

LEVEL 1/2 CAMBRIDGE NATIONAL AWARD/CERTIFICATE IN ENGINEERING DESIGN

R105: Design briefs, design specification and user requirements

Candidates answer on the Question Paper

Duration: 1 hour

OCR Supplied Materials:

- None

Other Materials Required:

- None



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

1. Use black ink. HB pencil may be used for graphs and diagrams only.
2. Complete the boxes above with your name, centre number and candidate number.
3. Answer **all** the questions.
4. Write your answer to each question in the space provided.
5. Do **not** write in bar codes.

INFORMATION FOR CANDIDATES

1. The total number of marks for this paper is **60**.
2. The number of marks for each question is given in brackets [] at the end of the question or part question.
3. Dimensions are in millimetres unless stated otherwise.
4. This document consists of **16** pages. Any blank pages are indicated.



Answer **all** questions.

- 1 Fig. 1 shows an example of a hairdryer. A large professional salon wants to replace their existing hairdryer with a new model.



Fig. 1

- (a) Shown below are five client requirements.

Join each client requirement to the correct suggested product feature.

The first one has been done for you.

Client requirement	Suggested product feature
Must be easier to use by all employees	New four speed setting
Must be in the salon's corporate colours	Casings can be made in any colour
Must dry hair faster than the existing model	Thermal overload cut out switch
Must not overheat	Improved, easy to hold handle
Must consume less power than the existing model	Energy efficient motor

[4]

(b) Describe why corporate colour is an important requirement of the hair salon's client brief.

.....
.....
.....
..... [2]

(c) Market research is used to inform the design of products such as a new hair dryer.
Give **two** examples of information that market research might try to identify from potential customers for a new product.

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.....
..... [2]

(d) Give two reasons why further research might be needed after an initial design brief is discussed by a client and designer.

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.....
.....
..... [2]

(b) Give **two** reasons why the design brief might ask for the bike to be suitable for a range of different users.

.....
.....
.....
.....[2]

(c) Describe the following product design cycle phases.

(i) Optimise.....
.....
.....
.....[2]

(ii) Validate.....
.....
.....
.....[2]

3 Fig. 3 shows a modern vacuum cleaner design.



Fig. 3

(a) Explain how **each** of the requirements below could influence the design of a vacuum cleaner as shown in Fig.3.

(i) aesthetics.....
.....
.....
..... [2]

(ii) ergonomics.....
.....
.....
..... [2]

(iii) sustainability.....
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.....
..... [2]

(b) Give two reasons why making a vacuum cleaner lightweight might be identified as important during initial market research.

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.....
..... [2]

(c) Give two examples of performance requirements for a vacuum cleaner.

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.....
.....
..... [2]

4 Fig. 4 shows a modern battery powered drill.

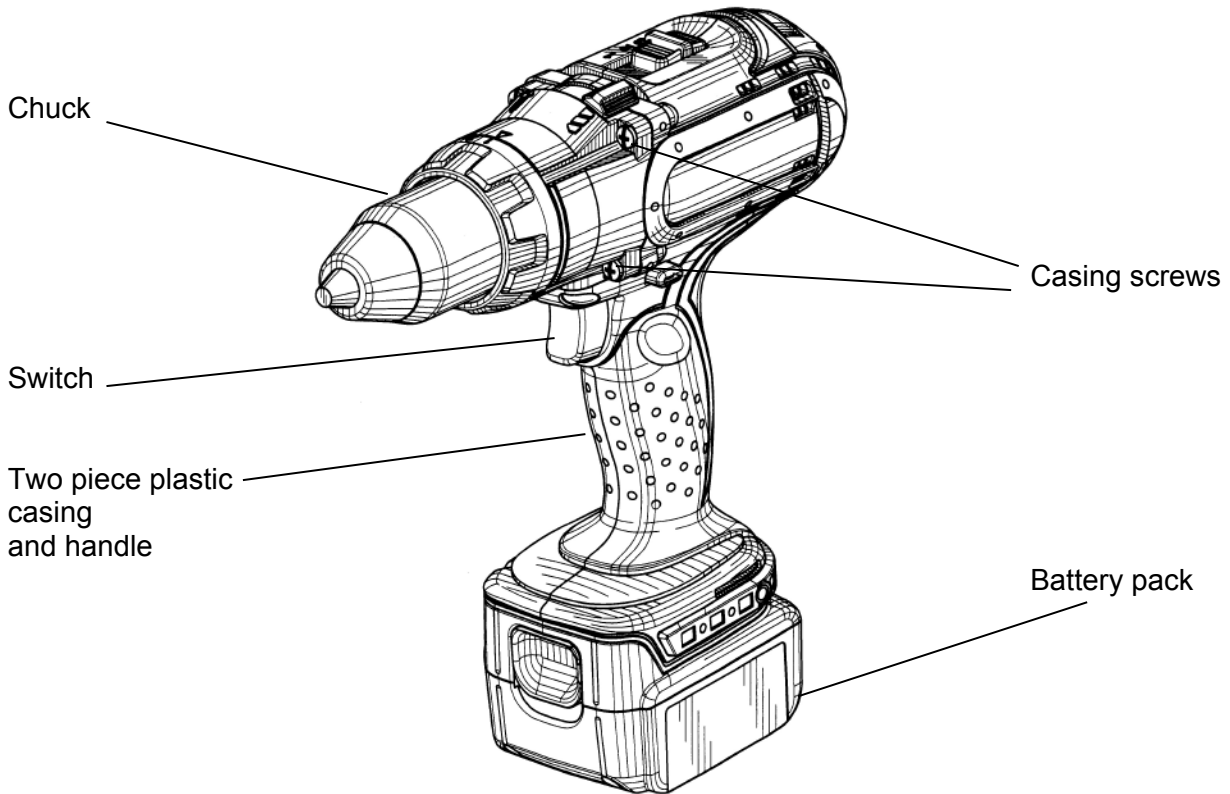


Fig. 4

(a) State **one** design feature that allows the product to be taken apart for maintenance.

.....
.....[1]

(b) Describe why designers consider availability of materials when designing products.

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.....
.....
.....[2]

(c) Explain **one** benefit of using plastics material for the casing and handle.

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.....[2]

(d) Describe why designers might use standard components across a range of products.

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.....[2]

(e) Explain the importance of Design for Manufacturing Assembly (DFMA) when developing new products.

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.....
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.....
.....
.....[3]

5 The table shows a comparison of six materials that could be used in the design of an engineered product.

Material	Factors to consider				
	Ease of Storage	Easy to use	Safe to use	Value for Money	Readily Available
A	8	1	9	7	9
B	5	6	5	5	4
C	8	2	1	3	3
D	2	9	1	2	2
E	3	8	7	3	5
F	9	5	4	9	7

10 = excellent and 1 = very poor

(a) Give **two** reasons why ease of storage could be an important factor when selecting a material for a new product.

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..... [2]

(b) Explain why material C would be least suited for the manufacture of a prototype product.

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.....

..... [2]

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SPECIMEN

Sample Assessment Material

LEVEL 1/2 CAMBRIDGE NATIONAL AWARD/CERTIFICATE/DIPLOMA IN ENGINEERING DESIGN

R105: Design briefs, design specifications and user requirements

MARK SCHEME

Duration: 1 hour

MAXIMUM MARK 60

SPECIMEN

This document consists of 12 pages

Section A

This section relates to the scenario in the case study and background research.

Question		Answer	Marks	Guidance
1	(a)	<p>One mark for each correctly joined client requirement with suggested product feature.</p> <p>Must be easier to use by all employees – Improved easy to hold adjustable handle (1) Must be in the salon's corporate colours – Casing can be made in any colour (1) Must not over heat – Thermal overload cut out switch (1) Must consume less power than the existing model – Energy efficient motor (1)</p> <p style="text-align: right;">(4x1)</p>	4	
	(b)	<p>Up to two marks for a clear description. Any feasible description related to the colour of the product.</p> <p>Colour is an important feature to identify with the salon (1) and will convey specific brand image (1)</p> <p>Unique brand colour will make the hair dryer recognisable (1) reduce the risk of theft (1)</p> <p style="text-align: right;">(2x1)</p>	2	
	(c)	<p>One mark for each valid example of information that market research could be used to identify.</p> <p>how much customers would pay for a product(1) what features are essential (1) what features are desirable (1) choice/range wanted (e.g. choice of colours) (1) what products they currently own/use (1)</p> <p style="text-align: right;">(2x1)</p>	2	

Question		Answer	Marks	Guidance
2	(a)	<p>Up to four marks for valid ways in which the design of the bike could ensure that it is suitable for a range of users.</p> <ul style="list-style-type: none"> - Adjustable frame (1) - Range of different size frames (1) - Adjustable seats (1) - Adjustable handlebars (1) - Standard brackets for lights/mudguards/accessories (1) - (Finish in) neutral colours (1) <p style="text-align: right;">(4x1)</p>	4	
	(b)	<p>One mark for each valid reason.</p> <ul style="list-style-type: none"> - Wider target audience (1) - Suit users of different heights & sizes (1) - Unisex/suitable for males and females (1) - Can be adjusted for comfort (e.g. longer/shorter arm reach or more upright sitting position) (1) - Suits children/young people as it can be adjusted as they grow (1) - More flexibility could make it stand out against other products (1) <p style="text-align: right;">(2x1)</p>	2	
	(c) (i)	<p>Up to two marks for a clear description.</p> <p>Optimise phase</p> <ul style="list-style-type: none"> - Designers will produce models and prototypes (1) - Explore the design on computer (virtual) and/or in real models (physical) (1) - Make adjustments and modifications (1) - Reduce errors and optimise performance and function(1) <p style="text-align: right;">(2x1)</p>	2	Award 1 mark for a limited relevant answer, and a further 1 mark for an expanded answer.

Question		Answer	Marks	Guidance
	(ii)	<p>Up to two marks for a clear description.</p> <p>Validate phase</p> <p>Designers test the prototype (1) Tests can be virtual or physical (1) Assess against the design specification (1) Evaluate how well it meets the needs of the client brief (1)</p> <p style="text-align: right;">(2x1)</p>	2	Award 1 mark for a limited relevant answer, and a further 1 mark for an expanded answer.
3	(a) (i)	<p>Any appropriate aesthetic point relating to the design of a vacuum cleaner. e.g.</p> <p>The body of the vacuum will be an attractive colour (1) to integrate into the home/suit different tastes/matches other appliances (1)</p> <p>The hose and accessories will fit into the main body when not in use (1) so that it is an attractive compact unit/can be stored away more easily (1)</p> <p>The colour of the hose and accessories could match the colour of the body (1) to make the overall look more attractive/make it look like one (integrated) product (1)</p> <p>The design of the shape of the body will be appealing (1) accept relevant example for second mark – e.g. sleek/modern/curved (1)</p> <p>The body of the vacuum will be made from material which makes it attractive (1) accept relevant example for second mark – e.g. gloss finish/matt finish/vivid colour/smooth/textured (1)</p>	2	Simple answer 1 mark, qualified answer 2 marks

Question	Answer	Marks	Guidance
	<p>(ii) Any appropriate ergonomic point relating to the design of a vacuum cleaner. Simple answer 1 mark, justified answer 2 marks e.g.</p> <p>The vacuum will feature an extendable hose (1) for ease of reach high places without stretching (1)</p> <p>The vacuum will be as light(weight) as possible (1) so that it is easy to use and move around (1)</p> <p>The vacuum and any attachments will be compact (1) so that it can be carried/moved around comfortably (1)</p>	2	
	<p>(iii) Any appropriate sustainability point relating to the design of a vacuum cleaner Simple answer 1 mark, qualified answer 2 marks e.g.</p> <p>The vacuum will use an energy efficient motor (1) so that it is cheaper to run/so that it is more environmentally friendly. (1)</p> <p>Most component parts easily recyclable (1) minimizing the impact on the environment at end of product life.(1)</p> <p>Standard components used where possible (1) to make production more energy/resource efficient (1)</p> <p>Design so that it can be repaired (1) so that replacing components can prolong overall product life (1)</p> <p>Minimum packaging will be used to package the vacuum cleaner (1) using less natural resources/creating less waste for disposal/making it lighter/smaller to transport. (1)</p>	2	

Question	Answer	Marks	Guidance
(b)	<p>One mark for each valid reason.</p> <ul style="list-style-type: none"> - many people will need to carry it upstairs (1) - needs to be light enough to be used by a wide range of people (e.g. elderly people) (1) - makes the task of cleaning less tiring (1) - more portable so can use more easily for cleaning other areas e.g. car, garage, loft space) (1) - lighter weight would make storage more flexible (e.g. loft, cupboard, shelving unit, hang on wall bracket) (1) <p style="text-align: right;">(2x1)</p>	2	
(c)	<p>One mark for each example of how performance would be important.</p> <ul style="list-style-type: none"> - needs to clean effectively/have good suction (1) - needs to be suitable for different floor types (1) - needs to be efficient so that you don't have to keep cleaning the same area (1) - noise made by vacuum should not be too loud (1) - suitable accessories to clean thoroughly (1) - needs to have big enough capacity that it does not need emptying all the time (1) - should be durable and withstand prolonged use (1) <p style="text-align: right;">(2x1)</p>	2	

Question		Answer	Marks	Guidance
4	(a)	One mark for correct identification of a feature. Screws (1) or two piece/half of the casing fastened together (1)	1	
	(b)	Up to two marks for a clear description. Designers need to know if the availability of a material will be able to meet the demand of manufacture (1) through different manufacturing scales of production (1) (2x1)	2	
	(c)	Up to two marks for a clear explanation. Easy to mould complex shapes (1) which makes manufacture less expensive (1) The casing can be melted and reused through recycling (1) which is better for the environment (1) Easy to make and mould in any colour (1) no need for expensive paints (1) Plastics material provides better insulation properties (1) so no need to add an earth connection (1)	2	
	(d)	Up to two marks for a clear description. Reduced range of parts need to be made or bought in therefore cost effective (1), existing trusted parts, known to work well, can be used again (1), parts of the design can be copied across the range of products (1). (2x1)	2	

Question		Answer	Marks	Guidance
	(e)	<p>Up to three marks for a clear explanation.</p> <p>Answers show understanding of the importance of DFMA e.g.</p> <p>Designers look at ways to simplify the design and reduce the number of parts (1) Standardised common parts and materials reduce the number of component parts, assembly tasks/operations (1), greater opportunity for automation (1), which all save time (1) and make the product more cost effective (1).</p> <p style="text-align: right;">(3x1)</p>	3	
5	(a)	<p>One mark for each valid reason.</p> <p>Relevant answer to ease of storage consideration; e.g.</p> <p>Material not available locally requires transportation so could consider buying in bulk to reduce transport cost and pollution (1)</p> <p>Safety toxic or degrading materials need special storing (1)</p> <p>Bulk or large materials need a large foot print (1)</p> <p>High production line demand could be halted if materials cannot be stored on site (1)</p> <p>storage space may not be available (1)</p> <p>specialist storage would be costly (1)</p> <p>if no storage, materials could be damaged (1)</p> <p>if materials are weather resistant could be stored outside (1)</p> <p>specialist storage may mean materials cannot be kept on site (1)</p> <p style="text-align: right;">(2x1)</p>	2	

Question		Answer	Marks	Guidance
	(b)	<p>Up to two marks for a clear explanation.</p> <p>Chart suggests it is difficult to use, it is not very safe to use, has poor value for money and is not readily available (1) prototyping could prove expensive if needed to be repeated (1) The material is not easily available and could hinder full scale production if the same material is used (1) dangerous products require detailed safe working procedures and could not be tested in prototype work (1)</p> <p style="text-align: right;">(2x1)</p>	2	
	(c) (i)	<p>Up to three marks for a clear explanation.</p> <p>More sustainable materials may be chosen, instead of the cheapest (1) (Although) for some products, using sustainable materials may be too expensive (1) Consumer awareness of sustainability may lead to different product choices (1) Consumers may pay more for sustainably designed products (1) (which in turn) may lead to different material choices by producers (1) Resource depletion may make it necessary to find other sustainable materials (1) Using sustainable methods is good PR for companies which produce products (1) Sustainable design may lead to production efficiency/reduced costs (in some circumstances) (1)</p> <p style="text-align: right;">(3x1)</p>	3	

Question		Answer	Marks	Guidance
	(ii)	<p>Up to three marks for a clear explanation.</p> <p>Particular materials may be 'in' or 'out' of fashion (e.g. not using real fur in clothing) (1)</p> <p>Designers may be using particular materials in their designs (due to fashion trends) (1)</p> <p>Some materials may limit design/may not have suitable properties for the use/design (1)</p> <p>Some materials may only be available in certain colours (1)</p> <p>Fashion trend for the product may affect materials (e.g. needs to be lightweight, so material has to change) (1)</p> <p style="text-align: right;">(3x1)</p>	3	
6	(a)	<p>One mark for each valid reason.</p> <p>The design of new products must consider any breaches in current regulations (1), designs could face financial penalties (1) and be banned from further production (1) or pay royalties (1)</p> <p>Some products need to pass safety tests before they can be sold (1), (Producing/selling unsafe products) can damage a company or designers reputation (1)</p> <p>The designer/company could face legal action, unsafe designs could face financial penalties (1) designs could be banned from further production (1)</p> <p style="text-align: right;">(2x1)</p>	2	
	(b)	<p>One mark for each way that environmental pressures could influence:</p> <p>ethical approaches to design: materials used, recycling ability, reduction in chemical uses (1) use of sustainable materials, energy in manufacture, transports of products and materials (carbon footprint) (1) product disposal which should demonstrate responsible design (1)</p> <p style="text-align: right;">(2x1)</p>	2	

Question	Answer	Marks	Guidance
(c)*	<p>Award up to six marks for a discussion of the impact which improvements in materials and production processes can have on the development of a new product.</p> <p>Level 3 (5–6 Marks) Learners provide a thorough discussion of materials and production processes and show a clear understanding of the required question material. Specialist language and terms would be used in the appropriate areas being discussed and the required information will be well structured in its presentation. Good examples used to justify both materials and production process impacts. Learners will demonstrate an accurate level of spelling, punctuation and grammar.</p> <p>Level 2 (3–4 Marks) Learners provide an adequate discussion which shows a reasonable level of understanding of materials and production processes impact. Some examples used to justify materials and production process impacts. Some evidence of the use of specialist language although not always in the appropriate areas being discussed. Information, for the most part, will be reasonably structured but may contain occasional errors in spelling, punctuation and grammar.</p> <p>Level 1 (1–2 Marks) Learners provide a basic discussion which shows some understanding of the question material but uses little or no specialist language. Few or no examples used to justify materials or production process impacts. Answers may be ambiguous or disjointed. Contains obvious errors in spelling, punctuation and grammar</p> <p>0 marks = no response or no response worthy of credit. Annotate as ‘Seen’ at end of the response.</p>	6	<p>Examples and relevant points could include:</p> <p>Materials:</p> <p>Improved use of materials or material technologies to be able to create new product features and functions including using new or better use of existing materials</p> <p>Manufacturers need to have cost effective designs to produce and meet market demands; improvements in material properties could speed up or reduce the cost of designs to manufacture.</p> <p>Product lifecycle/sustainable design should mean less waste from new materials and more use of recyclable components.</p> <p>Production processes:</p> <p>Time taken to prototype a product can be reduced by advances in modelling, production processes, and use of modelling techniques resulting in reduction of time to market (TTM).</p> <p>Use of improved production processes and new technologies to enable improved product features and functions, using technology in manufacture.</p>

Learning Outcomes (LO) Grid

Question Number			Content Area		
			LO1	LO2	LO3
1	a		4		
1	b		2		
1	c		2		
1	d		2		
2	a			4	
2	b		2		
2	c	i	2		
2	c	ii	2		
3	a	i		2	
3	a	ii		2	
3	a	iii		2	
3	b		2		
3	c			2	
4	a			1	
4	b			2	
4	c			2	
4	d			2	
4	e			3	
5	a			2	
5	b			2	
5	c	i			3
5	c	ii			3
6	a				2
6	b				2
6	c*				6
Total Marks					