



General Certificate of Education

**A2 Design and Technology:
Product Design 6551**

PD6D Written Paper

Mark Scheme

2007 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.

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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. This candidate does not have a clear idea of what s/he is writing about.
(mid mark range)
The candidate has some knowledge but there will be less clarity of understanding. Some correct examples given to illustrate points made. This candidate knows what s/he is writing about but is confused in part.
(high mark range)
The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. This candidate knows what s/he is writing about and provides clear evidence of understanding.

Section A: Materials and Components

Question 1

- (a) Answers should relate to both manufacture **and** function. However, there needs to be no penalty for concentration of a particular focus. **No marks** for naming a product but the type of product will dictate the accuracy and appropriateness of the answer given.
- (i) Example products: food can / car body shell.
- Ability of metal to withstand deformation by compression forming without cracking, this may be improved by heating but cold forming OK.
 - Ensures relatively cheap mass-production by press forming
 - Thin sheet can be pressed cold – economics
 - Corrosive, requires finish, can be welded
 - Damage in accidental impact costly/difficult to repair
 - Etc.
- (ii) Example products: cooking pans / engine blocks / drinks cans.
- Ability to dissipate heat evenly / quickly - speed / ease of use in cooking.
 - Non-corrosive – anodised finish.
 - Light weight an advantage – esp. for engine block also manufacture by casting
 - Etc.
- (iii) Example products: flat pack furniture, work surface under-form.
- Does not warp / split, uniformity - has no grain. Can use re-cycled waste – cost
 - Needs finish, easy to apply, fabricate
 - Etc.
- (iv) Example products: tools / chisel saw blade / drill bits
- Tough, can be heat treated to be hard and withstand wear / temper to reduce brittleness.

Breakdown:

Low:

Simple statements, generic non-specific to product, some inaccuracies.
Sometimes show a lack of knowledge of the named properties.

(1 - 2 marks)

Mid:

Understands properties but lacks detail, minor inaccuracies.

(3 - 4 marks)

High:

All properties identified accurately and appropriate to product.

(5 marks)

(4 × 5 marks)

(b) Can be **either** simple workshop, dot punch test **or** laboratory Brinell / Vickers hardness test.

Basic description / simple crude sketch with limited annotation

(1 – 2 marks)

Accurate, detailed description with good annotation to clear sketch

3 – 4 marks)

(4 marks)

Question 2

Material must be specific for the award of marks.

1 mark possible for specific material.

Do not penalise if wrong if goes on to give accurate description of properties relevant to product.

Container

Accept - PE/LDPE (Low density polyethylene). PS . PP combination polymers, PET, PVC.

Do not accept acrylic, abs.

Low raw material cost due to minimum quantity (refer to use of finite resource – oil).

Vacuum formed manufacture. High volume mass production. Automated machine production

Light weight, can be printed, self-coloured, disposable (non-bio-degradable

– possible to bio-degrade)

Food safe, hygienic, waterproof.

Push chair, baby buggy frame

Accept - aluminium/ duralumin / chrome/molybdenum tube/ mild steel, extruded polymer.

Light weight, flex, easy to join / finish – paint, anodised / self finish- corrosion resistant / can be extruded or electric resistance welded to form tube. Fabricated with rivet /nut-bolt

Medium volume, batch produced using basic workshop labour skills and/or semi automated machine manufacture.

Point of sale display

Laminated/ varnished card, correx, accept corroflute, 3mm MDF or hardboard, foamboard, also plastics, e.g. acrylic, HIPS.

Light weight, low cost, ease of print. Mass / batch production requires basic manufacture techniques and some machine production

Life span a few months

Wedding ring / commitment ring

Accept- gold, platinum, titanium alloy.

High cost – exclusivity/ association with symbolic, does not tarnish hypoallergenic, cast – fabricated – soldered, small scale or batch produced requiring specialist craft skills.

Coffee table

Accept- any appropriate but specific wood / hard/soft.

Accept glass.

Use of attractive grain, hand made joints, one-off – batch production requires craft skills etc.

Breakdown:

Low:

Non-specific or inappropriate material. Fails to refer to manufacture, function, use or quantity. Shows limited understanding of material and / or application.

(1 – 3 marks)

Mid:

Named and appropriate with reference to manufacture etc.

Content has some inaccuracies and lacks detail.

(4 – 6 marks)

High:

Accurate and appropriate materials with full detailed reference to manufacture, function etc

(7 – 8 marks)

(3 × 8 marks)

Section B: Design and Market Influences

Question 3

- (a) Look for understanding of specific ergonomic issues relevant to each product.
Anticipate that each product has a varied number of opportunities for ergonomic points for improvement.
Do not disregard points which may not be strictly ergonomic if they are relevant improvements.
Reward quality of description esp. through use of sketches – annotation.

Figure 1 Moulded plastic handles shaped to fingers, left/right handed, blade angled from handle, protrusion between handles to prevent them coming together, serrated blade. Range of colours – stainless steel, blades for long life edge.

Figure 2 Clam or slide cover to protect screen/buttons and/or make microphone to speaker distance suit ear to mouth larger keys, colour coded, smaller/slimmer = lighter, ergonomic to hand shape, Bluetooth technology for hands free, voice recognition auto dial.
Range of colours/patterns/textures.
Magnetic –one hand catches.

Figure 3 Plastic or soft grip, moulded handles, range of colours / chrome plated to add interest, stainless steel for ease of wash-anti corrosion, magnetic bar to catch lid once removed.
Left/right hand grips.

Breakdown:

Low:

General descriptive issues only, does not show real understanding of ergonomics.
Only one or two points, with poor descriptions.

(1 – 2 marks)

Mid:

Shows basic understanding of ergonomics and provides a number of relevant improvements which are easy to follow.

(3 – 4 marks)

High:

Fully appreciates ergonomic issues across each product.
Provides a good description of a number of useful improvements.

(5 – 6 marks)

(3 × 6 marks)

- (b) Should refer to a specific product and provide suitable annotated sketch.
May include aesthetic improvements – reward accordingly.
- To enhance appeal e.g. children’s toys, primary colours.
 - Safety – tools, motor vehicle/machine switch gear markings etc.
 - Differentiate parts for ergonomic interaction e.g. Dyson parts.
 - Signage – road signs, instruction manuals.
 - Use of smart materials / thermochromic.

Breakdown:

Low:

Poor choice of product and only limited description of how product improves.
(1 – 2 marks)

Mid:

A small number of reasonable suggestions for improvements which are explained and are relevant to the product.
(3 – 4 marks)

High:

Shows sophisticated understanding of how colour can be used to improve the function of a specific product.
Well explained and appropriate.
(5 – 6 marks)

(6 marks)

Question 4

Better candidates can be expected to begin with a discussion of the meaning of the opening statement and to express their acceptance or otherwise of the three factors.

Two different products must be referred to for full marks.

Candidates should work with reference to the framework of materials, manufacture, aesthetics, style and function-use as asked for, however, they should not be penalised for not doing so or for having any particular emphasis.

Breakdown:

Low:

Candidate shows limited understanding of any or all of the three factors.

Response is largely a generalised description of the product with concentration on one or two aspects. Answer appears to be confused.

(1 – 4 marks)

Mid:

Candidate understands the suggested principles of good design and how these contribute to the success of a named product. There may be a small number of errors or omissions and some confusion.

(5 – 7 marks)

High:

Candidate fully understands the premise for good design and provides a sophisticated analysis of their chosen product, making reference to all of the suggested factors and provides a detailed and accurate description of the product.

(8 – 12 marks)

(2 × 12 marks)

Section C. Processes and Manufacture

Question 5

(a) The question centres around issues of environmental impact. **There should be no specific mark allowance for naming a product** but issues must be relevant to a product and not simply generalisations. Marks are not necessarily divided equally between the two strands named in the question.

- The use of raw materials which may be non-renewable/ finite. Environmental damage due to extraction and use of energy in extraction / processing.
Effect of manufacturing – energy – toxic waste
- Depending upon product – use of energy in function/use.
Generation of waste in use.
Disposal of finite product, effect on environment of toxins as waste
 - CFC's in refrigeration, recycle / re-use. Bio-degradable
 - Etc.

Breakdown:

Low:

Candidate shows some confusion regarding the issues of environmental impact. Simplistic statements and concentrates on only a small number of points with some inaccuracies

(1 – 4 marks)

Mid:

Candidate shows understanding of many of the issues of environmental impact, relevant to chosen product. There may be minor confusion but points will be supported by explanation and detail in descriptions.

(5 – 9 marks)

High:

Candidate shows complete understanding of most of the issues of environmental impact and provides accurate and detailed explanation of the various points they include.

(10 – 14 marks)

(14 marks)

- (b) The response may be divided (see below) into design and/or retail issue but anticipate that most will provide a holistic answer.
Some may concentrate on commercialisation issues i.e. sales / retail

Pre- Production –

Establish the need for product – gap in the market, review of competition / existing products.
Market research, niche market, conduct survey, business plan, produce prototype.
Issues of “Good Design “ – originality/function/excellence.

Post Production –

Advertising / promotion offers. Consumer support, warranty, on-going development.

Breakdown:

Low:

Candidate has a very “narrow” view with perhaps a single or limited number of strands to their answer and does not fully understand the range of the question.

(1-3 marks)

Mid:

Candidate suggests a number of ways in which to improve commercial success, makes reference to these and explains how they could be applied to a given product.

(4-6 marks)

High:

Candidate explains in detail a varied number of appropriate ways to improve the success of a given product. Referring to both design and manufacture issues.

(7-10 marks)

(10 marks)

Question 6

The question concerns the development of specific plastics to suit the needs of a variety of products and how these products have been re-designed in order to facilitate the use of the new / plastic material.

The quality of the answer may depend upon choice and specific nature of product but no marks for this.

Marks: Name of plastic must be specific and correct / appropriate plastic: for full marks.

(2 marks)

(3 × 2 marks)

Properties may not be equally divided between manufacture and function/use, however, do not reward with high marks if either is ignored.

Manufacture Plastic can be formed / moulded with limited fabrication – less labour needed.
Can be mass-produced in high volume, low unit cost.

Function Self finish / coloured, light weight, ergonomic shape,
non- corrosive, non-contaminant , bio-/ non biodegradable.

Marks:

Low:

Candidate shows only basic knowledge of material and how individual properties are linked to the specific needs of both manufacture and use of different products and so has a narrow concept of material properties.

(1-2 marks)

Mid:

Candidate has a reasonable understanding and knowledge of materials development and application. Can link properties to both manufacture and function issues.

(3-4 marks)

High:

Candidate fully appreciates how plastics can be developed to meet specific and varied needs, links these to manufacture and function use.

(5-6 marks)

(3 × 6 marks)