2013 Product Design

Higher

Finalised Marking Instructions

Part One: General Marking Principles for PRODUCT DESIGN HIGHER

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question.

(a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader/Principal Assessor.

(b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

GENERAL MARKING ADVICE: PRODUCT DESIGN HIGHER

The marking schemes are written to assist in determining the "minimal acceptable answer" rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates' evidence, and apply to marking both end of unit assessments and course assessments.

Part Two: Marking Instructions for each Question

SECTION A

Question			Expected Answer/s	Max Mark	Additional Guidance
1			**Each of the lawnmowers shown below have been designed for a well known high street DIY retailer.**		

Electric Hover Mower

Blade – Mild Steel
Handle – Plastic coated Mild Steel
Body – Polypropylene
Gears/Fasteners – Nylon
Cable Length – 20 Metres

Weight – 4·2 kg

Retail price £29·99

Cylinder Mower (Manually Operated)

Blade – HSS (Tool Steel)
Handle – Foam Rubber coated Aluminium
Body – Mild Steel
Gears/Fasteners – Nylon
Wheels – Metal Alloy
Grass Catcher – Nylon with Polypropylene base

Weight – 7·3 kg

Retail price £119·50

Question			Expected Answer/s	Max Mark	Additional Guidance
1	a		**Write a product specification for one of the lawnmowers in relation to its target market.** The Lawnmower must: • cut grass • adjustable height of cut • be easily stored when not in use • be easily manoeuvred • be manufactured from **durable** materials that are suitable and appropriate for their function • be priced to suit the intended target market • ensure aesthetics suit the market niche or consumer aspirations • be used in larger gardens (lawnmower B) • cut on sloping ground (lawnmower A) • production costs significantly less than selling price. • looks obvious to use • be easy to empty (lawnmower B) • pick up cut grass (lawnmower B) • be easy to clean/maintain • safety (when in context) eg blades guarded • reference to suitable cable length (lawnmower A) • comply with relevant safety regulations • any other suitable statement. **Any 6** **Comments Accept** **Lifespan Corrosion issues Portability Comfortable to use** **Weather conditions Sustainability Circuit breaker (RCD)**	6	***No direct lift from stem.*** ***NB – Lawnmower A has no grass catcher***

Question			Expected Answer/s	Max Mark	Additional Guidance
1	**b**		**Justify the choice of materials used to produce both lawnmowers**. Statements which justify issues such as: • durability of material/impact resistance (*non corrosion*) **[Do not accept metal alloy]* • strength to weight issues • readily available materials • Nylon – self lubricating gears • HSS/tool steel – hardness • rubber – excellent grip • chemical resistance • comfort of foam • foam gives excellent grip • suitability for production methods • function of component parts • aesthetic properties • ease of cleaning • re-cycling • any other suitable statement	**6**	

Question			Expected Answer/s	Max Mark	Additional Guidance
1	b		**(cont)** **Sample answers** *Aluminium offers an excellent strength to weight ratio which is ideal for use with lawnmower B as it has to be transported by the user*. **(1)** *The nylon mesh offers an extremely light and hard wearing material that can be easily cleaned.* **(2)** *PP is a good choice of material for lawnmower A as it is durable, easily maintained and offers a good strength to weight ratio.* **(3)** *Metal alloy is durable (not acceptable/properties are not known.* **(0)** **NB – mention of mass production can be awarded in (1b) only six valid statements @ 1 mark each (5+1)**		

Question			Expected Answer/s	Max Mark	Additional Guidance
1	c		**Identify and justify the production processes that could be used to manufacture both lawnmowers.** Suitable Processes Lawnmower A – Extrusion, Bending, Injection Moulding, Piercing & Blanking, Plastic/Powder/ Dip coating, Sharpening Lawnmower B – Injection moulding, Compression Moulding, Welding, CNC Machining, Bending/press forming, Extrusion, Pressure die casting, sharpening, spray painting. Accept general term *spray painting* • How manufacturing/assembly techniques are influenced by volume of production • Process is suitable for the material eg (sheet metal for press forming) **Statements could include:** Standardisation of sizes, component parts all the same size. No further finishing required. Shapes suitable for process. Standardisation of components and materials chosen because they are easily sourced/formed. Suitable for mass/batch production – injection moulding. Economy of scale – mass/continuous production/JIT **Maximum of 3 for identification of process. (1 each process)** **Maximum of 3 marks per process (1 identification, 2 justification)** ***Comments Accept*** **Manufacture – Quality of standard components** **Consumer – High quality finish**	**6**	

Question			Expected Answer/s	Max Mark	Additional Guidance
1	d		**Explain the ergonomic issues associated with both lawnmowers.** Any four issues explained in the context of ergonomics: Examples from: • Anthropometrics relating to handle grip, position and locking • Position of handles for operation (dead man's switch) • Handle adjustment (Height) • Hand size (for access to components) • Finger traps • Surface texture to prevent slipping • Weight for lifting/strength issues • Strain/fatigue issues • Psychological issues – colour, ease of assembly, looks safe and easy to use • Comfort during use • Access for cleaning/maintenance • Any other relevant answer. **4 statements at 1 mark each** **1 mark can be awarded if range of issues are identified but not explained.**	**4**	***Bullet points which are not expanded to show understanding are not accepted.***

Question			Expected Answer/s	Max Mark	Additional Guidance
1	e		**Describe the appeal of both lawnmowers from the consumer's viewpoint.** Any description from: • Cost (only if compared) • Aesthetics • Durability • Brand name/Image • Recycling • Easy to use/store • Lightweight • Grass catcher (Lawnmower B) • Safety • No need of electricity (Lawnmower B) • Easy to move due to wheels (Lawnmower B) • lower disposable income (Lawnmower A) • No cable, so it can be used more than 20m from a power point (Lawnmower B) • Can be used on severe slopes (Lawnmower A) • Any other acceptable answer. **4 issues described at 1 mark each (3+1)** **Comments Accept**	**4**	

Question			Expected Answer/s	Max Mark	Additional Guidance
1	f		**Describe how the design of both lawnmowers has been influenced by functional issues.** **NB – a maximum of 3 marks from any functional aspect.** Any four identified issues described: • Fitness for its purpose (*not simply cut grass*) • Durability to withstand continual use/outdoor environment • Safety aspects of function – dead man's trigger; electrical safety • Maintenance issues • Ease of use • Easy to clean • Ease of adjustment • Choice of materials (relating to function) • Stability of lawnmower • Portability • Storage • Any other acceptable issues. **Four issues identified, 4 issues at 1 mark each (3+1)**	**4**	
				30	

SECTION B

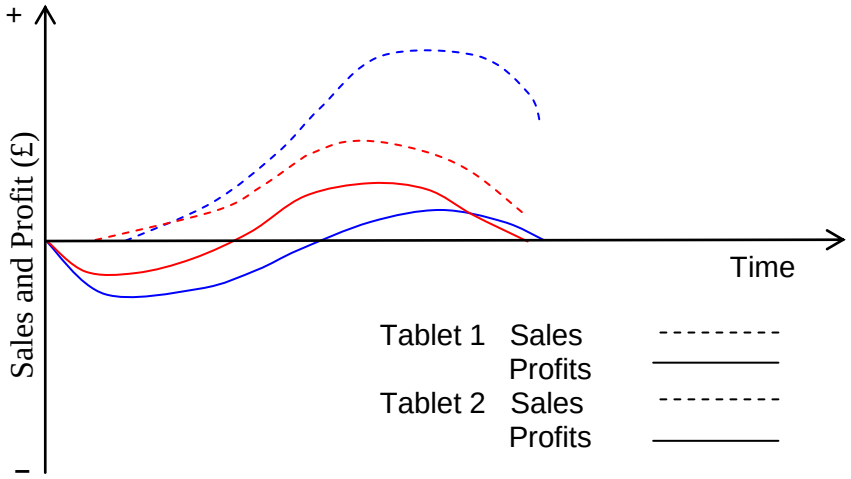
Question			Expected Answer/s	Max Mark	Additional Guidance
2			**The body of the adjustable spanner shown below is made by the process of drop forging.** 		
2	**a**		**Explain why drop forging is a suitable process for producing the body of this adjustable spanner.** The benefits of drop forging are: • Stronger than similar cast or machined products/improved strength characteristics • Repeatable process • Accuracy • Complex shape • Good surface detail • One piece construction • Or any other suitable answer. 1 mark for explanation	**1**	
2	**b**		**State two features that would indicate that this product was made by drop forging.** The features of drop forging are: • Parting lines/flashing/flash removal/split lines • Quality of surface detail/texture • One piece construction • Contrast of finishes • Evidence of further finishing might be apparent • Draft angle/relief profile • Or any other suitable answer. ***No repetition from A*** **1 mark for each appropriate statement (2@1 mark)**	**2**	

Question			Expected Answer/s	Max Mark	Additional Guidance
2	**c**		**State a suitable material that could be used for the body of the spanner and give a reason for your choice.** While most metals can be dropped forged, the material selected should be appropriate to the product. • Chromium alloy steel (Accept stainless steel) • High carbon steel (Do not accept steel) • Nickel/Nickel alloys • Titanium Reason for choice: • Durability • Toughness • Resistant to corrosion (*Chromium alloy steel, stainless steel, Nickel/Nickel alloys, Titanium*) • Any other suitable answer. **1 mark for suitable material** **1 mark for appropriate reason – one mark can be awarded for stating incorrect material but correct reason (applicable to given material)**	**2**	
				5	

Question			Expected Answer/s	Max Mark	Additional Guidance
3			**Aesthetics is a major consideration in the design of a product such as the Sky+ remote control shown below.**  **Describe where four aspects of aesthetics have influenced the design of the Sky+ remote control.** Description should include at least **two** aspects from: • Aesthetics to enhance function • Aesthetics to promote/enhance style • Shape/Layout of buttons enhanced by aesthetic • Form of product • Colour contrasts/harmonies • Contrast/harmonies in shapes • Gloss surface compared with matt surface • Texture • Any other suitable answer. **4 @ one mark for each appropriate description. Maximum 2 marks per aspect.**	**4**	Use of standard symbols - no marks
				4	

Question			Expected Answer/s	Max Mark	Additional Guidance
4			**A designer has been asked to produce concepts for a new style of domestic kettle.**  **Specification** Stainless steel body Programmable timers Protective thermal security system stops overheating Save up to 25% more energy Display integrated in the handle Electronic temperature control  Bugatti Vera Eectric Kettle − £189·95 **The kettle shown above has been designed for a niche market.**		
4	a		**With reference to the kettle explain the term "niche market".** Any 2 issues explained with reference to the product • Focussing product to specific target group • Aspirational group – prestige, brand awareness • Financial aspects • Profitable segment of a market • Satisfying specific market needs • Any other relevant answer. **Generic description of market niche – one mark**	**2**	

Question			Expected Answer/s	Max Mark	Additional Guidance
4			**Another selling point is that the kettle could be recycled easily.**		
4	**b**		**Describe the steps the designer could take to make the kettle easier to recycle at the end of its working life.** **Any two issues described** • Fewer types of materials per product • Lower volume of materials per product • Materials that are easy to recycle/renewable • Materials easily identifiable • use alternative materials • Product easily dismantled for recycling • Any other relevant answer. **Any 2**	**2**	
4 **4**	**c**		**The kettle could be manufactured using batch production techniques.** **Describe the considerations the manufacturer would need to make before deciding upon this production system.** **Any two issues described** • Demand for product • Price point (Usually towards top end of market for batch produced items) • Flexibility of design (batch) • Flexibility of production • Less machinery required but generally multipurpose machines to allow retooling (batch) • Particular components which must be batch produced • Standard components • Production planning • Production costs • Any other relevant answer. **2 marks can be awarded for a full description of an issue explaining reasons for production method.**	**2**	
				6	

Question			Expected Answer/s	Max Mark	Additional Guidance
5			**The graph shown below has been used to predict and compare how well two new graphics tablets will sell.** **Product Life Cycle (Sales and Profit)**  		
5	a		**Describe what steps a manufacturer could take to reduce the time required to introduce a product onto the market.** • Use of Rapid Prototyping to shorten Research & Development time • Outsourcing to specialists • Ensure reliable delivery of raw materials • Efficient production and process scheduling • Reduce the number of processes employed • Reduce transit time • Efficient Quality Assurance procedures • Higher staffing level/work longer hours • Reduced Research & Development time • Any other relevant answer. **Any 2**	**2**	

Question			Expected Answer/s	Max Mark	Additional Guidance
5	**b**		**From the graph above state which of the two graphics tablets would be commercially viable and explain your reasons for this choice.** Tablet 2 is the most viable. Reasons for choice: • Although the sales are lower in terms of volume the profits are higher (from graph) • Longer and costlier lead time for Tablet 1 • Less negative profit during lead in for Tablet 2 • Sales start earlier (Tablet 2) • Sales last longer (Tablet 2) • Tablet 2 in profit longer. **1 mark – correct product** **2 marks for correct explanation of correct tablet.**	**3**	
5	**c**		**Describe how a company could extend the sales life of a product.** • Reduce price of product • Special offers (eg Free tablet case) • Increased advertising • Updated versions (software) • Introduce special editions/additional features • Any other relevant answer **Any 2**	**2**	
				7	

Question			Expected Answer/s	Max Mark	Additional Guidance
6			**The carcass of the kitchen cabinet shown below has been constructed using manufactured boards and knock down fittings.** 		
6	a		**Explain the benefits to the manufacturer of using knock down fittings instead of traditional joining methods.** • Cost of manufacture reduced (simple tooling) • Speed and simplicity of assembly • Can be purchased as standard components • Unskilled labour can be employed • Can be Flat-packed/Easily Stored/Easily Transported • Fittings are produced to suit manufactured boards • Standard components/parts • Speed of manufacture is increased • Any other relevant answer. **Any 2 explained**	**2**	

Question			Expected answer/s	Max mark	Additional guidance
6	b		 **The door of the kitchen cabinet is manufactured using solid timber.** **Explain the benefits to the consumer of using solid timber for the cabinet doors.** • Quality of finish • Aesthetics • Fashion/style • Durability • Strength issues • Recyclability • Any other relevant answer. **Any 2 explained**	**2**	
6	c		**Describe the obsolescence issues associated with modern fitted kitchens.** • Ease of recycling • Changes in fashion/style • Ability to change doors/worktops • Durability of carcase materials and fittings • Maintenance/replacement issues • Obsolescence of appliances • Any other relevant answer. **Any 2 described**	**2**	
				6	

Question			Expected Answer/s	Max Mark	Additional Guidance
7			**During design development many designers use CAD software to simulate the behaviour of products.**		
7	a		**Explain the benefits of computer simulation over user trials with prototype models.** **All answers must <u>clearly</u> refer to simulation v user trials.** Explanation should include; • Saving money on product development phase • Reduced labour costs • Money saved on testing components • Quicker development phase • Faster resetting time for tests • Quicker feedback • Exact conditions can be replicated • Material wastage • No human error • Can run 24/7 • Safety aspects • Or any other suitable answer. **Any 2**	**2**	
7	b		**A prototype model of a car disc brake was produced using Fused Deposition Modelling.** 		

Question			Expected Answer/s	Max Mark	Additional Guidance
7	**b**	**i**	**Name a suitable material that could be used for the Fused Deposition Modelling process.** Suitable materials; • Polycarbonate/ABS mix • ABS • Polycarbonate • SAN (Styrene Acrylonitrile Resin) • Or any other suitable material [Do not accept thermoplastic alone as an answer]	**1**	
7	**b**	**ii**	**State one advantage and one disadvantage associated with Fused Deposition Modelling.** Advantages; • No material is lost • High strength • Cost effective • Component accuracy/detail • Reduced lead times • Assembled prototypes produced • Functional prototypes/products • Multiple materials can be used • Robust/tough • Impact resistance • Choice of colours • Or any other acceptable answer. [**No repetition from 7 a)**] Disadvantages; • Can show “ribbing” from layers • High set up costs • Slow compared to other RP processes • Supports in structure might be needed • Large areas require longer build times • Or any other suitable answer. **One mark for each advantage and disadvantage. (2 @ 1 mark)**	**2**	
				5	

Question			Expected Answer/s	Max Mark	Additional Guidance
8			**A company has commissioned a designer to produce a range of kitchen accessories suitable for users with limited manual dexterity.**  		
8	a		**Explain how the designer could identify the needs of the user group before developing concept ideas.** • Observation • Questionnaires/surveys • User group testing • Information from experts/focus groups • Any other suitable description.	**1**	
8	b		**Describe the physiological needs the designer might find within the user group.** • Strength issues • Fatigue • Dexterity • Mobility • Any other suitable description. NB. Additional marks may be awarded for descriptions of ***specific*** physiological aspects. **Any 3**	**3**	

Question			Expected Answer/s	Max Mark	Additional Guidance
8	c		**Describe two idea generation techniques that could be used to help produce concept ideas.** • Morphological Analysis • Brainstorming • Storyboard/mood board/image board • Technology transfer • Mind mapping/spider diagram • Analysis of existing products • Lateral thinking • Any other suitable answer. **Any 2**	**2**	
8	d		**Describe a technique that could be used to present the design concepts to the client.** • Use of programmes such as powerpoint • Manual graphics • Computer graphics • Animation • Modelling/prototyping • Demonstration • Any other suitable answer. **1 mark for description of how presentation technique is used to explain concepts.**	**1**	

[END OF MARKING INSTRUCTIONS]