnishing might be specified.

**Pewter casting** - Draw in suitable software (Corel, 2D Design Tools, ProDESKTOP), nominate different colours for different size cutters or, place material (typically MDF or Necuron) in milling machine/router and adjust setting (typically referred to as offsets, may include feeds and speeds relative to material). Send single design to plot so that quality can be checked. If ok, repeat to get a number of moulds. Heat pewter (variety of methods used) until molten and pour into moulds. Once cool, remove from mould and trim excess material. Polishing is likely, maybe application of colour.

**Die-cutting** – Make a cutter by fastening dieflex bade around MDF/plywood shape (double sided tape or screws). Use this in press to stamp out shapes. Likely to be linked to some form of printing eg. Laser printing is likely for card, sublimation printing/transfer printing for fabrics. Latter involves a heat transfer system – press or iron. Reference might be made to crop marks for alignment. Fabric parts might be sewn together and filled with wadding.

**Chocolate moulding** – First issue is to manufacture moulds in large quantity. Any system can be used for making formers although CAM system (laser/milling) is most likely. Vacuum form moulds (most likely from HIPS or PET – food quality needed) in trays. Trim and clean/disinfect. Heat chocolate in bain marie or microwave, pour into moulds, scrape off surplus chocolate and put in fridge to set. A protective cover will be needed (foil, polythene).

**Pastry/biscuit/salt-dough/clay cutting** – a cutter will need to be made. A simple vacuum formed HIPS cutter can be made over any rigid former and trimmed to make an effective stamping tool. Alternatively, a strip of sheet metal could be shaped and joined to form a cutter. Material will need to be rolled out into even sheets and stamped. Excess material rolled out again and process repeated. Cooking or kiln firing should be noted. Decoration might include icing or edible printing onto rice paper, painting, glazing etc. Edible decorations likely to be covered (cellophane wrapping for example).

**Injection moulding** – could utilise an injection moulding machine or hot melt glue gun and coloured sticks. Mould could be made in acrylic layers (laser cutting most likely). Plastic injected into mould and allowed to cool (more than one mould would be needed). Once removed, excess plastic needs to be trimmed (fettling). No further work should be necessary.

**CNC turning** – as flat shape not specified this process might be suggested. Only suitable for forms made up cylinders, spheres, cones which are symmetrical around the length. Draw in suitable software (LatheCAM). Place material in lathe and ensure correct tools are in place. Length and diameter of material (billet) will need to be put into software. Send single design to machine so that quality can be checked. If ok, repeat until required number achieved. Unlikely any finishing is required in most materials (aluminium or brass most common) although polishing on buffing wheel is possible.

**Screen printing/block printing** – Might be suggested onto a range of materials such as card or fabric. Screen/printing block will need to be prepared. A wide variety of methods are possible. Ink applied to block and pressed onto material or pressed through screen using a squeegee. There will be a considerable amount of drying time needed. A suitable cutting out method will need to be specified but scissors used to cut a simple outline might be regarded as suitable. Additional work such as sewing fabric pieces together will gain extra credit.

**Machine embroidery** – this would be a very slow production method but might be suggested. Design to be drawn in suitable software (Corel Draw, Paint) and pasted into the embroidery software (PE Design). Fabric fastened into frame with backing fabric attached. Coloured threads threaded into machine in correct sequence. Design sent to machine. Excess threads need to be trimmed afterwards. A suitable cutting out method will need to be specified but scissors used to cut a simple outline might be regarded as suitable. It would not be feasible to cut out shape prior to embroidering in this instance as fabric needs to be held in frame. Additional work such as sewing fabric pieces together will gain extra credit.

Apart from good housekeeping rules the following additional safety issues are associated with the processes listed above:

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

Fasten all loose clothing /hair