



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 2015

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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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Question		Answer	Marks	Guidance
1	(a)	<p>One mark for each correctly joined client requirement with suggested product feature.</p> <ul style="list-style-type: none"> - Prevent <u>ultraviolet light</u> from degrading contents - Bottle made from light brown plastic - Made from lightweight material - PET is used for the bottle - Labels adhere to surface - Chemical free surface - Children must not be able to open - Tamper proof <p style="text-align: right;">(4x1)</p>	4	<p>Joining lines if extended must connect to the corresponding box.</p> <p>Only one line per requirement. If two lines drawn then one must be clearly erased or crossed out.</p>
	(b)	<p>Up to two marks for two simple statements</p> <ul style="list-style-type: none"> - Confirms that the product will work / functions / meets requirements / work as its / meets specification - Confirm whether it needs improvement / changes / modification. - Identify any faults / flaws / errors / problems / issues. - Ensure the product is safe / not dangerous / cause harm / injury - Ensure it complies or meets legislation / the law / standards - Check if materials are suitable - Check how it looks / feels / materials / texture / aesthetics - Check size / fit / function / dimensions are appropriate 	2	<p>Do NOT accept</p> <ul style="list-style-type: none"> - Check if any chemicals are inside - Check if any existing products are copied - See if product needs more work - Check quality of the design <p>Do NOT accept 'testing' unless qualified with a specific property e.g. strength, robust, rigidity, waterproof</p> <p>Award two marks for two valid responses given in one statement</p>

Question	Answer	Marks	Guidance
	<ul style="list-style-type: none"> - Check the strength / rigidity / robustness / waterproof / working environment - To test the views of the target market / audience / customer / end user / client <p style="text-align: right;">(2x1)</p>		
(c)	<p>One mark for each valid point about error proofing.</p> <ul style="list-style-type: none"> - Design features / processes in products so that manufacture / assembly / use cannot be carried out incorrectly (2) Stops errors in manufacture / assembly / use by designing in specific features / processes (2) Stops errors in manufacture / assembly / use (1) <p style="text-align: right;">(2x1)</p>	2	<p>Do NOT accept references to testing / finding faults / checking designs</p> <p>Two marks for a full explanation or one simple response with a valid explanation / example</p> <p>One mark for a simple response</p>
(d)	<p>One mark for each valid reason.</p> <ul style="list-style-type: none"> - Target audience widened / reduced / changed (1) - To gain feedback from the client / customer (1) - Budget change (1) - Limitations design / manufacturing / materials / availability (1) - Market research / initial evidence (1) - Influence of designer (1) - Competitors current / future designs (1) - Further research questions viability (1) - General update to project (1) - Does not comply with standards / legislation (1) - Discovered the idea has been copyrighted (1) <p style="text-align: right;">(2x1)</p>	2	<p>Do NOT accept answers such as related to testing / improvements e.g. Needs improving</p> <p>Award up to two marks when responses are specific to costs / budget e.g. budget change / increased material cost but do NOT award for repeat responses e.g. cost of manufacturing / cost of material</p>

Question			Answer	Marks	Guidance
2	(a)	(i)	<p>Up to two marks for two strengths the clients' product, compared with the competitors product.</p> <p>Strengths</p> <ul style="list-style-type: none"> - Touch screen keyboard / no push button keyboard (1) - Larger screen (1) - No moving parts / sliding parts (1) - Phone has rounded corners (1) - No keyboard (1) - No buttons (1) 	2	<p>Do NOT accept;</p> <ul style="list-style-type: none"> - Larger speaker - Quantity or quality apps - More modern or similar - Lighter / thinner <p>Award two marks for two valid responses given in one statement</p>
		(ii)	<ul style="list-style-type: none"> - Size of handset - Accessibility of functions offered by a touch-screen - Accessibility to reach / select icons - Accessibility of sockets / switches on the sides - Feel of material - Fits into owners' hand / usability with one hand - Feel and grip /comfort / texture / required touch pressure - Curved edges so it is more comfortable to hold - Lightweight - Position of speaker / microphone / buttons - Volume control - Screen brightness - Supports repetitive use without strain - Clarity of screen / icons / commands / apps 	2	<p>Curved edges must be qualified e.g. so it is comfortable hold / nicer to grip</p> <p>Do NOT accept generic responses;</p> <ul style="list-style-type: none"> - User friendly - Easy to use - Easy to setup - Aesthetic qualities <p>Responses related to 'how it feels' must be qualified e.g. how it feels in the users hand.</p>

Question	Answer	Marks	Guidance
(b)	<ul style="list-style-type: none"> - Size - Weight - Cost - Materials - Materials availability - Functionality limitations / data storage space / battery life - Meeting regulations / legislation - Quality control / assurance / removal of faults - Supply chain - Standard Components - Suitable components / housing the components in the design - Scale of production / mass produced - Environmental impact in manufacture - Assembly time - Shipping / distribution - Design for manufacture / assembly / DFMA <p style="text-align: right;">(4x1)</p>	4	<p>Do NOT accept responses related to the following;</p> <ul style="list-style-type: none"> - Ergonomics e.g. easy to hold - Portable battery - Detailed screen

Question	Answer	Marks	Guidance
(c)	<p>Up to two marks for each method identified for collecting information.</p> <ul style="list-style-type: none"> - Survey / questionnaire / quiz / online (survey, questionnaire) (1) - Bespoke advertising / online, customised product placement (1) - Suggestion boxes (1) - Observations - Focus groups(1) - Targeted interviews with specific demographics / interview (1) - Assessing / analysing existing / competitors products (1) - Monitor sales of existing products (1) - Product reviews (1) - Target Group Index (TGI) (1) - Electronic data collection (1) <p style="text-align: right;">(2x1)</p>	2	<p>Do NOT accept 'Primary / Secondary research' unless qualified with a method.</p> <p>Do NOT accept 'use the internet' unless qualified with a reason / method.</p> <p>Only accept reference to one example from 'Survey / questionnaire / quiz / online (survey, questionnaire)'</p>

Question			Answer	Marks	Guidance
3	a	(i)	<p>Appropriate size point relating to the design of a microwave. e.g.</p> <ul style="list-style-type: none"> - Microwavable volume adequate for domestic kitchen (1) - Large enough for microwave ready meals / plates / jugs / bowls / kitchen glassware (1) - Must be a suitable weight (1) so it is able to be transported (1) - It is a compact unit and occupies a small footprint (1) fits into a kitchen / on a unit / environment / worktop (1) - View window adequate size to be viewed(1) from different angles(1) - Shape and size of handle adequate (1) for a range of age groups (1) - Controls large enough (1) so a range are able to operate(1) - Displays large enough and visible (1) from a distance in a kitchen(1) - Big enough to accommodate a 1 litre Jug(1) for making soups, sauces and porridge, and heating up baked beans(1). 	2	<p>Simple answer one mark, qualified answer two marks. Also award two marks for two valid responses.</p>
		(ii)	<p>Appropriate lifecycle point relating to the design of a microwave. e.g.</p> <ul style="list-style-type: none"> - Electrical item cannot be disposed of in general waste (1) must be disassembled and recycled(1) - Consider resources used in manufacture (1) and their sustainability / replenishment (1) - Return of recyclable / hazardous material to supplier / manufacturer / WEEE / take back laws (1) - Consideration of component weight / packaging for distribution / transportation (1) to reduce emissions (1) - Reduction of materials (1) easier to recycle(1) 	2	<p>Simple answer one mark, qualified answer two marks. Also award two marks for two valid responses.</p> <p>Do NOT accept; 'last long', 'last as long as possible', 'If it has a long life cycle it is more reliable' or similar.</p> <p>Reference to 'recyclable', 'sustainable' is only with one mark unless each is qualified.</p> <p>Do NOT accept references to; 'pay more' or 'good PR.'</p>

Question	Answer	Marks	Guidance
	<ul style="list-style-type: none">- The microwave will be energy efficient (1) so that it is more environmentally friendly. (1)- Component parts easily disassembled and recyclable (1) minimizing the impact on the environment at end of product life.(1)- Use of standard components (1) to make production more energy/resource efficient (1)- Design so that it can be repaired (1) so that replacing components can prolong overall product life (1)- Reduction of non-renewable/hazardous materials(1) makes product more sustainable(1)		

Question	Answer	Marks	Guidance
	<p>(iii) Appropriate working environment point relating to the design of a microwave. e.g.</p> <p>Surface of worktops slippery (1) anti slip feet to stop slipping/movement on worktops (1)</p> <p>Distance of power points (1) length of cable (1)</p> <p>Areas radiating heat (1) prevent damage to body of microwave (1)</p> <p>Areas with moisture/water (1) protection / guards preventing damage to electrics (1)</p> <p>Microwaves leaking out of unit (1) make sure seals and hinges secure (1)</p> <p>Easy to clean (1) to improve the hygiene (1)</p> <p>The size of the microwave should be suitable for the type working environment i.e. commercial microwave for restaurant / compact microwave on planes (1)</p> <p>The microwave should not make excessive noise (1)</p> <p>Adequate alert noise when timer complete (1)</p>	2	<p>Simple answer one mark, qualified answer two marks. Also award two marks for two valid responses.</p> <p>Reference to 'harm', 'safety' must also include 'leakage of microwaves.'</p>

Question	Answer	Marks	Guidance
b	<p>One mark for each example human anthropometric data identified.</p> <ul style="list-style-type: none"> - Hand finger / size (1) - Hand breadth (1) - Hand length (1) - Hand circumference (1) - Hand grip circumference (1) - Hand sizes for 5th to 95th percentile / average hand size (1) - Hand measurements (1) <p style="text-align: right;">(2x1)</p>	2	<p>Answers must refer to the size of measured human features and not the size of the handle.</p> <p>Reference to grip strength / force not accepted.</p> <p>Accept reference to finger size / length / thickness etc.</p>
c	<p>One mark for each valid reason.</p> <ul style="list-style-type: none"> - Different target audiences multiple users e.g. family or single person (1) - Cater for commercial and domestic users / working environment / - Range of capacities (1) - Specifications for different countries / abroad (1) - Appeal to larger target market (1) - Different styles / colours / aesthetics / power ratings (1) for wider target market (1) - Create products for different price ranges (1) - Different amount of kitchen space for different users (1) <p style="text-align: right;">(2x1)</p>	2	<p>Do NOT accept simple answers;</p> <ul style="list-style-type: none"> - More can be sold - Customers get what they want - To sell more <p>Do NOT accept 'different languages', 'cook at different temperatures.' Reference to 'power rating' is acceptable.</p> <p>Do NOT accept 'compete with competitors products.'</p>

Question		Answer	Marks	Guidance
4	a	<p>One mark for correct standard component</p> <ul style="list-style-type: none"> - Fuse - Terminal screw / screw / bolt (1) - Case screw / bolt (1) - Cable grip screws (1) - Connecting pins (1) 	2	<p>Accept 'bolt', 'prong' as recognition of successful identification of 'standard parts.'</p> <p>Accept multiple answers containing 'screw' if qualified with correct identification name e.g. 'terminal screw', 'case screw.'</p> <p>Do NOT accept 'casing' or similar.</p>
	b	<p>Up to two marks for a clear description.</p> <ul style="list-style-type: none"> - The casing can be taken apart by unscrewing case screw (1) - Wires can be secured / loosened by screwing terminal screw (1) - Screws for cable grip can be secured / loosened (1) - Fuse holder is sprung loaded for easy removal / replacement (1) - A two piece plastic casing allows for easy disassembly (1) - Components only fit / assemble one way (1) - Locating features of casing allow for accurate positioning when assembling (1) - There are no permanent fixings. Welding / gluing (1) - Can be disassembled with common tools / due to standard parts (1) - Labelling of component location in moulding ensures accurate assembly (1) <p style="text-align: right;">(2x1)</p>	2	<p>Do NOT accept 'easy disassembly' unless qualified e.g. 'plastic casing comes off easily.' (0) Must say 'two piece plastic casing allows for easy disassembly.' (1)</p>

Question		Answer	Marks	Guidance
	c	<p>Up to two marks for a clear description or two points from those listed below:</p> <ul style="list-style-type: none"> - Component parts need to fit together (1) - Needs to fit the socket (1) so it can be easily inserted / removed (1) - Manufacturing will produce inherent variance (1) so tolerances are used to ensure suitable levels of accuracy (1) - Parts must be made to close tolerances to ensure that components fit together properly (1). This will ensure that parts do not come apart for safety. (1) <p>Plugs are widely used so they need to meet tolerances (1) to ensure they work in all applications / fit all sockets (1).</p>	2	Do NOT accept: 'reduces risk of shock.' 'Will function as intended.' 'Will overheat.'


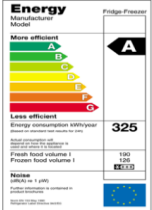
Question		Answer	Marks	Guidance
	d	<p>Up to four marks for a clear explanation.</p> <ul style="list-style-type: none"> - Lower skilled labour can be used (1), lowering the cost of production (1) - Less parts are used (1), making errors in assembly less frequent and saving cost of production(1) - Readily available / easy to source (1) - Cost less as mass-manufactured (1) - Guaranteed quality (1) - It is easier / quicker to assemble because common tools can be used / the operator is familiar with the components (1) - Internationally recognised (1) - Made to accepted tolerances (1) - Same component / part can be used in many products (1) - Cost less to buy in bulk (1) - Easy disassembly / accessibility for product maintenance is an advantage (1) - Standard parts can be reused on other products / for maintenance / servicing by the manufacturer (1) 	4	<p>Do NOT accept 'cheap', 'the company makes more profit', 'costs less' unless qualified with 'because they are mass produced', 'made in large quantities.'</p> <p>Do NOT accept 'easier', 'quicker' unless qualified e.g. 'it is easier to assemble because common tools can be used / the operator is familiar with the components.'</p>

Question		Answer	Marks	Guidance
5	a	<p>Up to two marks for a clear description.</p> <p>Market Pull</p> <ul style="list-style-type: none"> - Consumer demand (1) / consumer sees a product they want to buy (1) - Demand from consumers(1) for new or improved products.(1) - Competing product is launched by another manufacturer (1) which creates increased / new demand from customers - Manufacturer wants to increase their share of the market (1) bringing out a new improved product. (1) - Manufacturers respond to new fashion trends (1) based on consumer demand (1) - Customers' expectations of new technology / products (1) creates continued demand (1) <p>Technological Push</p> <ul style="list-style-type: none"> - Manufacturers can create a demand (1) by bringing out new products containing new technology (1) - New discoveries in materials / production processes(1) imaginative designers use it for a commercial application (1) - Technology becomes more affordable (1) so can be included into a new design (1) - Customers' expect new technology / products (1) which prompts manufacturers to continually research new developments (1) <p style="text-align: right;">(4x1)</p>	4	

Question		Answer	Marks	Guidance
	b (i)	<p>Up to two marks for a clear explanation or two of the points below.</p> <ul style="list-style-type: none"> - A Registered Design gives exclusive rights to the look / appearance / aesthetic of a physical object / product. (1) - Prevents other companies copying a design (1) in relation to the look / appearance / aesthetic of the design. (1) - Gives a registered number which offers proof of ownership (1) - Allows you to sell your design and the intellectual property (IP) rights to it; or licence somebody else to use your design whilst you retain the IP rights. (1) - Long period of protection for designs which can be renewed every 5 years up to a total of 25 years. (1) <p style="text-align: right;">(2x1)</p>	2	<p>Responses should relate to the protection of the 'look / appearance / aesthetic of the design of a physical object / product.'</p> <p>Award one mark for reference to the 'copying of a design.'</p>

Question	Answer	Marks	Guidance
	<p>(ii) Up to two marks for a clear explanation or two of the points below.</p> <ul style="list-style-type: none"> - Assist the prevention of other company's copying / replicating a brand / logo / slogan / statement. (1) - Registering your trade mark gives you the exclusive right to use your mark for the goods (1) - Deter people using your trade mark without your permission (1) - Makes it easier for you to take legal action against anyone who uses your trade mark without your permission (1) - Allows Trading Standards Officers or Police to bring criminal charges against counterfeiters if they use your trade mark (1) - It is your property, which means you can sell it, franchise it or let other people have a licence that allows them to use it. (1) <p style="text-align: right;">(2x1)</p>	2	Responses should relate to 'assisting the prevention of other company's copying / replicating a brand / logo / slogan / statement.'

Question	Answer	Marks	Guidance
	<p>(iii) Up to two marks for a clear explanation or two of the points below.</p> <ul style="list-style-type: none"> - A patent gives you the ability to take legal action to try to stop others from copying, manufacturing, selling, and importing your invention without your permission (1) - The existence of your patent may be enough on its own to stop others from trying to exploit your invention (1) - The patent gives you the right to take a legal action to try to stop exploitation of your invention (1) - Stops others from selling the invention and all the intellectual property (IP) rights(1) - Stops others licensing the invention to someone else but retain all the IP rights (1) <p style="text-align: right;">(2x1)</p>	2	<p>Responses should relate to the 'protection of an invention / idea / technology.'</p> <p>Award one mark for reference to the 'copying / protection of an idea / product / design.'</p>

Question		Answer	Marks	Guidance
6	a	<p>One mark for each correctly statement given.</p>  <p>Increases recycling of electrical and electronic equipment, limits the total quantity of waste going to landfill. (1)</p> <p>Prevents toxic items going to landfill (1)</p>  <p>EU Directive- inform consumer about the consumption of energy (1)</p> <p style="text-align: right;">(2x1)</p>	2	<p>Award one mark for 'do not put in the bin', 'not safe to put in the pin', 'do not throw away.'</p> <p>Do NOT award for the 'product is not recyclable.'</p> <p>Only award mark for 'efficiency / consumption' if qualified with 'energy'</p>
	b	<p>One mark for each valid reason or two marks for a description.</p> <ul style="list-style-type: none"> - Woven carbon fibre impregnated with resin to make lightweight body parts for cars/prosthetics (1) - Photochromic dyes which allow change colour in direct sunlight, warning of high exposure (1) - Starch based polymers for packaging, which biodegrade after use (1) - Shape memory alloys, currents of electricity can change its shape and be used as a sensor to indicate change of environment (1) - ** see Jan 2015 for Q5c <p style="text-align: right;">(2x1)</p>	2	<p>Marks only awarded for specific impact, development or reference to an application or material.</p> <p>Award marks for reference to material properties e.g. lightweight, rigidity, lighter but stronger, chemical resistance.</p>

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>Global trade means that companies / manufacturers carrying out business across the world must understand that aesthetics are interpreted in different ways in different cultures. Aesthetics acceptable in one country may be seen as unacceptable in another. When designing a product or its packaging designers often produce a variety of designs to match the preferences of different countries.</p> <p>AESTHETICS - Colour, Shape and Form The shape and form of the product may determine the look of a product. Products are often designed to look stylish. The style applied to the outside of a product can quite easily influence the technology inside it. Aesthetics can also alter the production / manufacturing techniques through which it is made.</p> <p>CULTURE – Values and Beliefs Some products are aimed at different cultures and countries. A product acceptable in one culture may be looked as offensive or less desirable in another. The use of colours and colour schemes are a good example of this.</p> <p>e.g</p> <ul style="list-style-type: none"> -Importance of colour schemes in different countries is linked to the success or failure of a product. -In China black is associated with evil, dirt, sin, disasters and bad luck. -In general, in China, colours are characterised by their lightness or darkness. For instance, white is regarded as a pure colour and reflects honesty. Red is associated with good luck. Elsewhere in the world red is used to represent danger.

Question	Answer	Marks	Guidance
c			<p>One example of cultural influence would be the Shell Petrol sign, developed for use initially in California, which at the time had a very much Hispanic culture, so Phillip Lowie considered pure red and bright yellow colours appropriate. So successful was the final colour choice that it was copied many times by other companies (for example the McDonald's logo colours).</p> <p>As a result of European interest in Japanese culture and beliefs in the early 1900's, the influence of the rising sun, geometric shapes, circles and straight lines and block colours were manifest in many of the iconic designs of Art Deco, particularly ceramics and decorative items.</p> <p>Earlier, in the 18th century, with extensive trade with China, there developed a now typically English preoccupation with the drinking of tea. The British ceramic industry flourished with the popularity of making and drinking tea.</p> <p>Even the Georgian furniture makers began an affair with everything Chinese: Chippendale, for example, created many chair and room screen designs based on interlaced geometric patterns in wood.</p> <p>More recently, because of the global success of Japanese electronic products, the influence of Japanese culture has had an impact in logo design and font design. Many forward looking UK companies have adopted the sleek, space age, often incomplete letter style for their trademarks and brand symbols inspired by Japanese origins.</p>

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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