



## General Certificate of Education

# Design and Technology: Product Design (5551/6551)

*Unit 6 (3D Design) PD6D*

## 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.

# Design and Technology: Product Design

## 3D Design (PD6D)

### *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.*

<i>Performance Criteria</i>	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

**NB** 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.

<b>(low mark range)</b>
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.
<b>(mid mark range)</b>
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.
<b>(high mark range)</b>
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.

**PD6D**

**SECTION A**

**1**

There are **8 marks** available for each specific chair.

*Candidate typically describes details seen from observing photos rather than showing knowledge and understanding of materials.*

*Generic comments “made from wood” – “hand made” / “plastic” – “machine made”*

(1 – 3 marks)

*Candidate shows appreciation of how properties relate to meet criteria for function and use. Although there may be some errors or lack of precise detail – “must be strong” – “look nice”. “A hard wood” – “thermo-plastic”*

(4 – 6 marks)

*Candidate shows depth of knowledge and sophisticated understanding of how properties meet criteria for function and manufacture. Accurate selection of both materials and methods of manufacture.*

(7 – 8 marks) (8 marks)

Arts & Crafts chair

Made using hard wood (oak) accept any reasonable hardwood.

- String, durable, solid timber, open grained dark brown attractive colour/grain
- One-off or batch produced - easily worked with hand tools
- Labour intensive / craftsman manufactured
- Fabricated using permanent / glued joints – mortice & tenon
- Natural – wax / clear varnish finish
- Natural materials suit Arts & Crafts ethics

Panton Chair

Manufactured using injection moulded polypropylene / original also laminated GRP.

- Strong, durable, flexible, self coloured – pigmented thermoplastic (except GRP version)
- Mass produced in volume
- Light weight / stacking
- No maintenance
- Low skill once dye is developed
- Initial set up costs high
- Contemporary materials suit modern style

Laminated wood / chrome steel legs 1970’s chair

- Strong, light, stacking, laminated to achieve curve one-piece seat / back unit
- Chromed steel legs – factory produced, bought in component
- Light, strong yet thin, easily bent – welded to form sub frame
- Easily mass-produced
- Use of veneer lamination to give natural wood finish

- 2 (a) (i) Any acceptable / common name for smart material  
e.g. thermochromic / photochromic pigments, phosphorescent pigments,  
shape memory alloys, piezoelectric effects on quartz crystals etc.  
(Only 1 mark if spelt wrongly) (2 marks) (2 marks)
- (ii) Products may typically include :-  
kettles, baby / children feeding equipment, thermometers, battery testers,  
graphics on clothes – safety clothing, cooking equipment, electronic  
devices. (2 marks) (2 marks)
- (iii) explanation for the use of smart material :-  
  
to achieve output/change i.e. safety, cost reduction, simplicity of  
manufacture, simplicity of function, accuracy etc.  
  
*Candidate provides only simplistic / basic reasons for use “it changes  
colour”.* (1- 3 marks)
- Candidate shows some understanding of benefits gained good appreciation  
shown regarding application.* (4 – 6 marks)
- Sophisticated and detailed knowledge / understanding of application of  
smart material.* (7 – 8 marks) (8 marks)
- (b) (i) Typical alloys from brass, stainless / other steels, duralumin and other  
engineering alloys etc. Must be relevant to named alloy. (3 marks) (3 marks)
- (ii) Ornaments, musical instruments, food / kitchen equipment, bicycles / motor  
vehicle applications, tools. (3 marks) (3 marks)
- (iii) Change of colour, melting points, resistance to corrosion, strength,  
durability etc, linked to stated application at (ii).  
  
*Simplistic / very basic knowledge of properties.* (1 - 2 marks)
- Some understanding of properties specific to named alloy & application  
e.g. more strength – hardness but with increased weight* (3 – 4 marks)
- Sound knowledge of properties e.g. harden / temper of high carbon steels.*  
(5-6 marks) (6 marks)

**SECTION B**

- 3 (i) Products from a typical list of :-  
kitchen / bathroom equipment, communication equipment / telephones,  
computers, furniture / storage etc.  
Analysis of product to show individual physical limitations associated with  
sight, movement, hand, arm, leg, hearing disabilities, wheelchair user.  
Improvements range from simple increase in size – ergonomics to use of  
new technologies - electronics etc.  
As there are few specialist products available on the general market it is  
anticipated that candidates will provide “inventive” / original design ideas.  
(12 marks) (12 marks)

- (ii) Issues connected with access – ramps, wide doors / corridors, handles at  
low level, lift access, signage etc.  
(12 marks)

*Candidates list basic problem areas with limited suggestions to improve the  
product / building. Simplistic understanding of the issues with little  
knowledge of ergonomics, application of technologies.*  
(1 - 4 marks)

*Some understanding of specific disability issues and how they may be  
addressed through good design – use of texture / colour, increased  
dimensioning, electronics – systems feedback, use of smart materials.*  
(5 - 8 marks)

*Detailed and sophisticated analysis of problems and elegant / original  
application of design solutions as above.*  
(9 - 12 marks) (12 marks)

4

Technological changes will relate to :-

Portable CD player using compact disc and portable mini-MP3 player

- Compact disc – liable to damage / wear
- Pre-recording quality excellent
- MP3- Digital quality recording but must access PC / internet
- Compressed files may limit quality of sound
- Power supply replaceable / re-chargeable batteries
- Internal power supply / battery with factory access only
- Ear phones with / without remote link
- MP3 player small size use of internal hard drive – down load music

(2 x 12 marks) (2 x 12 marks)

*Candidates simply describe what can be seen in the photographs with only passing reference to the list of suggested elements to address. Answers show very limited knowledge of many changes through developments in technologies (see above).*

(1 - 3 marks)

*Candidates show some understanding of the developing technologies and how they have improved the individual products, making specific reference to the areas listed. Use of engineering plastics – injection moulded to provide hard wearing / ergonomic attractive cases. Ease of use portability etc.*

(4 - 6 marks)

*Detailed and accurate knowledge of technology development showing study and appreciation of the use of these technologies to provide improved and quite sophisticated products which combine design and technology to produce successful products.*

(7 - 12 marks) (12 marks)

**SECTION C**

- 5 (a) Description must be of issues relating to the **use** of the stated product and this effect upon the environment.

Issues should relate to energy consumption / use of finite resources etc :-

- Electrical (include reference to original source of energy)
- Fuel petrol / oil (motor vehicle)
- Water consumption (washing machine)
- Pollution / air and water
- Sight / noise pollution
- Solid waste residue in sewer / drains (washer)
- Use of finite resources
- Environmental danger due to accidents

*Candidates simply provide a list of general issues which lack specific understanding of the type of factors listed above.*

(1 - 4 marks)

*Candidates show understanding and appreciation of the issues (see above) however, there will be some confusion and generalisation and a lack of detail in the answer.*

(5 - 8 marks)

*Candidates show detailed knowledge and understanding of all of the relevant issues and how these relate the chosen product to specific environmental concerns (see list above).*

(9 - 12 marks) (12 marks)

- (b) Typical design issues listed below :-

Vehicles

- Light weight / aerodynamics to improve fuel economy
- Use of plastics – to improve weight / re-cycleable
- ‘Smart’ car technology
- Hybrid power supply
- Alternative – non-finite fuels
- System based engine management technology

Washing machine

Eco-labelling

- Low energy / off peak use
- Cool wash / small load settings
- Improved powder / liquid detergents
- enzyme reactive, bio - active
- bio-degradable / low phosphate



*Candidates show only basic understanding of how design/technologies can be employed to address issues. Expect to see generalized statements – “make it lighter – use less energy”.*

( 1- 4 marks)

*Candidates show some understanding of how modern technologies / design has improved recent products - should refer to use of catalytic converters etc. Anticipate some confusion and / or lack of detail in the answer.*

(5 - 8 marks) (8 marks)

*Up to date and detailed appreciation of how current technologies address issues-energy council marking / grading of domestic products, hybrid motor technology by Toyota/Honda etc.*

- 6 (a) The answer may be a holistic essay addressing use of computers generally but must include specific reference to the named elements or each of the three references may be treated individually.

Answers should address efficiency and waste and not simply general use of computers.

- CIM direct telecommunications between design and manufacture.
- FMS facility to modify production / output according to need.
- CAM application of computers to control manufacturing systems.

*Little depth of knowledge of use of computers and their application in manufacturing industries. Answer will be mostly generalisations.*

(1 - 4 marks)

*Candidates show some accurate knowledge of the issues (see above) relating to each specific technology and show some knowledge of the efficiency and effect upon waste.*

(5 - 8 marks)

*Candidates show detail and depth of knowledge including appropriate terminology to explain manufacture efficiency issues specific to each technology system.*

(9 - 12 marks) (12 marks)

- (b) It is hoped, but not anticipated, that candidates will be aware of new government legislation relating to the issues of re-cycling such consumer products.

Typically candidates will refer to :-

- Use of smart materials to facilitate disassembly
- Use of thermoplastics for re-cycleability
- Re-use of components
- Bio-degradability
- Use of finite materials
- Use of toxic / dangerous materials / finishes
- Factory support – return facility

*Candidates show only basic knowledge of the importance of “end of life” issues and the problems which must be addressed. Answers do not show any appreciation of how good design can be used to improve products.*

(1 – 4 marks)

*Candidates show some understanding of how designers employ issues (see list above) to address problems. Despite some confusion / lack of specific detail there will be appropriate reference to use of materials / technologies and relevant products.*

(5 - 8 marks)

*Candidates show accurate and sophisticated appreciation of the place new technologies / materials / manufacturing methods have in addressing the problems associated with relevant products.*

(9 - 12 marks) (12 marks)