OCR
Oxford Cambridge and RSA

Cambridge National

Engineering

Unit **R105:** Design briefs, design specifications and user requirements

Level 1/2 Cambridge National Award/Certificate in Engineering Design
J831/J841

Mark Scheme for June 2017

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning of annotation
BP	Blank page
VG	Vague
	Tick
SEEN	Noted but no credit given
	Unclear
REP	Repeat
BOD	Benefit of doubt
	Cross
DEV	Development
EG	Example/Reference
K	Knowledge
L1	Level 1
L2	Level 2
L3	Level 3

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>One mark for each product sustainable design consideration listed in the correct order

<table><tr><td>1</td><td>Selection of raw material</td></tr><tr><td>2</td><td>Energy used in manufacturing</td></tr><tr><td>3</td><td>Energy use during operation</td></tr><tr><td>4</td><td>Ease of disassembly</td></tr><tr><td>5</td><td>Recycling of materials</td></tr></table></td><td>4</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>One mark for each valid point up to a maximum of three from:

• Could be made from sustainable source materials (1)
• Could use less energy in production (1)
• Could be reused / recycled with less reprocessing (1)
• Could last longer, not wear out so quick (1)
• Could allow the product to be disassembled easier at the end of its life (1)
• Could extend the life of the product without breaking (1)
• Could mean no fossil fuels are used during production / transportation / disposal. (1)
• Could be widely available reducing the use of non-sustainable sources (1)</td><td>3</td><td>Accept suitable alternative answers related to product lifecycle e.g. extraction of materials, production, transportation, usage and end of life.</td></tr>
</table>

Question			Answer/Indicative content	Mark	Guidance
	(c)		Up to **three** marks for a description e.g. • Materials can be separated for recycling • Parts that fail can be removed and replaced • Less waste overall • Allows for re-use of parts • Use less energy to disassemble / process • Could lead to a reduction in the number of components within the product • Reduces process time at the end of life • Regular maintenance could improve life span	3	Accept any valid alternative answers.

Question			Answer/Indicative content	Mark	Guidance
2	(a)	(i)	One mark for each valid factor up to a maximum of two e.g.: • Research on target market (1) • User requirements (1) • Performance requirements / Material selection (1) • Improvements to existing products (1) • Specific client requirements / initial specification from client (1) • Budget (1) • New technological development (1) • Material availability (1) • Gap in the market / market need (1) • Changes in fashion/trends/aesthetics (1) • Analysis of competitors products (1) • Legislation (1)	2	Accept any valid alternative answer. Accept reference to colour or aesthetics as 'specific client requirements.' 'Size' and 'shape' is too vague unless qualified.

Question			Answer/Indicative content	Mark	Guidance
	(a)	**(ii)**	**One** mark from: • Research (1) • Process Planning (1) • Communication between the client and the designer (1)	1	Accept specific types of research e.g. surveys, focus groups
	(a)	**(iii)**	One mark for each correct phase up to a maximum of two from: • Design phase (1) • Optimise phase (1) • Validate phase (1)	2	
	(b)		One mark for each valid factor up to a maximum of two e.g.: • Change in range/colours available (1) • Additional features / improvements (1) • Product style, casing design (1) • Improved accessibility of functions, controls (1) • Improved safety features (1) • Improved manufacturing processes become available (1) • New technological advances become accessible / available (1) • Changes to the design texture / size (1) • Changes in the needs of the market / customer / trends e.g. cost, quality, energy efficiency (1)	2	Accept other feasible and valid responses
	(c)		**One** mark for the function and up to **two** marks for an explanation e.g.: Function: Automatic brightness feature for a tablet/mobile phone screen (1)	3	Accept other feasible and valid responses Function or feature (1) A description of how this has been influenced by the target audience (2).

Question			Answer/Indicative content	Mark	Guidance
			• Consumers feedback surveys said that they have difficulty seeing the screen in daylight (1). The manufacturer has designed the brightness of the screen can be set by the user to automatically adjust depending on light levels. (1)		.
Question			**Answer/Indicative content**	**Mark**	**Guidance**
3	**(a)**		One mark for each valid factor up to a maximum of two: • Blocks should be big enough to avoid choking (1) • Blocks should not have sharp edges (1) • Blocks should be strong enough not to break when used and create sharp edges (1) • They must be made from a non-toxic material (1) • Should not be coated in any toxic materials (1)	2	
	(b)		One mark for each valid reason up to a maximum of two e.g.: • Can be manufactured in large volumes (1) • Large volume manufacturing means each individual unit cost is cheap (1) • Large numbers can be made in a short amount of time (1) • Large quantities are required and injection moulding is a suitable high-volume production process (1) • Repeatable quality is achieved, as all blocks will be moulded exactly the same (1) • Plastic can be easily shaped into complex forms using moulding (1)	2	Only award reference to ‘low cost’ or ‘cheap’ if qualified by ‘scale of manufacture’ or ‘cost per unit.’

Question			Answer/Indicative content	Mark	Guidance
			• Plastic is a safe material for children's toys (1) • Plastic a durable material (1) • Can be recycled at the end of life (1) • Material is readily available allowing large quantities to be manufactured (1) • Waste material is kept to a minimum using moulding (1)		

			Guidance		Answer/Indicative content
	(c)		Up to six marks for a discussion of how the manufacturing processes determine the design of the building blocks. **Level 3 (5–6 Marks)** Learners provide a thorough discussion of how the manufacturing process has affected the design of the building blocks. They 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 how the manufacturing process has affected the design of the building blocks. Learners will demonstrate an accurate level of spelling, punctuation and grammar. **Level 2 (3–4 Marks)** Learners provide an adequate discussion which shows a reasonable level of understanding of how the manufacturing process has affected the design of the building blocks. Some examples used to illustrate how the manufacturing process has affected the design of the building blocks during the development of the design. 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. **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 show	6	Examples and relevant points could include • The building blocks are manufactured using injection / plastic moulding this requires large numbers to be produced in order to offset the cost of the tooling. The geometry is therefore produced in a way so that it can be easily moulded. • The building blocks have thin wall sections / are hollow parts so that when moulded they do not warp or shrink to much once cooled. • The components are designed in such a way so that the same component can be clipped / assembled together with each other. This means that lots of them can be produced in a repeatable process like injection moulding without the need for lots of different mould tools. • The building blocks are made using similar geometry but come in a range of colours. This allows for large batches of building blocks in the same colour to be produced and then the colour of plastic to be changed and additional batches made without the need for additional mould tools. • The components need to be made in very large quantities so plastic is a suitable material. This means they can be produced and sold at a low-cost once large numbers of them have been produced. • The edges of the geometry all have slight fillet radii added to them which will allow for the plastic to flow more effectively in the mould. • The raised protrusions on the top of the building blocks are hollow meaning they have the same wall thickness as the rest of the part, reducing warping and improving the moulding process. • Mould design can mean that no more plastic than necessary is used during production. This could be a two piece or three piece mould with draft angles added to the design for easy ejection from mould. The sprue position

			understanding of how the manufacturing process has affected the design of the building blocks. Answers may be ambiguous or disjointed. Contains obvious errors in spelling, punctuation and grammar 0 marks = no response or no response worthy of credit. Annotate as 'Seen' at end of the response		within the mould will also ensure no post-mould finishing required.

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>One mark for each tick in rows 1, 4, 5 and 6:

<table>
<tr><th></th><th>Component name</th><th>Standard Component</th><th>Pre-manufactured Component</th></tr>
<tr><td>1</td><td>Roof truss</td><td></td><td>✓</td></tr>
<tr><td>2</td><td>M6 Bolt</td><td>✓</td><td></td></tr>
<tr><td>3</td><td>Car seat</td><td></td><td>✓</td></tr>
<tr><td>4</td><td>Bearing</td><td>✓</td><td></td></tr>
<tr><td>5</td><td>Gear</td><td>✓</td><td></td></tr>
<tr><td>6</td><td>Injection moulded casing</td><td></td><td>✓</td></tr>
</table></td><td>4</td><td>No marks to be awarded for ticks next to components 2 and 3 as these are already given as examples.</td></tr>
<tr><td></td><td>(b)</td><td></td><td>One mark for each valid reason up to a maximum of three e.g.:
• Component manufacture can be outsourced (1)
• Outsourcing manufacture saves investment costs for machinery (1)
• Saves assembly time / final production time (1)
• Improves responsiveness to fluctuations in demand (1)
• Improved quality from reliable / specialist suppliers (1)
• Increase the ease of assembly in the final production stage (1)
• Regular ‘just-in-time’ deliveries from suppliers can help to mange stock /inventory levels (1)</td><td>3</td><td>Accept other feasible and valid responses</td></tr>
</table>

Question			Answer/Indicative content	Mark	Guidance
	(c)		Up to **three** marks for an explanation e.g. • If large volumes are to be made the initial cost of tooling can be offset (1) therefore reducing the cost per component (1) Small scale manufacture tends to cost more due to the high setup costs and material sourcing. (1) • High volume manufacture requires a high level of investment in machinery and tooling (1) whereas small scale production minimises this investment (1) but labour costs can be higher. (1)	3	Accept other feasible and valid responses

Question			Answer/Indicative content	Mark	Guidance
5	(a)		One mark for each valid factor up to a maximum of two e.g.: • Must be able to cope with the heat of the boiling liquid (1) • Must be stable when placed on the kitchen surface (1) • Must insulate the heat to avoid burning the user (1) • Must be able to be wiped clean (1) • Must be able to be moved around the kitchen (1) • Must be a suitable size to fit within a kitchen workspace / small footprint (1) • Must withstand regular use (1) • Cable length is suitable to not cause a hazard or limit placement (1)	2	Accept other valid factors

Question			Answer/Indicative content	Mark	Guidance
	(b)		One mark for each valid aesthetic feature up to a maximum of three e.g.: • The colour of the kettle could be changed (1) • The contrast between the body and plastic coloured elements of the kettle could be changed (1) • The size / capacity of the kettle could be increased/reduced. (1) • The kettle could be minimalized to make it look more contemporary (1) • The design of the exterior could be changed to represent more traditional kettle designs (1) • The materials could be changed (1) • The size / shape of the handle could be adjusted (1)	3	Accept other valid features. Reference to 'shape' should be qualified with specific feature e.g. 'handle' or 'body.' Accept reference to specific terms e.g. colour, shine, contrasts, textures, finishes
	(c)	**(i)**	One mark for each valid method up to a maximum of two: • A designer may produce a prototype by hand using card or craft materials (1) • A designer may produce a virtual computer model (1) • A designer may use a 3D printer (1) • A designer may build a working prototype using manual machining or bench fitting techniques. (1)	2	Accept references to virtual / augmented reality

Question			Answer/Indicative content	Mark	Guidance
		(ii)	Three marks from e.g: • Handle it / see it • Assess the ergonomics of the design • Assess its size / dimensions • Test its functionality / fit / stress / aerodynamics • Ensure it meets the design specification / standards / legislation • Assess the suitability of materials • Check for any errors in the design • To assist in error proofing the design • Gain client feedback on the design	3	Accept other valid responses
Question			**Answer/Indicative content**	**Mark**	**Guidance**
6	**(a)**	**(i)**	One mark awarded for an example of an iconic product e.g.: • Mini • iPod / iPhone • Concorde • Jaguar e-type • Dyson Bagless Vacuum Cleaner • Biro • Swiss Army knife • Phone box • Post-It note • Thermos flask • Walkman • Lego • Zippo lighter • Angelpoise lamp • Spitfire • Macintosh	1	Accept any suitable alternative answer. Do not accept reference to ‘phone’/‘smartphone’/’touchscreen’ phone unless qualified with a specific example e.g. iPhone

Question			Answer/Indicative content	Mark	Guidance
		(ii)	One mark for each valid reason up to a maximum of two e.g.: • New technology in the product changed the way consumers interact with the product e.g. iPod and storage of media • Brand power of the company appealed to the public e.g. iPhone • Large sales numbers drove demand from consumers • The design became popular with celebrities which increased the appeal of the product, driving sales e.g. mini cooper / Jaguar e-type • The design was cost effective and therefore appealed to a wider market market increasing sales e.g. mini • The design is deemed to aesthetically beautiful or represents the era in which it was designed therefore continues to be sold in high numbers years later e.g. angle poise lamp • The design removes issues found in previous versions of the product making it more convenient to use e.g. dyson vacuum cleaner.	2	Accept any other valid reasons
	(b)		Up to **three** marks for an explanation e.g.: • Designers may use iconic products as inspiration because the design of the product has been extremely popular before (1) so therefore the design will probably be successful when put on the market, (1) instantly attracting a large customer base. (1) • Designers may use iconic products as inspiration because the design may have aesthetic features that are deemed to be examples of good design. (1) Designers may want to incorporate similar features into their new design (1) making their product function or look similar. (1)	3	Do not give marks for repeated answers from part (a)(ii).

Question			Answer/Indicative content	Mark	Guidance
	(c)		Up to **three** marks for an explanation e.g.: • Designers may apply for a patent when they have created a new idea/invention (1) and they want to ensure that it cannot be copied or used by competitors (1) without the permission of the designer/company. (1) • Designers will apply for a patent when they have created a new process or piece of technology (1) and they want to protect it for a period of time (1) so that it restricts other companies using the technology and allows them to maximise its unique selling potential. (1) • A patent allows companies to protect a design/idea from being copied. (1) It allows them to take legal action against companies who copy the idea without permission. (1) This also allows the companies to generate income by selling the rights to the patent. (1) • Patents can be used as a marketing tool to validate the uniqueness of the technology / invention / design. (1)	3	
	(d)		One mark for a valid answer: • A symbol (word/words) registered as representing a company or product. • A company can hold the rights to a logo/slogan. • Stops a logo/slogan being copied.	1	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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