2012 Product Design

Advanced Higher

Finalised Marking Instructions

2012 Product Design

Advanced Higher

Question 1

(a) Up to 3 marks for description of how idea generation techniques may have been used in the development of products. The candidate may describe one technique in detail or more techniques with briefer descriptions, eg

Designers often use technological push as the starting point for innovative products. This involves the use of existing materials or technology within another field to produce a new product. The time and money spent researching and developing carbon fibre was initially funded by the aero space industry, helping to develop space craft. The same technology was then used by Formula One race teams to make race cars safer and lighter. The production costs of the material were still very high and only high end products could justify the expense and use. As time has gone on and production costs reduced, carbon fibre has been used to revolutionise sports equipment from tennis racquets to bicycle helmets. This is an example of technological push.

Maximum 3 marks

(b) 1 mark for each valid description of the benefits that rapid prototyping may have brought to the development of the helmet 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.

Maximum 2 marks

(c) 1 mark for each valid description of how computers can be used to test products prior to launch.

- Simulation – use to simulate different operating conditions prior to full production
- Stress analysis – static stress analysis, testing the strength/suitability of a product prior to full production
- High quality graphics can be produced from 3D models, which can be used to test the market – aesthetics/styling
- Links to CAD/CAM and testing
- Controlling test rigs
- Market research through web.

Maximum 3 marks

(d) **1 mark for each valid description of the influence each of the following may have had on the design of products; Ergonomist, Accountant & Market Researcher. Max 4 marks per person, must cover all 3 to gain 8 marks, eg 4,3,1, answers may include**

(i) Ergonomists may have influenced:

- The size and form of the helmet – drawing from their knowledge of the sizes and shapes of the human head
- The final weight of the helmet – help influence the decisions made in selecting the materials due to the stresses the human neck can withstand
- The size/position of clips and or fastenings – drawing from their knowledge of the sizes, range of movement and strength of human arms/hands
- The size of the opening at the front of the helmet – drawing from their knowledge of the typical field of vision.

(ii) Accountant may have influenced:

- The timescales involved at various stages – keeping things on budget
- What manufacturing methods were used in the production – keeping production costs in check
- Whether parts of the product were designed / manufactured in-house or outsourced – the use of outsourcing is a way of keeping budgets low.

(iii) Market researcher may have influenced:

- The colour and style of the helmet – providing data on what the target market find desirable
- The scale of production – identifying the size of the potential market
- The age range of the target market – by – identifying the size of the potential market at various age brackets
- The promotion of the product – based on their knowledge of the target market.

Maximum 8 marks

(Total 16 marks)

Question 2

(a) **1 mark for each valid description of the economic constraints that would have to be considered when manufacturing and transporting the chair.**

Alternatively,

2 marks for more detailed descriptions of the economic constraints that would have to be considered when manufacturing and transporting the chair.

To gain 4 marks candidates must refer to manufacturing and transport constraints.

Constraints may include:

- The distance between the manufacturing base and the intended market
- Transportation channels/modes
- The stack-ability/weight of the chair
- The volume of production – large scale, highly automated or not
- The size of the potential market
- Final retail price of the chair
- Selecting and managing production systems
- Packaging costs for transportation

Maximum 4 marks

(b) **2 marks for each valid description of 3 difficulties associated with producing the chair from sheet metal and explanation as to how these could have been resolved.**

Potential difficulties and resolutions may include:

- Uniform wall thicknesses not providing enough strength at various points – webs/strengthening pieces would be added where necessary
- Complex nature/form of the chair would be difficult to achieve from a single piece – manufacture the chair from a number of parts and have these assembled together
- Keeping the top surface (seat & backrest) of the chair smooth after the holes had been punched out – some sort of de-burring/shot blasting process post punching would be required to maintain the high quality finish
- Difficulties in replicating same aesthetic appeal
- Selecting a cost effective process for the material and numbers of chairs to be produced.

Maximum 6 marks

(c) **Up to 4 marks for valid points related to how new materials have been used to improve products and benefit consumers. –**

Answers will depend greatly on products chosen, but may include the following:

- Increased strength to weight ratios in sporting equipment (carbon fibre)
- Increases durability in soles/midsoles of sports shoes (new polymers)
- Improved thermal properties in garments – (smart materials)
- More efficient cars, due to lighter more aerodynamic bodies – (carbon fibre)
- Greater storage capacity on electrical devices – (silicon wafer technologies)
- Introduction of materials that can be recycled
- Introduction of smart materials

Maximum 4 marks

(Total 14 marks)

Question 3

(a) 1 mark for each valid point made to explain how issues may have influenced the design of the Bixi bike and its docking station.

A maximum of 4 marks can be awarded for considering each issue.

Candidates are **not** required to consider both the Bixi bike and the docking station to achieve full marks.

Possible answers may include:

- Ergonomics; comfort, adjustability, access, safety, ease of use,
- Obsolescence; durability, constant use and abuse, life span, replacement costs, frequency of use
- Safety; different user groups, legislation, health and safety, accountability,
- Function; simplicity, basic primary functions, limited function, ease of use,

Maximum 12 marks

(b) 1 mark for each valid point made to explain how economic and environmental issues may influence the decision to import products.

A maximum of four marks can be awarded for each issue.

In order to achieve full marks candidates will have to consider both issues.

Possible answers may include:

- Cheaper manufacture
- Cheap labour
- Exploitation of workforce
- Transport costs both economic and environmental
- Distance from suppliers
- Sustainability
- Economic growth

Maximum 4 marks

(Total 16 marks)

Question 4

(a) 1 mark for each valid point used to explain the advantages offered of using a range of communication techniques.
Marks will **not** be awarded for stating names of different communication techniques.

Possible answers may include:

- Sketches; quick, efficient, simple to execute, easy to change
- Computer generated; facilities change, 3D visualisation, modelling, simulations
- Block models; human interactions, instant feedback
- Scale drawings; detail
- Photographs

Maximum 5 marks

(b) (i) 1 mark for each valid point used to explain the risks associated with redesigning an existing product

Possible answers may include:

- Customer rejection
- Sales uncertainty
- Investment
- Unfamiliarity
- Competition
- Legal issues

Maximum 3 marks

(ii) 1 mark for each valid point used to explain how branding can reduce the risk of launching a new product.

Possible answers may include:

- Customer confidence
- Familiarity
- Recognition
- Reputation
- Advertising/endorsement
- Brand loyalty

Maximum 3 marks

(c) 1 mark for each valid point used to describe an <u>appropriate</u> method to protect the intellectual property rights.

Answers may include points describing features and benefits of the method.

Candidates will **not** be awarded marks for simply naming different methods of protecting intellectual property rights.

Maximum 5 marks

(Total 16 marks)

Question 5

(a) 1 mark for each valid point relating to the steps a designer and manufacturer could take.

Possible answers may include:

- Sustainable materials
- Sustainable manufacture
- Reduction of waste
- Improved life expectancy
- Reduction in different materials
- Consideration of disassembly
- Consideration of projected sales
- Planned disposal
- Improved efficiency
- Local manufacture
- Improved transportation
- Importance of research into materials and production

Maximum 4 marks

(b) 1 mark for each valid point describing how society has influenced other products.

Links between the social change and resultant changes to products must be clear.

Possible answers may include:

- Greater leisure time linked to more designs for hobbies, holidays and pastimes
- Economic changes linked to efficient and affordable products
- Longer life expectancy linked to product features for the elderly, redesign for the elderly
- Awareness of the environment linked to marketing of green products, efficient products, and recycled products
- Health awareness linked to sports equipment and health products
- Dependency on technology, over use of technology

Maximum 4 marks

(c) (i) 1 mark for each valid point describing features of an effective evaluation strategy.

Candidates may choose to provide a detailed description of a strategy used to evaluate a final prototype or consider a more general approach to the whole design process.

Possible answers may include:

- Evaluation against the specification
- Evaluation of models, test rigs and prototypes
- Expert appraisal
- Outside agencies
- User tips and trials
- Surveys, questionnaires and observations

Maximum 3 marks

(ii) 1 mark for each valid point made in leading to a clear explanation as to why evaluation is an essential activity.

Answer must include examples to support their answer.

Possible answers may include:

- Importance of accurate feedback using models and prototypes
- Seeking different opinions using user trials leads to unforeseen problems and solutions
- Refining aesthetics creates greater appeal by considering the target market
- Evaluation of materials will improve durability, manufacture and sustainability, through expert appraisal will ultimately lead to a better products

Maximum 3 marks

(Total 14 marks)

Question 6

(a) 1 mark for each valid point explaining the benefits of concept designs bring to the consumer. Alternatively, 2 marks for more detailed explanation of the benefits.

Possible answers may include:

- Introduction of new technologies to the market place early on
- Provision of more cutting edge products
- Identifies the pathways to winning designs early in the process
- Shifts focus away from one aspect of a solution – from 'what we need' to 'what we could have'
- Pushes technological advancement.

Maximum 4 marks

(b) 1 mark for each valid point describing of the benefits incremental change in products brings to the designer and to the manufacturer.

Benefits may include:

- Reduced risk of failure – benefits both Designer & Manufacturer
- Repeat sales, caused by upgrading of products – benefits the Manufacturer
- Products & company seen to be moving forward - benefits both Designer & Manufacturer
- Never lose ' the magic' of a successful product - benefits both Designer & Manufacturer
- Incremental changes can be used to develop human and technical competencies - benefits both Designer & Manufacturer
- Companies also experience improvement in their efficiency through incremental changes -benefits both Designer & Manufacturer
- New organisational structures are generated smoothly without hampering the functioning of the organisation - benefits both Designer & Manufacturer
- When the pace of Incremental change is slow, it allows designers time to review their work and correct their mistakes - benefits the Designer
- Incremental changes also help the change agents and management hone their skills in managing change, as the pace of change is slow and it allows them time to review their work and correct their mistakes

Maximum 4 marks

(c) 1 mark for each valid point describing the activities the designer could have employed to ensure the wheelchair was ergonomically sound.

Possible answers may include:

- Consult anthropometric data charts to decide / influence sizes for the wheel chair
- Conduct tests on complete full scale models to decide / develop sizes for the wheel chair
- Use computer simulation to test the suitability of the wheel chair in a safe environment..
- Conduct tests on specific parts (not the complete product) to decide/develop sizes for the wheel chair

Maximum 4 marks

(Total 12 marks)

Question 7

This question is set to test the candidate's ability to present a reasoned discussion about 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
An answer which falls into this category may do so for a number of reasons. It could be that: • 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.	• 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.	• 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.	• Detailed knowledge of the subject matter and a secure understanding of 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 (even a single product) or selected references to a wide range of products. • Examples are clearly used to illustrate and support points.

(Total 12 marks)

[END OF MARKING INSTRUCTIONS]