



2009 Product Design

Advanced Higher

Finalised Marking Instructions

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Question 1

- (a) (i) **1 mark per valid justification, maximum 2 marks, eg**

Injection moulding:

- high volume production
- details/complexity of part
- accuracy required by parts
- no secondary process required
- high quality finish.

- (ii) **1 mark for specifying a suitable material and 2 marks allocated for explanation, maximum 3 marks**

Material:

Any suitable thermoplastic, eg

- polypropylene
- ABS, etc.

Suitability:

Explanation including properties of material in relation to component A, eg

- durable
- tough
- good surface finish possible
- range of colours
- reduction in friction.

- (b) (i) **One mark for each description of advantage or disadvantage up to a maximum of 3 marks, eg**

Advantages:

- economy of scale
- details/complexity/accuracy of part
- efficiency of material.

Disadvantages:

- high cost of tooling
- reduction in strength
- requires secondary processes
- limits types of materials used.

- (ii) **One mark for each benefit up to a maximum of 2 marks. One mark for each valid example up to a maximum of 2 marks.**

Benefits of using alloys:

- combination of best of multiple materials
- “new” properties
- properties to suit specific uses
- enhancement of existing properties (conductivity, strength, durability, etc).

NB Examples may be of products or alloys

(c) One mark for each justified point up to a maximum of 3 marks

- Suitability for automated production.
- Limited range of materials.
- Limited range of processes.
- Few parts.
- Simplicity of product.
- High volume.

**(d) One mark for justifying each market, maximum 2 marks
NB There are no marks for identification of market.**

First pair – “professional”

- High quality.
- Cost.
- Accuracy.
- Lifespan.
- “Looks the part”.

Second pair – “school children”

- Simplicity.
- Low cost.
- Aesthetics.
- Features.

(Total 17 marks)

Question 2

(a) **1 mark for each valid reason that leads to a clear explanation that demonstrates an understanding as to why car design is not based on the average user, eg**

- Unlikely for any one person to represent the 50th percentile in every piece of ergonomic data.
- Designing for the average does not mean the majority. Everyone above or below the average would be excluded.
- Importance placed on safety, comfort and ease of use which are heavily influenced by ergonomics. The more people that are comfortable and find the car easy to use, the safer it will be.
- Designing for the average user would cause the majority to suffer different forms of discomfort and problems with operating the car.
- Global market for cars also forces the designer away from the average as demographic changes have a large impact on ergonomic considerations. The average American driver differs from the average Japanese driver.
- Cars in order to be commercially successful have to have a wide appeal and be accessible.
- Wide range of users, male and female, young or old makes it impractical to design for the average user.
- High levels of competition and high expectations from the consumer place greater demands on comfort, ease of use and safety.
- Candidates could also explain in detail how different types of ergonomic data, if based on the 50th percentile, would impede the majority of users and cause problems for the user and/or manufacturer. For example:
If the distance to the gear stick was derived from the average person's reach, based on arm length, only those with above average arm length would be able to reach it comfortably. Over stretching could present a safety risk when driving or at the very least make the car less appealing to the consumer.

(b) **1 mark for each valid description as to how physiology and psychology will have influenced a car's interior. Maximum 3 marks if only one is described.**

Possible answers may include how certain parts of the car's interior will have been developed with consideration to the:

- strength of the user
- range of movement of the user
- reactions of the user
- co-ordination of the user.

Descriptions could also include how certain parts of the cars interior will have been developed considering the user's **senses** in relation to **colour, sound, perception, vision etc.**

NB Marks will not be awarded for generic statements about psychology and physiology.

(c) **1 mark for each valid description as to how rapid prototyping has improved the development of new cars, eg**

- accurate modelling
- rapid models (24hs) quicker and more instant feedback and evaluation
- freedom from resistant materials
- models can be made with exact features such as wall thicknesses, ribs and webs
- some rapid prototype machines can use the same material or imitate the properties of the actual materials used
- direct transfer from computer to 3 dimensional models.

(d) **1 mark for each valid advantage of using jigs, eg**

- accuracy
- repeatability
- ease of alignment
- speed
- deskilling of assembly (reduction in costs).

(Total 14 marks)

Question 3

- (a) **1 mark for each valid point that leads to a clear description of the impact on economics and safety. A maximum of 4 marks can be awarded to each issue described, eg**

Economics and Durability

- Cost of materials could be more expensive.
- Cost of coatings and protective finishes.
- Extra costs involved to make the product more robust ie, thicker stronger materials, fixings and construction.

Safety and Durability

- Durable play frames are likely to remain safe.
- Corrosion and broken parts will present a danger to the public.

Economics and Aesthetics

- Creating an exciting and interesting playground will add to its design and manufacturing costs.
- Colourful and complex shapes tend to be more expensive to manufacture.
- More expensive materials chosen for their aesthetic properties.
- Design development will take longer and therefore be more expensive.

Safety and Aesthetics

- Compromise between aesthetics and safety.
- Playground will have to look fun and exciting, encouraging children to jump, swing and slide but at the same time be safe.
- Playgrounds also have to assure parents and guardians that the children will not come to any harm.
- Designers have to strike a balance of exciting and safety in the minds of the children.

- (b) **1 mark for each valid point that leads to a clear description of an effective evaluation strategy.**

Clear **description of strategy** that would be effective at gaining the information required. Descriptions could focus on the user or the client as the target market or both.

Description may include the following:

- building prototypes, test rigs and/or computer models
- creating questionnaires, observations and planned user trips
- descriptions are likely to include what information is required, how it will be obtained and why it is useful
- research leading to good specification which is then met.

NB No marks for stating a range of different strategies.

(Total 13 marks)

Question 4

(a) **1 mark for each valid description that has considered the benefit of collaboration in a project such as the XO-1 laptop, eg**

- larger knowledge base
- expertise
- existing research and data
- reduced development time
- spreading the costs
- latest technology
- specialisation
- improved infrastructure
- reduced risk of failure
- better understanding of market
- possible reduction in distribution costs.

Maximum of 3 marks for each area (research, development, production and distribution) described.

(b) **1 mark for each valid point of how costs could be minimised during the manufacture, eg**

- just in time production
- standardisation
- subcontracting
- standard components
- automation
- CAD, CAM and CIM
- flow production
- reduction of materials and components
- efficient assembly methods
- quality control.

NB Marks will not be awarded for simply stating a range of steps. Candidates have to explain in some detail how the steps result in a reduction of manufacturing costs.

(c) **1 mark for each valid point when describing the benefits of involvement in a non profit project, eg**

- marketing and advertising opportunity
- improved public perception
- positive reputation
- improved knowledge and understanding
- new links and collaboration opportunities
- introduction to new market
- diversification
- wider understanding of market
- company may gain new skills
- boost to company morale.

(Total 17 marks)

Question 5

(a) **1 mark for each disadvantage identified, maximum 3 marks, eg**

Recycling:

- storage of waste in house
- collection of waste.

Reusing

- regular supply of waste parts
- cleaning of parts
- legislation.

Replanting:

- ensuring suitability of replacement tree
- environmental damage
- economics.

(b) **1 mark for each change described in a product, maximum 3 marks per pressure group, eg**

- introduction of legislation (environmental)
- more efficiency demanded from customer
- safety demanded from customer
- cheaper products demanded from customer
- profit margins for manufacturers
- better looking products demanded by consumer.

(c) **1 mark for each valid point, maximum 6 marks, eg**

- explaining benefits over conventional product
- celebrity endorsements
- replacement old for new
- limited editions
- adverts in magazines read by influencers/decision makers
- raising profile of issues through published articles
- try before you buy.

(Total 15 Marks)

Question 6

All answers must make reference to products. Marks will not be awarded for general statements. Answers will depend on products selected.

- (a) 1 mark for each valid point, maximum 3 marks
- (b) 1 mark for each valid point, maximum 3 marks
- (c) 1 mark for each valid point, maximum 3 marks
- (d) 1 mark for each valid point, maximum 3 marks

(Total 12 Marks)

Question 7

This question is set to test the candidate's ability to present a reasoned argument to a design issue. Although there is an underlying body of design knowledge required to answer it there is a very wide range of possible answers. Therefore the question is marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made.

The table below is designed to assist with the placing of answers within the full mark range.

0-3	4-6	7-9	10-12
<p>An answer which falls into this category may do so for a number of reasons. It could be that:</p> <ul style="list-style-type: none"> • It demonstrates very little knowledge or understanding of the subject matter. • There is little or no reference to products. • Very few points are made. • Much of it does not answer the question. • The answer is simply too thin. 	<ul style="list-style-type: none"> • Knowledge of the subject matter and a secure understanding of the main aspects will be demonstrated. • The answer will be relevant to the question. • Reference to at least one product. • Although examples are used points made are unclear. 	<ul style="list-style-type: none"> • Knowledge of the subject matter and a secure understanding of the main aspects will be demonstrated. • The answer will be relevant to the question and demonstrate a good level of comprehension. • Reference to a few products or selected references to a number of products. • Several clear points are made and examples are used to support them. 	<ul style="list-style-type: none"> • Detailed knowledge of the subject matter and a secure understanding of the all aspects will be demonstrated. • The answer will be relevant to the question demonstrating a high level of comprehension. • Very detailed reference to a few products or selected references to a wide range of products. • Examples are clearly used to illustrate and support points made.

Points made may include:

- (a)
- adopting a structured approach
 - consideration specification
 - meeting needs of users
 - desk research for market research
 - listening to views of specialists
 - product placement
 - place of branding
 - saturation of markets
 - tainted products
 - avoiding recurring problems
 - making product stand out
 - appeal of product for retail
 - filling gap in market
 - social context.
- (b) **Compromise (Failure)**
- Reduction of originality.
 - Limitation of design styling.
 - Conflict of designer ideas with user's needs.
 - Distillation of ideas to settled design.
 - Refusal to compromise can lead to failure.
 - Government legislation.

Compromise (Necessary)

- Sharing ideas can lead to extra/better design features.
- Advances in technology.
- Conflicts of costs/manufacture/material/etc.
- Safety.
- Required for product development.

NB Marks will not be awarded for simply stating points such as those given. Points must be part of reasoned discussion.

[END OF MARKING INSTRUCTIONS]