# Cambridge National

# Engineering Design

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

Level 1/2 Cambridge National Certificate/Award

# Mark Scheme for June 2019

**Annotations**

| Annotation | Meaning of annotation |
|:---:|:---:|
| BP | Blank page |
| VG | Vague |
| ✖ | Cross |
| ✔ | Tick |
| SEEN | Noted but no credit given |
| ? | Unclear |
| REP | Repeat |
| BOD | Benefit of doubt |
| ECF | Error Carried Forward |
| EG | Example/Reference |
| K | Knowledge |
| DEV | Development |
| L1 | Level 1 |
| L2 | Level 2 |
| L3 | Level 3 |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 1 | (a) | | One mark awarded for each correct answer | 4 | |

**Purpose of the product**      **Suggested product feature**

| Be a wearable message receiver | Digital clock |
|---|---|
| Act as a fitness monitor | Heart rate sensor |
| Be an accurate time piece | NFC chip |
| Be a personal navigation assistant | Cellular data |
| Process contactless payments | GPS technology |

| 1 | (b) | | Award one mark for each valid response <br> • Market gap (1) <br> • New technology (1) <br> • User need (1) <br> • Target market/age group (1) <br> • Market research (1) <br> • Product function (1) <br> • The design problem (1) <br> • The brief provided (1) <br> • Customer specifications( 1) <br> • Age range for the product (1) <br> • Legislation (1) <br> • Product Use (1) <br> • Trends (1) <br> • Working environment (1) | 3 | Accept other valid responses |
|---|---|---|---|---|---|
| 1 | (c) | | Award up to three marks for an explanation <br> • If the purpose of the product is not clearly defined, then designers may invest time and money (1) in the development of a product that is not a fit for purpose. (1)  This could cause delays in bringing the product to market. (1) <br> • Ensuring a clearly defined product purpose means that designers can develop a product that accurately meets the needs of the client/user (1) whilst ensuring development time is as fast as possible (1) allowing them to beat the competition to market. (1) <br> • Ensures the designer can incorporate key features (1) | 3 | Accept other valid responses |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 2 | (a) | (i) | Award up to two marks for a valid answer<br>• The weight of the case is critical as it needs to be as light as possible (1) so the user can easily carry it around. (1)<br>• The case needs to be strong but light (1) so that it is not too heavy for travel when it is full. (1)<br>• Weight is a consideration so materials will have to be chosen that are strong but light (1) to ensure the case can withstand transportation and use. (1) | 2 | |
| 2 | (a) | (ii) | Award up to two marks for a valid answer<br>• Size needs to be considered because the case must be easy to transport (1) and will need to fit within standard storage compartments on trains and planes. (1)<br>• Size is important as the case needs to maximise the usable storage space inside (1) this will define the outside geometry of the case. (1)<br>• Travel companies generally have limitations on the size of luggage that can be transported (1) so designers will have to take this into account when defining the external geometry of the case. (1) | 2 | |

| 2 | (a) | (iii) | Award up to two marks for a valid answer <br> • The case is designed to be wheeled around by the user so the handle needs to reach a suitable height from the ground. (1) This means that the user can comfortably move the case around without over extending. (1) <br> • The case has a carry handle so that it can be easily lifted. (1) The handle needs to be comfortable to hold even when the case is fully loaded (1) and shaped to allow a range of users to grip it effectively. (1) | 2 | |
|---|-----|-------|------------------------------------------------------|---|---|
| 2 | (b) | | Award one mark for a valid example <br> • Change the material (1) <br> • Change the shape of the main body of the case (1) <br> • Change the colour of the main case body (1) <br> • Change the trim colour (1) / material (1) <br> • Add a pattern to the case (1) <br> • Change the texture (1) | 1 | Accept other valid examples |

| 2 | (c) | | Award up to three marks for a detailed explanation | 3 | Accept other valid responses |
|---|-----|---|---|---|---|
| | | | • The case has been manufactured from a durable material to withstand transportation. (1) The material is water resistant to resist weather (1) which ensures that the contents are protected when the case is being moved around. (1)<br>• The case has a set of durable wheels that allow the case to be moved around (1) but also mean the case may collect dirt or debris whilst being transported. (1) The material that the case is made from protects the belongings from this and is easily cleaned. (1) | | |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 3 | (a) | (i) | Award one mark for each valid symbol<br><br>British Toy and Hobby Association Lion Mark (1)<br><br>Age restriction symbol (1)<br><br>British Standard kitemark (1)<br><br>CE mark (1)<br><br>Highly flammable (1) | 2 | Accept other valid examples |

| 3 | (b) | | Award one mark for each valid reason<br>• Protects customers / users. (1)<br>• It is a legal requirement. (1)<br>• Products have to be safe to be sold. (1)<br>• Ensures the company does not get sued. (1)<br>• Protects the company reputation. (1)<br>• More likely improve sales/affects sales (1)<br>• Meets legislation/regulations (1)<br>• Makes customers feel safe (1)<br>• Affects age range product can be sold to (1)<br>• Could damage property/surroundings (1) | 2 | |
|---|---|---|---|---|---|
| | | | **Guidance** | | **Answer/Indicative content** |
| 3 | (c)* | | Award up to six marks for a discussion on the difference between market pull and technological push.<br><br>**Level 3 (5–6 Marks)**<br><br>Learners provide a thorough discussion of the difference between market pull and technological push. 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.<br><br>Good examples used to discuss the difference between market pull and technological push. Learners will demonstrate an accurate level of spelling, punctuation and grammar.<br><br>**Level 2 (3–4 Marks)**<br><br>Learners provide an adequate discussion of the difference between market pull and technological push. Some examples used to illustrate the difference | 6 | Examples and relevant points could include.<br>• Market pull is when a new product is designed and developed based on a need that is identified in the market. This need is usually identified by the customers, client or through market research.<br>• Market pull can sometimes occur due to customers demanding improvements or variations of existing products.<br>• Market pull may occur when a competitor releases a new product and therefore designers have to develop a new or variation of their product in order to compete or take/retain a larger share of the market.<br>• Technology push is when the development of a new product is driven by research and development into new technologies.<br>• Instead of basing product development on market research companies will invest their time and money in R&D to discover how new technologies can be applied in products. Once this has been completed companies will launch products that use the technology to the market and create a new customer base due to the |

between market pull and technological push.

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 understanding of the difference between market pull and technological push. 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.

desire by new customers to own the product.
- Technology push can also be driven by the development of new materials or manufacturing methods.  These processes or materials can have an impact on the design of the product by making them more cost effective to produce and therefore appeal to a new market.

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| **4** | **(a)** | | Award up to four marks for valid answers<br>• anthropometrics<br>• benefits and features<br>• product safety<br>• function<br>• features<br>• performance<br>• target group/intended users<br>• working environment<br>• appearance<br>• ergonomics<br>• lifecycle<br>• materials availability/supply chain<br>• use of standard components<br>• pre-manufactured components<br>• design for manufacturing assembly (DFMA)<br>• design for disassembly<br>• manufacturing process<br>• scale of production - one off, batch, mass production<br>• prototyping<br>• durability and reliability<br>• tolerances<br>• product safety<br>• sustainability<br>• production costs<br>• regulations and safeguards – copyright, patents, registered designs, trademarks, European Conformity (EC) | 4 | |

| 4 | (b) | | Award three marks for a valid explanation | 3 | Accept other valid responses |
|---|-----|---|---|---|---|
| | | | • Design specifications set out all of the requirements for a product. (1)  This must be defined before pursuing manufacture to ensure all of the product details are included (1) and the product functions in the way it was intended. (1) | | |
| | | | • A design specification ensures that when a product goes into production all of the features required for effective operation have been defined. (1)  The designer will use the design specification with the client or brief to ensure that the product is fit for purpose (1) and that it can be manufactured on time and within budget. (1) | | |
| | | | • The design of a new product will be limited by the timescale for its development and the budget. (1)  The materials, manufacturing processes and components will be limited by these constraints (1) therefore the design specification is developed to define exactly what the product needs to do within the available scope of the project. (1) | | |

| 4 | (c) | | Award one mark for each valid response<br>• How the material is sourced (1)<br>• How much energy used during the material processing (1)<br>• How the material or components are transported (1)<br>• Energy used during manufacturing (1)<br>• Product in use / useful life (1)<br>• Can the materials be separated (1)<br>• Can the materials be recycled (1) or reused (1) reduce (1)<br>• How much energy used in the disposal (1)<br>• Are materials biodegradable (1)<br>• Maintenance capability (1)<br>• End of life (1) | 3 | Accept other valid responses |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (i) | Award one mark for the correct answer<br>• Identify | 1 | |
| 5 | (a) | (ii) | Award one mark for each valid response<br>• Process planning takes place early in the design cycle so designers can define the scope of the project (1)<br>• To ensure that the product can be delivered on time and within budget. (1)<br>• To ensure the brief can be implemented within the limitations or expectations of the client (1)<br>• Ensure the client requirements are feasible (1)<br>• Plan scale of manufacture (1) | 2 | Accept other valid responses |

| 5 | (b) | (i) | Award up two marks for a correct answer | 2 | |
|---|---|---|---|---|---|
| | | | • The situation is the location or need (1) where the product will be used and what for (1) | | |
| 5 | (b) | (ii) | Award up two marks for a correct answer | 2 | |
| | | | • The context is the circumstances and need that have led to the problem being developed (1) such as the events that have occurred leading up to the development of the product (1) | | |
| 5 | (c) | | Award up to three marks for a valid description | 3 | |
| | | | • Inspirational and iconic products can inform a new design as designers will look at these products as examples of good design. (1) They will know that the design has sold products previously so will probably be successful again (1) which, allows them to tap into existing markets. (1) | | |
| | | | • Inspirational and iconic products are recognised internationally as examples of good design. (1) They have generated large amounts of sales (1) and their design appeals to a large target market. (1) | | |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 6 | (a) | | Award one mark for each correct answer<br>• The main dust collection bin is removable, so it can be easily cleaned (1)<br>• Filters can usually be removed to be cleaned or replaced (1)<br>• The brushes / dust bin are easily visible so the user can see when they need to be cleaned. (1)<br>• Key attachments / parts can be removed to allow for easy cleaning / be replaced (1)<br>• Ease of disassembly / easy to repair (1)<br>• Standard components may have been used to allow easy disassembly (1)<br>• Can be disassembled with standard tools (1)<br>• Components designed to only fit one way (error proofing) allowing for easy reassembly after maintenance (1)<br>• Certain components easily clip on / off to improve maintenance / cleaning (1)<br>• May include instructions / diagrams to show how to repair / change / clean components (1)<br>• No permanent fixings / glue / welding (1)<br>• Fewer components to make disassembly easier / quicker (1) | 3 | Accept other valid responses |
| 6 | (b) | | Award three marks for a valid explanation<br>• Maintenance can improve a product's life span (1) which stops the materials or components going to landfill (1) reducing the amount of waste that needs to be disposed of. (1)<br>• Good maintenance can ensure that components that fail are replaced (1) which ensures the product's useful life is extended (1) which ensures the product does not need to be disposed of. (1) | 3 | Accept other valid responses |

15

| 6 | (c) | (i) | Award one mark for a valid example<br>• Automation (1)<br>• Additive manufacturing / 3D Printing (1)<br>• Composite lamination processes (1)<br>• Industry 4.0 (1)<br>• Closed loop systems – the recycling of energy / water within the process (1) | 1 | Accept other valid examples |
|---|---|---|---|---|---|
| 6 | (c) | (ii) | Award one mark for each valid answer<br><br>Automation<br>• Reduces / removes human error (1)<br>• Improves efficiency / speed of manufacture (1)<br>Additive manufacturing<br>• Reduces or eliminates waste material (1)<br>• Allows for complex geometry to be produced, not possible with other technologies (1)<br>• Allows for customisation / variation of design to be easily produced (1)<br>• Reduces human error as it is a computerised process. (1)<br>Composite lamination processes<br>• Reduces component's weight (1)<br>• Complex geometry can be produced (1)<br>• Improves strength to weight ratio (1)<br>Industry 4.0<br>• Allows live complex data to be shared across technologies (1)<br>• Utilises cloud computing to manage data improving responsiveness and adaptability (1)<br>Closed loop systems – the recycling of energy / water within the process<br>• Reduces the overall energy usage of processes (1)<br>• Makes manufacturing more sustainable / environmentally friendly (1) | | Error carried forward (ECF) Award up to three marks for three advantages if a valid process is not given in 6 (cii) e.g. continuous production |

**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

**www.ocr.org.uk**

For staff training purposes and as part of our quality assurance
programme your call may be recorded or monitored