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GCE 2005
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ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Design & Technology: Product Design
(Subject Code PD1D)

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.

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Design and Technology: Product Design

3D Design Unit 1 (PD1D)

Quality of Written Communication

The following marks are allocated to the quality of the candidate's written communication. Make a separate assessment of the candidate's overall ability as demonstrated across the paper using the criteria given below.

Performance Criteria	Marks
The candidate will express complex ideas extremely clearly and fluently. Sentences and paragraphs will follow on from one another smoothly and logically. Arguments will be consistently relevant and well structured. There will be few, if any, errors of grammar, punctuation and spelling.	4
The candidate will express moderately complex ideas clearly and reasonably fluently, through well-linked sentences and paragraphs. Arguments will be generally relevant and well structured. There may be occasional errors of grammar, punctuation and spelling.	3
The candidate will express straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.	2
The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.	1

This mark scheme is intended as a guide to the type of answer expected but is not intended to be exhaustive or prescriptive. If candidates offer other answers which are equally valid **they must be given full credit.**

Many responses at this level are assessed according to the **quality** of the work rather than the number of points included. The following level descriptors are intended to be a guide when assessing the quality of a candidate's response.

(low mark range)
The candidate has a basic but possibly confused grasp of the issues. Few correct examples are given to illustrate points made. Description may be unclear.
(mid mark range)
The candidate has some knowledge but there will be less clarity of understanding. Some correct examples given to illustrate points made. Description better but unclear or confused in parts.
(high mark range)
The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. This candidate's answer shows clear evidence of understanding.

Question 1

(a) (i)

- Picnic cutlery – Any suitable polymer e.g. High Impact Polystyrene.
- Yoghurt pot – PET, PP, HIPS, HDPE, LDPE, (Not acrylic)
- Tennis Racket – Carbon fibre reinforced polymer / aluminium alloy, etc.
- Cricket bat – willow. Other hardwoods are not normally used but could be e.g. beech.

(Award 1 mark if material is not quite suitable but would work or for basic answers such as 'steel' or polystyrene'. For two marks look for 'High Impact Polystyrene, etc) (2 x 2 marks)

(ii)

- Basic explanation with a few basic points e.g. its 'strong', won't rust. (1 - 2 marks)
- Better explanation with a number of correct points linked to product / application

  e.g. 'its hard, doesn't scratch and harbour dirt, easy to clean.' 3 – 4 marks
- Full explanation with all points linked to product / application. (5 -6 marks)

(**maximum 3 marks if basic list of generic properties given).** (2 x 6 marks)

(iii) Basic diagram of a suitable manufacturing process with a few points labelled.

(1 mark for stating correct process) (1 – 3 marks)

Better diagram of a suitable manufacturing process with all points labelled and some explanatory notes. (4 – 6 marks)

Detailed diagram with all points labelled and or a good explanation of the process. (7 – 9 marks)

(2 x 9 marks)

Suitable answers include:

Picnic cutlery – injection moulding. (Accept compression moulding if thermoset given in (a))
Yoghurt pot-vacuum forming, thermoforming
Tennis racket-lay-up method or die cast (for aluminium)
Cricket bat-turned handle, bat-cut and planed, glued with specific adhesives, details of finish.

(b) Expanded Polystyrene cup –

- Thermoplastic is suitable to injection mould or thermo form
- Thermoplastic can be recycled
- Low cost – essential for a disposable item
- Non – toxic – food safe
- Insulator – for reasonably safe holding of hot liquid

(1 – 2 marks for each relevant point)

(maximum 3 marks if simple generic list of properties) (6 marks)

Total 40 marks

Question 2

(a) Response may include:

Metal watch

- Reference stainless steel / aluminium alloy or mild steel chrome plated steel, silver, etc
- Stainless steel is hard, resists corrosion etc. no need to finish
- Case die cast
- Possible reference to punching components such as gears, etc
- May refer to manufacture of strap. Greater complexity with metal strap – increasing cost
- Use of glass or Polycarbonate for watch face
- Press forming of parts e.g. back, strap

Plastic watch

- Thermoplastic –e.g. P.P. or HDPE, LDPE, etc used in plastic watch. (Acrylic only in face)
- Potential for colour with plastic – improving aesthestics
- Reference to injection moulding plastic parts
- Improved ergonomics by using plastic
- Cost linked to materials / manufacturing process / volume.

(1 – 2 marks per relevant point)

Award marks as follows:

- Candidate uses basic terminology, some of the materials stated may be inappropriate. Very little knowledge of manufacturing process. No reference to volume of production. Generic properties given. (1 – 3 marks)

- Better terminology with correct specific materials. Some knowledge of manufacturing processes. May not be entirely correct description of processes. Answer may still be quite basic with little reference to the cost of production, volume, etc. Properties will be linked to aesthetic and functional requirements of the products. (4 – 6 marks)

- Full answer with correct specific materials and appropriate manufacturing processes described. Good reference to the functional and aesthetic requirements of each product and how each material meet these. Some knowledge of costs, speed and volume of production. (7 – 10 marks)

(2 x 10 marks)

(b) Health and safety may include:

- Guarding machines
- Personal protective clothing
- Training – for safe operation of tools / equipment

- Use of isolator / RCD
- Supervision by adult
- Risk assessments carried out of each process / material
- Health and safety inspection of equipments / tools
- Use of dust extraction
- Check location of emergency stops
- Use of 110v or battery powered tools where possible
- Limit machining of harmful materials such as MDF, Fibre Reinforced Composites, etc.
- Etc.

(1 – 2 marks per relevant point). Max 1 mark if list of protective clothing.

Award marks as follows:

- Very little knowledge of health and safety. Basic list of protective clothing and possibly basic school workshop rules. (1 – 3 marks)

- Some knowledge of health and safety. One or two points maybe expanded in some detail. (4 – 5 marks)

- Good knowledge of health and safety with either a comprehensive list of health and safety measures or several explained in detail. (6 - 8 marks)

(8 marks)
Total 28 marks

Question 3

(a) (i) Rough sawn pine – frame work e.g. shed frame, roof truss.

(ii) Low – density polyethylene, (LDPE) e.g. carrier bags, sachets, squeezy bottles, flexible lids etc.

(iii) Acrylic sheet e.g. signs, shop displays, etc.

(iv) Plywood – Wardrobe backs, table tops, boat construction. (4 x 1 mark)

(b) Suitability for application

(i) **Rough sawn pine e.g. fencing / shed timber frames**

- Sustainable (essential for large volume work in building trade etc).
- Relative low cost compare to planed timber and more exotic timbers.
- Readily available as grown in Europe.
- Seasons fairly quickly compared to hardwoods.
- Rough sawn absorbs applied preservatives better than planed timber.

(ii) **Low Density Polyethylene (LDPE) e.g. carrier bags**

- Good tensile strength-ideal for shopping bags carrying loads
- Can be printed on for store advertising, etc
- Thermoplastic and therefore recyclable
- Can be plastic welded to make bags, etc
- Safe to use with food stuffs
- Inexpensive when made in large volume.

(iii) **Acrylic Sheet e.g. menu card holder**

- Can be line bent on a strip heater to make 3D objects
- Can be vacuum formed to make 3D objects
- Available in a wide range of attractive colours, etc
- Does not require any surface finish

(iv) **Plywood e.g. table tops**

- Available in large wide boards
- Good strength obtained from lamination
- Available with high quality veneers to colour match
- Stable
- Strength allows thin sheets to be used

(1 -2 marks for each relevant property linked to application)
max 3 marks if list of generic properties) (4 x 6 marks)

Total 28 marks

Question 4

(a) e.g. Aluminium / aluminium alloy

Steel – 1 mark
Mild steel – 1 mark
Stainless steel – 1 mark (2 marks)

(b) Award marks as follows:

- Basic explanation with a few basic points e.g. its 'strong', won't rust, etc (1 – 2 marks)
- Better explanation with a number of correct points linked to product / application. E.g. reference to aluminium having good aesthetic properties for product marketing, it won't be too heavy for children to use, etc (3 – 4 marks)
- Full explanation with all points linked to product / application. Good insight to materials e.g. aluminium is the most suitable material although difficult to joint. Steel would work but is not really suitable because of corrosion etc. (5 – 6 marks)

(maximum 3 marks if basic list of generic properties given)

(c) No diagram or basic diagram of a suitable fabrication process with a few points labelled
(1 mark for stating correct process) (1 – 2 marks)

Better diagram of a suitable fabrication process with all labelled and some explanatory notes, or a good explanation with a basic or no diagram (3 – 4 marks)

Detailed diagram with all points labelled and a good explanation of the process. (5 marks)
(2 x 5 marks)

Accept the following fabrication process:

Arc welding
Mig welding
TIG welding
Aluminium brazing
Machine screws / grub screws
Cap screws
'Cam' operating machine screw on adjustable handle
Nut + Bolt
(do not accept simply 'welding', 'soldering').

(d) **Justification for fabrication may include:**

- Difficult to cast in a single piece
- Needs to be built with component parts to allow height adjustment etc
- Casting can have hairline faults, difficult to detect. Fabricated would be robust, safer.
- Bikes and similar products generally made this way. (proven, reliable, construction method)
- Buy in components from specialist manufacturers
- Casting would be too expensive.

(1 – 2 marks per relevant point) (4 marks)

(e)

- Basic explanation with a few basic points e.g. plastics are 'strong', available in colours, 'durable', etc (1 – 2 marks)

- Better explanation with a number of correct points linked to product / application
  e.g. polymers can provide traction as surface can be textured, hard – resist abrasion from road (3 – 4 marks)

- Full explanation with all points linked to product / application.

e.g. Use of colour to attract purchase and to identify different tyre types for racing, stunts, etc. Ability to be moulded into tyre shape. Grip qualities of polymer. Resistance to abrasion from road surface. Resistance to impacts curb, misuse. Solid moulded tyre avoids punctures, etc. (5 – 6 marks)

(maximum 3 marks if basic list of generic properties given). (6 marks)

Total 28 marks