

## **Cambridge National**

### **Engineering Design**

**R105/01:** Design briefs, design specifications and user requirements

Level 1/2 Cambridge National Certificate/Award

**Mark Scheme for January 2021**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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## Annotations

Annotation	Meaning
<b>BP</b>	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓	Tick - 1 Tick for each mark awarded. Do not use ticks for question 4(b)*
<b>SEEN</b>	Noted but no credit given, or no response for whole part-question Use 'Seen' and <b>NR</b> - No Response (bottom right of screen) where there is no response for whole part-question. Typing NR also works.
<b>REP</b>	Repetition - Repeated answer or knowledge point - no additional credit/marks awarded
<b>BOD</b>	Benefit of doubt given, if you use BOD do not also add a tick.
<b>K</b>	Knowledge - used for question 4(b)* only
<b>DEV</b>	Developed knowledge point - used for question 4(b)* only
<b>L1</b>	Level 1 response (i.e. in the range of 1-2 marks) used for question 4(b)*
<b>L2</b>	Level 2 response (i.e. in the range of 3-4 marks) used for question 4(b)*
<b>L3</b>	Level 3 response (i.e. in the range of 5-6 marks) used for question 4(b)*
<b>VG</b>	Too vague, not worthy of credit/marks
No other annotations should be used. <b>Do not</b> use crosses ✗	

**Subject Specific Marking Instructions**






Mark all questions using a tick when answer is correct, BOD (benefit of doubt) may be awarded on some occasions.

Where work is presented but it is incorrect use SEEN to shown that the answer has been read.

Q4b the candidate is expected to discuss knowledge of the question. When knowledge points are valid this should be shown by inserting a K above the written text. If the knowledge point is explained/justified then DEV (development of point) should be added above the written text. Once the candidates answer has been read it should be awarded a level for the response according to the descriptors in the body of this mark scheme which should be indicated as L1, L2, L3 with an appropriate mark awarded.

Question		Answer	Mark	Guidance																		
1	(a)	<p>One mark awarded for each correct answer</p> <table border="1"> <thead> <tr> <th>Fixing method</th> <th>Helps disassembly</th> <th>Does not help disassembly</th> </tr> </thead> <tbody> <tr> <td>Welding</td> <td></td> <td>✓</td> </tr> <tr> <td>Screws</td> <td>✓</td> <td></td> </tr> <tr> <td>Adhesive / glue</td> <td></td> <td>✓</td> </tr> <tr> <td>Nut and bolt with washer</td> <td>✓</td> <td></td> </tr> <tr> <td>Rivets</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Fixing method	Helps disassembly	Does not help disassembly	Welding		✓	Screws	✓		Adhesive / glue		✓	Nut and bolt with washer	✓		Rivets		✓	4	
Fixing method	Helps disassembly	Does not help disassembly																				
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Nut and bolt with washer	✓																					
Rivets		✓																				
1	(b)	<p>Award one mark for each valid response</p> <ul style="list-style-type: none"> <li>• Components or materials can be easily separated at the end of the products life (1)</li> <li>• Disassembly allows components or materials to be recycled/reused (1)</li> <li>• Disassembly allows parts to be replaced/fixed/repared (1)</li> <li>• Disassembly allows the user to carry out maintenance/cleaning (1)</li> <li>• Easier to transport/portable/store (1)</li> </ul>	2	<p>Easier to put together/assemble (0)                      Easier to dispose of (0)                      Can be dismantled safely/can be disassembled (0)</p>																		

Question			Answer	Mark	Guidance
1	(c)		<p>Award up to 4 marks for a valid explanation</p> <p>When undertaking an LCA the designer should consider how the materials can be separated (1) and how they can then be reused or reprocessed/recycled. (1) Designers will also want to consider how the products life can be extended through maintenance (1) and where the fixings/standard components are sourced. (1)</p>	4	<p>Looking for responses that consider saving resources rather than wasting resources and have limited impact on the environment/land pollution.</p> <p>Less waste produced (1)</p> <p>Easier to dispose of (0)</p>
2	(a)	(i)	<p>Award one mark for each valid response</p> <ul style="list-style-type: none"> <li>• Mini (1)</li> <li>• E type Jaguar (1)</li> <li>• VW Beetle (1)</li> <li>• Concorde (1)</li> <li>• Dyson Vacuum cleaner (1)</li> <li>• PlayStation/X box (1)</li> <li>• iPod/iPhone/imac/ipad (1)</li> <li>• Jet engine (1)</li> </ul>	3	<p>Accept other valid iconic products must be specific <b>not</b> car, phone, car phone, chair, games console, fit bit etc.</p> <p>Other valid answers may include-</p> <p>Spitfire plane, Lego, Alessi 3 legged lemon squeezer, Vespa Scooter, Swiss Army Knife, Angle poise lamp, Bic ballpoint pen, Coca Cola. (this list is not final)</p> <p>Sydney opera house, Clifton Suspension bridge, Eiffel Tower</p>
2	(a)	(ii)	<p>Award one mark for each valid response</p> <ul style="list-style-type: none"> <li>• The product sells in large numbers/high sales (1)</li> <li>• The design becomes instantly recognisable (1)</li> <li>• The design has global recognition (1)</li> <li>• The product is renowned for being exceptional quality/example of excellent design/innovative (1)</li> <li>• The product is an integral part of a cultural / or fashion trend/very popular (1)</li> </ul>	2	<p>Do not award marks for because of market pull/push or similar explanations.</p> <p><b>Not</b> they get copied (0)  Unique is too vague (0)  Celebrity endorsement (0)</p> <p>Accept revolutionary as innovative (1)</p>

Question			Answer	Mark	Guidance
2	(b)	(i)	Award one mark for a drawing of the correct symbol   (1)	1	 (1)  (1) <b>Not</b>  (0)  (0)
2	(b)	(ii)	Award one mark for a valid response <ul style="list-style-type: none"> <li>Registered design/R (1)</li> <li>Trademark/TM (1)</li> <li>Patent (1)</li> <li>Licensing your work (1)</li> </ul>	1	Not copyright (already given in question)  Not company logo or label (0)
2	(c)		Award up to three marks for a valid explanation <ul style="list-style-type: none"> <li>By protecting a design it stops companies copying ideas of other businesses (1) that allows the company with ownership to control the market (1) and maximise the sales of the product (1) copiers of the design can be sued. (1)</li> <li>No one can copy the design and make a profit from it (1) you get all the credit for the design (1) legal action can be taken against copiers of the design (1) or they have to be given permission to use it. (1)</li> </ul>	3	
3	(a)		Award one mark for each valid response <ul style="list-style-type: none"> <li>Nuts (1)</li> <li>Bolts (1)</li> <li>Screws (1)</li> <li>Washers (1)</li> <li>Fuses (1)</li> <li>Bearings (1)</li> <li>Gears (1)</li> </ul>	3	Accept other valid answers e.g. Switches, buttons, nails, spring, rivets, hinges.

Question		Answer	Mark	Guidance
3	(b)	<p>Award one mark for each valid reason</p> <ul style="list-style-type: none"> <li>• Manufactured in large quantities so generally low cost per component. (1)</li> <li>• No need to create custom components which is an expensive process. (1)</li> <li>• Standard tools can be used so specialist equipment does not need to be purchased. (1)</li> <li>• You can purchase them from another supplier / manufacturer, to save cost of manufacturing yourself (1)</li> <li>• They are cheap/low cost to mass produce (1)</li> </ul>	2	<p>Answers should relate to the use of standard components and impact on the budget.</p> <p>Cheaper/low cost (0)            Cheaper when bought in bulk (0)            Easy/easy to fit/easy to buy (0)            Mass produced and readily available (0)</p> <p>Reference to labour costs (0)</p>
3	(c)	<p>Award one mark for a valid response</p> <ul style="list-style-type: none"> <li>• Ensure client expectations / design specification is fully defined (1)</li> <li>• Monitoring/managing energy costs (1)</li> <li>• Meeting deadlines / timescales (1)</li> <li>• 'Just In Time' deliveries to manage inventory (1)</li> <li>• Minimise defects / errors/waste (1)</li> <li>• Testing to ensure the design functions correctly (1)</li> <li>• Quality control procedures in place to minimise waste (1)</li> <li>• Use/Apply the DFMA (Design for manufacture and assembly) principle (1)</li> <li>• Pre manufactured components could be used in manufacturing production.</li> </ul>	1	<p>This question is about controlling the budget when manufacturing not designing</p> <p>Using cheaper materials (0)            Using recycled materials/components (0)            Using standard components (given) (0)</p>
3	(d)	<p>Award up to 4 marks for a valid explanation</p> <ul style="list-style-type: none"> <li>• To ensure that the details of the product can be delivered within the budget. (1) If the budget is not understood then costs could become unaffordable (1). This will mean the product cannot be completed to specification (1) and will not make it to market to ensure sales for the business. (1)</li> </ul>	4	<p>Answers should relate to budget and financial considerations/effects.</p>



Question			Answer	Mark	Guidance
4	(a)	(i)	<p>Award up to two marks for a valid response</p> <ul style="list-style-type: none"> <li>The helmet has a contemporary/modern look (1) that will appeal to customers and drive sales (1)</li> <li>Aesthetics are important to differentiate the product when on sale (1) this will ensure it stands out to new customers (1)</li> <li>The designer has used striking colour combination (black &amp; white) (1) which is a popular modern combination (1)</li> </ul>	2	<p>Aesthetics considered (1) user consideration (1)</p> <p>Reference to any aesthetic point i.e. appearance/shape/style/texture/looks colourful (1)</p> <p>Appeal to customer/attract/be popular (1)</p> <p>Stand out to other road users (1)</p> <p>Aesthetically pleasing /unique/aerodynamic (0)</p>
4	(a)	(ii)	<p>Award up to two marks for a valid response</p> <ul style="list-style-type: none"> <li>The helmet has a chin strap (1) this will ensure it is securely fixed to the riders head. (1)</li> <li>The helmet has soft internal layer (black) and a rigid external layer (white) (1) which will resist impact should the rider have an accident. (1)</li> <li>Strong hard carbon fibre shell (1) that will protect the head/user. (1)</li> <li>Strong enough to withstand impact (1) without causing injury to user (1)</li> </ul>	2	<p>Response should include reference to a safety feature of the helmet (1) protects the user (1)</p>
4	(b)*		<p>Award up to six marks for a discussion about the relationship between a design brief and a design specification</p> <p><b>Level 3 (5–6 Marks)</b></p> <p>Learners provide a thorough discussion about the relationship between a design brief and a design specification. They show a clear understanding of the required question material. Specialist language and terms would be used in the appropriate areas being</p>	6	<p>Examples and relevant points could include.</p> <ul style="list-style-type: none"> <li>The design brief provides the initial outline of what the product needs to do and what market it is for. It might identify the target user but give the designer options of what the product might look like or how it might function.</li> <li>A design specification is created from the design brief and the research undertaken from the brief. It lists a detailed set of criteria that are used to ensure that the product fits the brief and meets the expectations of the customer and user.</li> </ul>

		<p>discussed and the required information will be well structured in its presentation.</p> <p>Good examples used to the relationship between a design brief and a design specification. Learners will demonstrate an accurate level of spelling, punctuation and grammar.</p> <p><b>Level 2 (3–4 Marks)</b></p> <p>Learners provide an adequate discussion about the relationship between a design brief and a design specification. Some examples used to illustrate the relationship between a design brief and a design specification.</p> <p>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><b>Level 1 (1–2 Marks)</b></p> <p>Learners provide a basic discussion which shows some understanding of the question material but uses little or no specialist language.</p> <p>Few or no examples used to show understanding of the relationship between a design brief and a design specification. Answers may be ambiguous or disjointed. Contains obvious errors in spelling, punctuation and grammar.</p>		<ul style="list-style-type: none"> <li>• The brief is utilised to guide a designer or design team to areas of research that will allow them to explore possible solutions that will meet the brief.</li> <li>• The brief is not a detailed set of criteria like a design specification but it sets out the key topics that need defining in further detail to ensure a specification and designs for a product can be created.</li> <li>• The design specification, although much more detailed than the brief, should provide a set of criteria that the final product can be assessed against. These criteria should not only allow a successful product to be produced, but should ensure the product meets the needs of the market, customer and problem defined in the brief.</li> <li>• The brief outlines the problem and market gap where an opportunity for a new product exists, the design specification sets out the detailed criteria, features and performance requirements that the product must have in order to meet this market gap or target user.</li> </ul>
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			<p>Where the candidate only provides a list of points, without any discussion, this is a Level 1 response and can only be awarded a maximum of 2 marks.</p> <ul style="list-style-type: none"> <li>0 marks = no response or no response worthy of credit. Annotate as 'Seen' at end of the response.</li> </ul>		
Question			Answer	Mark	Guidance
5	(a)		<p>Award one mark for each valid response</p> <ul style="list-style-type: none"> <li>Change the material/texture (1)</li> <li>Change the colours of the back pack (1)</li> <li>Use different types of material for different parts of the backpack. (1)</li> <li>Add reflective panels (1)</li> <li>Include logos or branding on the back pack (1)</li> </ul>	2	<p>Question is about changes to the backpack appearance <b>NOT</b> redesigning the backpack.</p> <p>Alter shape/size (0), Add zip/pockets/more padding/extra strap (0)</p>
5	(b)		<p>Award up to three marks for a valid description</p> <ul style="list-style-type: none"> <li>Design is inspired by trends that have become popular or appealing to customers (1) so the designer may want to incorporate the designs into the product (1) which may increase sales. (1)</li> <li>The back pack may be sold around the world. (1) Therefore, different colours or logos should be considered (1) because some symbols or colours have different meanings in different cultures. (1)</li> <li>Electronic devices are an increasingly common element of culture and society, (1) back packs now need to be designed to accommodate multiple devices (1) and should protect them when being transported. (1)</li> <li>Connected/smart products are increasingly popular (1). The back pack may include connectivity such as charging ports (1) and could be made from anti-theft material. (1)</li> </ul>	3	<p>Question is about influencing the <b>design</b> of the backpack.</p> <p>The bullet point answers given are examples of possible answers, combinations of such examples may be appropriate.</p> <p>Other acceptable answers may include:</p> <p>Recent fashion trends also include a bottle holder (1)</p> <p>Fashion – personal preferences/different colours may appeal (1)</p> <p>Fashion trend for fashion handbags (1) have led to smaller versions of the backpack (1).</p>

Question			Answer	Mark	Guidance
5	(c)	(i)	Ergonomics	1	
5	(c)	(ii)	Anthropometrics	1	
5	(d)		<p>Award up to 3 marks for a valid explanation</p> <p>The designers will assess what is already on the market as part of their research (1) so they understand what customers think are strong points of competitors' products to include in the design. (1) They will also want to know what customers do not like to ensure they can improve this. (1) this should increase sales and ensure the product is successful. (1)</p>	3	
6	(a)	(i)	<p>Award up to two marks for a valid reason</p> <ul style="list-style-type: none"> <li>A reusable bag can be made from textile material (1) Textiles are made from sustainable resources.(1)</li> <li>A reusable shopping bag uses stronger material allowing longer life (1) and saving use of resources <b>or</b> making use of sustainable resources (1)</li> </ul>	2	<p>Do not award marks for repeat of the stem i.e. reusable</p> <p>Question relates to sustainable resources</p> <p>Can be recycled at end of life (0) Longer lasting (0)</p>
6	(a)	(ii)	<p>Award up to two marks for a valid reason</p> <ul style="list-style-type: none"> <li>Traditional cars are powered using fossil fuels (petrol/diesel) (1) electric cars minimise the need for more fossil fuels to be taken from the earth (1)</li> <li>Electricity used to recharge electric cars can be generated using sustainable energy (1) Using sustainable energy sources to recharge the car minimises use of finite resources such as oil (1)</li> </ul>	2	<p>Question relates to sustainable resources</p> <p>Does not create pollution/less emissions/greenhouse gasses causing global warming (0)</p> <p>Better for the environment – too vague (0)</p> <p>Car is rechargeable (0)</p>

Question			Answer	Mark	Guidance
6	(a)	(iii)	<p>Award up to two marks for a valid reason</p> <ul style="list-style-type: none"> <li>LED lamps are much more energy efficient (1) and last longer than filament lamp (1) which means they reduce electricity consumption in use (1)</li> <li>Reduced electricity consumption (1) which will save fuels from finite sources used in power stations to generate energy. (1)</li> </ul>	2	<p>Saves energy (1)</p> <p>Save money (0)</p>
6	(b)		<p>Award up to four marks for a valid explanation</p> <ul style="list-style-type: none"> <li>Companies can use renewable energy sources to power manufacturing facilities. (1) They can ensure they minimise transport distances to reduce emissions (1) and ensure that they utilise materials from sustainable sources (1) and recycle any waste material. (1)</li> </ul>	4	<p>This question relates to manufacturing being sustainable <b>NOT</b> the design or use of a sustainable product.</p> <p><b>Note:</b> Recycle any waste material refers to waste produced during manufacturing stage.</p>

**OCR (Oxford Cambridge and RSA Examinations)**  
**The Triangle Building**  
**Shaftesbury Road**  
**Cambridge**  
**CB2 8EA**

**OCR Customer Contact Centre**

**Education and Learning**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

[www.ocr.org.uk](http://www.ocr.org.uk)

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