



General Certificate of Secondary Education

Design and Technology: Product Design 3544

Higher Tier

Mark Scheme

2006 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

**ASSESSMENT AND QUALIFICATIONS ALLIANCE
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

June Examination 2006

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

HIGHER TIER

Question 1

- (a) (i) (ii) Two marks for relevant properties. One mark for stating whether it is recyclable or not.

Material qualities Natural Strong Absorbent Hardwearing Washable	Cotton Shirt recyclable
Material qualities Protein Calcium Vitamins A and d Some Fat Texture Flavour	Dairy Products Cheese Non-recyclable
Material qualities Hard wearing Non-absorbent Easily cleaned Washable	Porcelain Teacup Non-recyclable
Material qualities Good print surface Print on both sides Resists grease/moisture Easily cut Flexible	Laminated Plying cards Non-recyclable

<p>Material qualities</p> <p>Will not rust Light in weight Can be highly polished Soft to work</p>	<p>Aluminium Scooter</p> <p>recyclable</p>
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<p>Material qualities</p> <p>High impact strength A thermoplastic Flexes without breaking Range of colours Mouldable</p>	<p>Polypropylene Toy</p> <p>recyclable</p>
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<p>Material qualities</p> <p>Very strong Stable Different finishes Flexible</p>	<p>Plywood Skateboard</p> <p>recyclable</p>
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(6 marks) (6 marks)

- (b) (i) copper / zinc
copper / aluminium
cotton / elastane
wood fibres / urea formaldehyde
polyester resin / glass
cardboard / aluminium
wood veneers / glue
cement / aggregate
fat / flour
polyester / cotton
wool / acrylic

(2 x 1 marks) (2 marks)

- (ii) Named product

(1 mark)

Explanation which indicates both where and why the material is used

(2 marks)

Explanation which only indicates where or why the material is used.

(1 mark) (3 marks)

Marks can be awarded for part (ii) independent of answer in part (i)

Total 11 marks

Question 2

(a) (i) (ii) (iii)

Market research:

To collect information using questionnaires, interviews and customer preferences. To enable the provider to improve their product. (2 marks)

Collecting information on the product service or system (1 mark)

Prototype:

The first stage in developing a product, a model or product used to improve the final outcome during testing and evaluation. (2 marks)

A model or product to see how it looks (1 mark)

Evaluation

Evaluation can take place during the development of a product to improve the final outcome. The final product can be tested and modification made if required. (2 marks)

The final product can be tested and modification made if required. (1 mark)

Anthropometrics

The study of human measurements in relation to a man made object, the height of a seat the size of a handle etc. (2 marks)

The study of human measurements (1 marks)

Ergonomics

Ergonomics is the study of people in their environment. Ergonomics deals with issues such as comfort, size, smell, sound etc.

A detailed description with reference to its application. (2 marks)

A basic description related to objects/environments and people. (1 mark)

Product Analysis

To compare information and establish a direction for the project or product based on evidence. You can analyse research information or existing products to form an opinion.

(2 marks)

You can analyse research information or existing products to form opinions.

(1 mark)

Questionnaire

A structured set of questions developed for a target audience with the results recorded and information collected. An essential market research tool.

(2 marks)

A structured set of questions developed for a target audience

(1 mark)

Design Brief

The design brief explains why there might be a need for a new product. An outline of the problem and who it affects, the needs arising from the problem. How the product will be used and the environment it will be used in.

(2 marks)

The design brief explains why there might be a need for a new product. An outline of the problem and who it affects.

(1 mark) (6 marks)

(b) This question covers a wide range of ICT applications, equipment and processes. The marking scheme does not cover every eventuality. However pupils must explain how this process and equipment helped with the development of their projects and show working knowledge to gain the full marks. In this situation software is acceptable within the answer (6 marks)

(i)/(iii) Name of ICT product/application (general purpose software such as WORD would get 1 mark if explained) (1 mark)

(ii)/(iv) Full explanation (2 marks)

Partial explanation (1 mark)

Examples of ICT applications.

Plotter/cutter – Large scale production of graphical images in sheet or roll form. Materials used paper card and vinyl.

Flatbed Scanner – Used to input images and text which can enhance the research process.

Colour Printer – used to output images and text created on the computer to be included within the design folio.

Information processing collection and storage

Development of databases spreadsheets etc. can be very helpful in the production of research analysis.

Graphic and Presentation software

A wide range of software could be suggested, Corel Draw, Photoshop, Pro desktop etc.

Digital Camera

Total 12 marks

Question 3

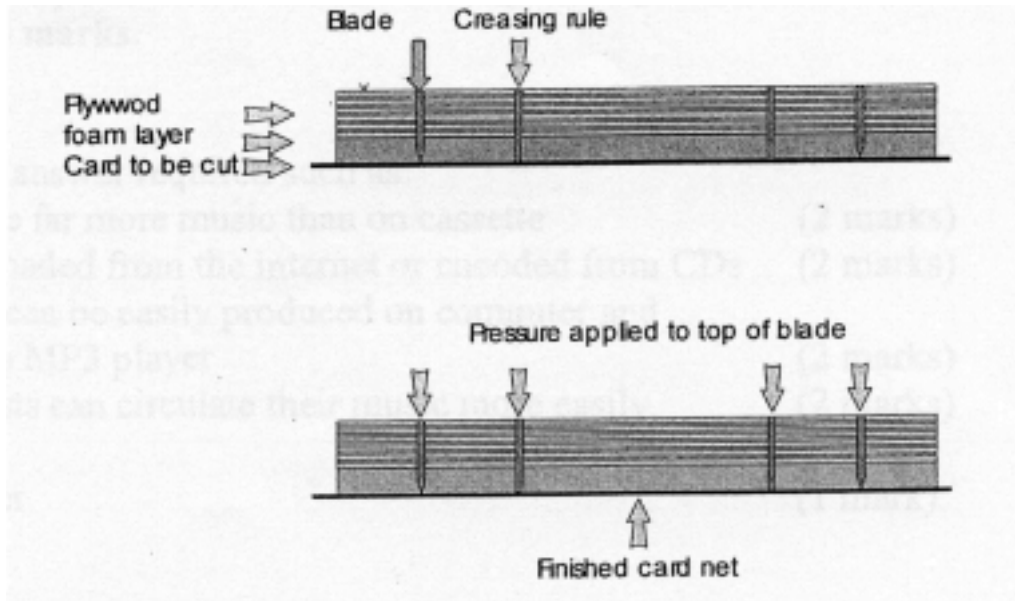
- (a) (i) Cup is wider at top than base and therefore less stable
 Straw can act as lever and increase chance of tipping
 Lightweight materials
- Detailed qualified response noting one or more of above points (2 marks) (2 marks)
- Superficial response noting one of above points (1 mark)
- (ii) The cup needs to be insulated, easy to lift, easy to drink from, easy to carry, lid to prevent spills, stable, rigid, fairly firm. (1 mark)
- Single point given (1 mark)
- (iii) To protect the user and keep the drink warm.
 Detailed response which relates to (ii) (2 marks) (2 marks)
- Superficial response or another requirement not used in (ii) (1 mark)
- (iv) Expanded polystyrene/waxed card
- Single point (1 mark) (1 mark)
- (b) (i) 4 suitably positioned holes cut into top surface (1 mark) (10 marks)
- the design is made rigid (1 mark)
- the design can clearly be manufactured from a single piece of card (1 mark)
- ease of holding (1 mark)
- should be easy to fold (1 mark)
- should be held in place without any adhesives (1 mark)
- drawings and notes are clear and are easily understood (1-2 marks)
- feasibility of solution illustrated (1-2 marks)
- (ii) **Design details of how the carrier fits together,** (4 marks)
- A viable clear and detailed method shown and explained (4 marks)
- A viable solution given but would need some minor modifications for it to work. Clear and well explained sketches and notes. (3 marks)
- A solution that would be difficult to put into practice, not very well explained. (2 marks)
- A vague solution proposed difficult to follow (1 mark)

(c) Only accept one of the following for 2 marks: (6 marks)

Lithography, Screen Printing, Flexography (2 mark)

Any other named printing process – gravure, sublimation, block, letterpress, etc (1 mark)

Die-cutting or stamping (accept press-knife cutting)



A detailed explanation which might show cross section of die cutting tool or some other “pastry cutter” type tooling. Should reference sharp block for cutting, rounded block for creasing. (3 marks)

A partially correct explanation which might omit creasing rule or indicate printed image applied after cutting. (2 marks)

Superficial reference to stamping (1 mark)

One additional mark awarded for any one of the following terms used

Die cutting or stamping
Press knife cutting or stamping
Forme (1 mark)

Total 26 marks

Question 4

(a) **A - 35 mm film camera** (8 marks)

Advantages – Very good picture quality with proven technology very reliable. Interchangeable lenses with manual setting. Removable flash system. Speeds and shutter speeds can be adjusted for different effects. Use of filters. Film readily available in B&W or colour. Can be used with tripod.

Disadvantages – Heavy to carry replacement films are sensitive to light, Films have a shelf life. Take time to process the pictures. Complex to use, limited number of pictures, requirement to change films, etc.

B – 35 mm film disposable camera

Advantages – cheap to buy, simple to use, lightweight, compact size.

Disadvantages – This is not the best system for the environment very wasteful, as the camera is used once and thrown away. Limited functions often with poor lens quality. Has to be sent away for processing film.

C - phone camera

Advantages – easily carried small in size easily used to take quick photos. Can send pictures via blue-tooth technology (wireless). Part of another product which is always carried around.

Disadvantages- new technology untested, limited picture control and quality. Expensive.

D - digital camera with memory card

Advantage – the picture can be processed very quickly. Interchangeable memory cards to which can be reused. Small light and compact in design very good picture quality. Can delete unwanted pictures. Store images on computer. Can email images. No printouts needed.

Disadvantages – involved process to print pictures requires high volume batteries, battery life.

One advantage/disadvantage with qualification (2 marks)

Very simple statement (1 mark) (4 × 2 marks)

(Accept answers for more than two cameras if rubric is not followed)

(b) Reference to continuous change new and developing technologies fashion / public taste, legislation safety standards. Plasma screens, wall mounted interactivity, digital technology, improved reception. Surround sounds, remote controls, watch and record options, market pull/technology push, etc.

Specific improvements stated one mark each

1 mark for each development listed up to 4 marks (4 × 1 marks) (4 marks)

Total 12 marks

Question 5

- (a) (i) Any suitable material which can be moulded, stamped milled etc, Plywood, MDF, aluminium, Polystyrene, felt, fabric clay, card, biscuit mix, pastry, acrylic, etc (1 mark) (1 mark)
- (ii) Any sensible reason related to chosen material such as: Ease of production, cost, availability (1 mark) (1 mark)
- (b) An accurate description of the process such as casting, injection moulding, laser-cutting, die-cutting, milling etc. is required. The process chosen must be feasible for this quantity and related to school production.
- (i) Clear and accurate description where candidate shows a full understanding of the process and has taken account of repeatability through moulds, jigs, formers CAD/CAM etc. (4 marks) (4 marks)
- Candidate shows some understanding but response is lacking in some areas (2 – 3 marks)
- Simple division of labour with no reference to manufacturing aids (1 mark)
- (ii) A full list of tools and materials correctly named. (3 marks) (3 marks)
- Some items not mentioned on the list (2 marks)
- A limited list with several omissions (1 mark)
- Reward responses if found in places other than tools and equipment box.
- (iii) Clarity of communication: Drawings and notes are easy to follow. Candidate has laid out process sequentially (3 marks) (3 marks)
- Drawings and notes are detailed but they are not easy to follow or may be superficial in detail. (2 marks)
- Clear sketches without notes or clear notes without sketches (1 mark)

- (c) Appropriate decoration techniques might include: printing, painting, texturing, engraving, glazing, icing, embossing, embroidery etc. depending on the material used. (4 marks)
- Door and windows shown appropriately positioned (1 mark)
- Decoration is appropriate to the house design and adds visual impact. The process, which will be suitable for a batch of 500 is clearly explained and takes account of repeatability and accuracy. (3 marks)
- Decoration is generally appropriate to the house and adds visual impact. The process is reasonably explained but may not take account of repeatability and accuracy or may not be suitable for the scale of production. (2 marks)
- Decoration provides some visual impact. (1 mark)
- (d) Response needs to deal with quality systems and should take note of manufacturing aids. (3 marks)
- A full response which might include: QA is accounted for through the choice of process, such as CAM, which ensures consistency. Materials are checked, samples are taken at various stages. Final check against agreed sample. (3 marks)
- A more superficial response may refer to checks being made at some stages during production. (2 marks)
- Some mention of a specific check being made. (1 mark)
- (e) (i) Full explanation (2 marks) (2 marks)
- Vague explanation (1 mark)
- (ii) Specific clear relevant example (2 marks) (2 marks)
- Vague explanation (1 mark)
- Total 23 marks**

Question 6

(a) **3D Modelling** (4 marks)

Can see the whole project turn the product to see all side. Work out proportion of design elements within the product. Estimate internal space and key sizes working to scale. The effect of light on a product. Visual appeal of the product.

Food analysis

Software systems to analysis the content of a recipe and calculate the nutritional vale within the food product. To be able to construct specific meal to meet a medical condition relevant to diet.

Rapid Prototyping

Computer generated 3D model of a component or product. The development time of a product is reduced as these items are produced in the fraction of the time tradition machining would require, the lead time of a product is reduced.

Wear Testing

A test jig to create a friction test on fabric. A test rig to see how many times a car door will open and close successfully until it fails.

Computer generated modelling

A pictorial view of a product that can display colour shading and texture.

Can be turned to display more than one side of the product.

A system model of an electronic circuit, the designer can simulate the circuit performance under powered conditions.

Identifying one or more advantages and qualifying the statement with examples (2 marks)

Identifying advantage only, without explaining example (1 mark)

(b) (i) Quality Assurance checks the systems before, during and after manufacture. It ensures that consistency is achieved. The benefits to the customer are improved outcomes. General quality of manufacture, reliability and responding to the customers needs. (4 marks)

Clear definition of QA being related to checking the systems throughout manufacture. (2 marks)

Mention of checks being made (1 mark)

Benefit to customer in improved products, checked against standards, externally certificated. (2 marks)

Benefit to customers, better quality products only. (1 mark)

- (ii) Quality control is a series of checks which are carried out on a product as it is made. The checks are made to make sure that each product meets a specific standard. The benefits to the manufacture are less waste materials saving time and energy. A reputation for a high quality product which is reliable and in turn improves sales. (3 marks)

Explanation which shows understanding of QC being ongoing checks (1 mark)

Example is detailed and sensible.
Checks are measurable. (2 marks)

Example is superficial or checks are not measurable. (1 mark)

- (c) (i) An example of a batch produced product, such as food, clothing, furniture, ceramics. (1 mark) (3 marks)

Full explanation which includes time saving strategies, jigs, etc. (2 marks)

Partial explanation (1 mark)

- (ii) An example of a product using continuous production technology, such as coca cola, washing powder, electrical goods. (1 mark) (3 marks)

Full explanation which includes automation, specialised assembly / production lines (2 marks)

Partial explanation (1 mark)

Total 17 marks

Question 7

- (a) Any two of the following function listed: (4 marks)
- To protect
 - To inform
 - To display
 - To transport
 - To contain
 - To preserve (2 marks)
- With an explanation (2 marks)
- Without an explanation (1 mark)
- (b) **Container A** - advantages - material is transparent level of milk visible. (4 marks)
Easy to hold, large volume, easy to pour. Re-sealable etc.
Container A - disadvantages –non biodegradable, heavy, difficult to pour
- Container B**- advantages – biodegradable, cheap to produce, advertising on the surface
Container B - disadvantages – Difficult to open, cannot reseal container.
Difficult to pour. Difficult to recycle.
- Container C**- advantages – Clean to use, can be sterilised and reused. Can contain advertising. Easy to pour, transparent.
Container C - disadvantages – Difficult to hold by some users, cannot reseal container expensive to produce, brittle will smash on impact.
- Any detailed advantage from above (2 marks)
- Any superficial advantage from above (1 mark)
- Same for disadvantage
- (c) Waste management landfill issues. As the materials will be broken down within the soil, the land could then be safely reused for a different purpose in the future. (3 marks)
- With an explanation (2 – 3 marks)
- Without an explanation (1 mark)

(d) **R - Registered design.** Often used with trademarks. Offers greater Protection. (2 marks)

P - Patents are for inventions. An invention is a product that is new or improved, or a process that can be used in industry. Mark awarded if “dry cleaning” given.

C - Copyright is an unregistered right and comes into effect immediately, as soon as something is created and fixed in some way. For example, drawn or printed on paper, recorded on film, recorded as sound on a tape or disk or formatted as an electronic file for the internet.

Full explanation (2 marks)

Partial explanation (1 mark)

Symbol name given only (1 mark)

Accept responses which clearly show understanding of design protection but do not name the degree of protection. (1 – 2 marks)

(e) Reasons such as preservation of natural resources, global warming, de-forestation, environmental impact of land fill sites, sustainable supplies etc. (3 marks)

Full explanation (3 marks)

Partial explanation (2 mark)

Limited understanding of the issues. (1 mark)

Total 16 marks

Question 8

(a) (i) **Advantages of using the internet** Simultaneous working in different location, improved communication via e-mail. Research information available 24 hours. (1 mark) (1 mark)

(ii) **Disadvantages of using the internet:** Computer system may have a virus, hackers can see restricted information. Distraction for employees, out of date, reliability, plagiarism. (1 mark) (1 mark)

(b) **Advantages of using CAM within a prototype** – with many CAM processes such as rapid prototyping manufactures can develop products in a much shorter time span, cutting down the lead time. The product does not have to have involved machining by technicians at an early stage which can be time consuming and costly. Changes can be made quickly. Repeatability of identical components. (3 marks)

Explanation **with** example and **discussed** (2 – 3 marks)

Explanation **with** example. (1 mark)

(c) **Advantages of using CAM in volume production** – very accurate, particularly useful in producing large quantities of the same the object. Will run for extended periods of time. Used to make complex moulding. Include references to automation/robotics. Working in hostile environments. H & S issues. (3 marks)

Explanation **with** example and **discussed** (2 – 3 marks)

Explanation **with** example. (1 mark)

Total 8 marks

Total marks for paper = 125