

Cambridge **NATIONALS LEVEL 1/2**

# **ENGINEERING DESIGN**



Combined feedback on the June 2017 exam paper  
(including selected exemplar candidate answers and  
commentary)

Unit R105 – Design briefs, design specifications and user requirements

Version 1

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# INTRODUCTION


This resource brings together the questions from the June 2017 examined unit (Unit R105), the marking guidance, the examiners comments and the exemplar answers into one place for easy reference.

We have also included exemplar candidate answers with commentary for Questions 2, 3.

The marking guidance and the examiner's comments are taken from the Report to Centre for this question paper.

The Question Paper, Mark Scheme and the Report to Centre are available from:

<https://interchange.ocr.org.uk/Modules/PastPapers/Pages/PastPapers.aspx?menuindex=97&menuid=250>

<b>OCR</b> <small>Oxford Cambridge and RSA</small>	
<b>Monday 15 May 2017 – Afternoon</b>	
<b>LEVEL 1/2 CAMBRIDGE NATIONAL AWARD/ CERTIFICATE IN ENGINEERING DESIGN</b>	
<b>R105/01 Design briefs, design specifications and user requirements</b>	
Candidates answer on the Question Paper	
OCR supplied materials: None	Duration: 1 hour
Other materials required: None	
	
Candidate surname	Candidate surname
Centre number	Candidate number
<b>INSTRUCTIONS TO CANDIDATES</b>	
<ul style="list-style-type: none"> <li>Use black ink. HB pencil may be used for graphs and diagrams only.</li> <li>Complete the boxes above with your name, centre number and candidate number.</li> <li>Answer all the questions.</li> <li>Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).</li> <li>Do not write in the barcodes.</li> </ul>	
<b>INFORMATION FOR CANDIDATES</b>	
<ul style="list-style-type: none"> <li>The total number of marks for this paper is 80.</li> <li>The number of marks for each question is given in brackets [ ] at the end of each question or part question.</li> <li>Dimensions are in millimetres unless stated otherwise.</li> <li>Your quality of written communication will be assessed in questions marked with an asterisk (*).</li> <li>This document consists of 12 pages. Any blank pages are indicated.</li> </ul>	
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<b>Cambridge National</b>
<b>Engineering</b>
Unit <b>R105</b> : Design briefs, design specifications and user requirements
Level 1/2 Cambridge National Award/Certificate in Engineering Design <b>J831/J841</b>
<b>Mark Scheme for June 2017</b>
<small>Oxford Cambridge and RSA Examinations</small>

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Level 1/2 Cambridge National Awards in Engineering <b>J830-3, J840-3</b>
Level 1/2 Cambridge National Certificates in Engineering <b>J830-3, J840-3</b>
<b>OCR Report to Centres June 2017</b>
<small>Oxford Cambridge and RSA Examinations</small>

## GENERAL EXAMINER COMMENTS ON THE PAPER

This was the sixth series for this examination. Due to the number of series that have now been undertaken, it is clear that centres are preparing candidates for the paper more effectively resulting in them being able to access and gain marks on the vast majority of topics covered in the specification. As in previous series, the paper was successful in discriminating across the ability ranges.

As mentioned in previous reports to centres, centres should cover the entirety of the content set out in the specification. Once the content has been covered it is advised that centres spend some time preparing learners for the examination using the past papers for this examination. This should allow learners to answer the whole paper with sufficient understanding and depth. There are key areas of the specification where candidates' understanding is not as fully developed as it needs to be to access the questions.

As mentioned in previous series, there are still times when candidates are not addressing the command verbs in the questions. At times it is clear that candidates are not always answering questions in the style expected of the command verb. For example, when a question command verb is 'Explain' or 'Describe' some candidates are answering with one-sentence answers which limit their ability to access the full marks available for the question.

### **Resources which might help address the examiner comments:**

From the link below, you'll find 'The OCR guide to examinations' (along with many other skills guides)  
<http://www.ocr.org.uk/i-want-to/skills-guides/>

## Question 1

Answer **all** the questions.

1 Product 'Life Cycle Analysis' (LCA) is an important consideration for designers.

(a) Complete the table below by adding the LCA considerations in the correct order.

One has been done for you.

	Selection of raw material	Recycling of materials
	Ease of disassembly	Energy use during operation
1	Selection of raw material	
2	Energy used in manufacturing	
3	Energy use during operation	
4	Ease of disassembly	
5	Recycling of materials	

[4]

(b) Give **three** ways in which new and emerging materials can contribute to a product's lifecycle.

1. 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)

[3]

(c) Describe how ease of disassembly can contribute to sustainable design.

- 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]

## Mark Scheme Guidance

Question 1(b):

Accept suitable alternative answers related to product lifecycle e.g. extraction of materials, production, transportation, usage and end of life.

Question 1(c):

Accept any valid alternative answers.

## Examiner comments

Part 1ai of this question required candidates to list important considerations of a product 'Life Cycle Analysis' (LCA) in order. On the whole, the question was answered well with a large majority of candidates achieving full marks. Where candidates have failed to achieve full marks they had clearly not covered LCA in detail or had simply not given due care and attention to the options given and their logical order of consideration.

In part 1b, candidates were required to give three ways in which new and emerging materials could contribute to a product's lifecycle. This was generally answered well, with most candidates able to give suitable ways in which new or emerging materials could contribute to a product's lifecycle. Where candidates lost marks here, general or vague responses were listed that did not give consideration of how 'new and emerging' materials rather than general material selection may have an impact.

In part c of question 1, design for disassembly had to be considered with candidates asked how the ease of disassembly can contribute to sustainable design. Many candidates focused on the requirement for maintenance or repair of the product. This point is valid and provided some excellent responses. In addition, candidates achieving full marks considered how the separation of materials allowed for more effective recycling and disposal of materials at the end of life.

## Questions 2(a) and (b)

2 The creation of a design brief is an important step in the identify stage of the design cycle.

(a) (i) Give **two** factors that may inform the development of a design brief.

- 1 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)  
 2 • Improvements to existing products (1) .....  
 • Specific client requirements/initial specification from client (1)  
 ... • Budget (1) ..... [2]  
 • 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)

(ii) State **one** other process carried out in the identify phase of the design cycle.

- ... **One** mark from: .....  
 • Research (1)  
 ... • Process Planning (1) ..... [1]  
 • Communication between the client and the designer (1)

(iii) Name **two** other phases of the design cycle.

- 1 One mark for each correct phase up to a maximum of two from: .....  
 • Design phase (1)  
 ... • Optimise phase (1) .....  
 2 • Validate phase (1) .....  
 ..... [2]

(b) Give **two** ways in which market research can be used to update an existing product.

- 1 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)  
 2 • Improved accessibility of functions, controls (1) .....  
 • Improved safety features (1)  
 ... • Improved manufacturing processes become available (1) ..... [2]  
 • 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)

## Questions 2(c)

- (c) Describe, using an example, how the function of a new product could be influenced by the target audience.

**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)
- 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)

[3]

### Mark Scheme Guidance

Question 2(a)(i):

Accept any valid alternative answer.

Accept reference to colour or aesthetics as 'specific client requirements.' 'Size' and 'shape' is too vague unless qualified.

Question 2(a)(ii):

Accept specific types of research e.g. surveys, focus groups.

Question 2(b):

Accept other feasible and valid responses.

Question 2(c):

Accept other feasible and valid responses.

Function or feature (1).

A description of how this has been influenced by the target audience (2).

### Examiner comments

In question 2ai candidates were asked to give two factors that may inform the development of a design brief. On the whole candidates were able to access marks here by giving valid responses. In some cases however, candidates gave vague or generic responses that struggled to gain the marks available. Centres and candidates are encouraged to ensure that responses are specific to the question and candidates do not rely on generic responses to gain marks in questions that may require a more detailed or specific response.

Question 2aii required candidates to state one other process in the identify phase of the design cycle. The understanding of the design cycle has been raised in previous series and is still not fully developed within candidates. Lots of candidates were unable to give a valid, additional process that is undertaken within the identify phase of the design cycle which has limited their ability to gain marks here. Some candidates gave processes that occur in different phases of the cycle.

In part iii of question 2, candidates then had to name two other phases of the design cycle. As per the commentary above, many candidates missed out on marks here as they detailed processes carried out within other phases and not actual phase titles as detailed in the specification. Centres are reminded to cover the specification in detail across all areas which should therefore allow candidates to access marks in questions such as this one.

Question 2, part b, asked candidates to give two ways in which market research can be used to update an existing product. On the whole most candidates were able to access marks here but in some cases they failed to action the specific points the question was asking for. Some candidates gave specific examples of market research which, when qualified were valid, but on their own, did not always meet the requirements of the question. Centres should ensure candidates fully read questions and act on the requirements of the specific question.



Part c of question 2 required candidates to describe, using an example, how the function of a new product could be influenced by the target audience. Responses to this question varied greatly with some candidates able to select a specific product, function or feature and describe how the target audience may have informed the design choices behind its development. In some cases however, as per previous questions, candidates relied on more generic answers that although sometimes relevant could at times limit the candidates' ability to gain marks.

## Exemplar candidate work

## Question 2(a) – Low level answer

3

2 The creation of a design brief is an important step in the identify stage of the design cycle.

(a) (i) Give **two** factors that may inform the development of a design brief.

- 1 The materia the designer wants to use is not cost effective
- 2 Also that material can not be recycled and is bad for the environment.

[2]

(ii) State **one** other process carried out in the identify phase of the design cycle.

- Is there another product like this on the market.

[1]

(iii) Name **two** other phases of the design cycle.

- 1 Optical is a phase you could use whi
- 2 Another phase is digital which is when the manufacture designs the component of a computer.

[2]

### Commentary

Question 2(a)(i) – This is a low level answer because the candidate has repeated the same factor. The question asks for TWO factors so the 'material' used in the product is a factor but repeating this does not show the breadth of different factors required to gain the higher marks. To make this a higher level answer the candidate could have mentioned two differing factors to avoid losing marks for repetition.

Question 2(a)(ii) – This is a low level answer because it does not specifically recognise the criteria detailed in the unit specification. The elements of the design cycle are detailed in the unit specification and questions of this nature should refer exactly to these key processes. This response is too generic in its content and does not demonstrate any knowledge of the specific design cycle that forms part of this specification. To make this a high level response the candidate should have given a response that was specific to the identify phase of the design cycle as outlined in the specification.

Question 2(a)(iii) – This is a low level response because it does not reference the correct terminology used with the unit specification. The specification for R105 is explicit in the names of the phases of the design cycle and these must be referenced in responses given by candidates otherwise marks cannot be awarded. In order to make this a high level response, candidates would have to give responses that match the phases of the cycle listed in the unit specification for R105.

## Exemplar candidate work

### Question 2(a) – High level answer

3

2 The creation of a design brief is an important step in the identify stage of the design cycle.

(a) (i) Give **two** factors that may inform the development of a design brief.

1 Asking the client what they like

2 Base the product on aesthetics

[2]

(ii) State **one** other process carried out in the identify phase of the design cycle.

Research and Design brief.

[1]

(iii) Name **two** other phases of the design cycle.

1 The design phase - the making the design.

2 The validate phase - Testing, Evaluating

[2]

### Commentary

Question 2(a)(i) – This is a high level answer because it gives two different specific factors that can inform the development of a design brief. It references the specification and highlights two key areas that would be regularly discussed or selected by the client at the stage when a design brief is developed. A further possible area of improvement for discussion could be the use of higher level, technical language.

Question 2(a)(ii) – This is a high level answer because it is specific to the unit specification. The areas that can be accepted are explicit in the unit specification and candidates who are fully aware of the design cycle, as detailed, in the specification will achieve full marks here.

Question 2(a)(iii) – This is a high level answer because, as per the response for question 2a(ii), it is specific to the unit specification. The phases of the design cycle are extremely explicit in the unit specification. Due to the defined nature of the design cycle model utilised within this specification it is not possible to award marks for responses outside of this particular model. The candidate's response here gives two examples in line with the specification and therefore fully meets the requirements of the expected response in the unit and mark scheme.

## Exemplar candidate work

## Questions 2(b) and (c) – Low level answers

(b) Give two ways in which market research can be used to update an existing product.

- 1 One of the ways of updating an existing product, is by software update.
- 2 To sell Ad-ons.

[2]

(c) Describe, using an example, how the function of a new product could be influenced by the target audience.

- The function of a tooth brush could influence the target audience because of the skin Anesthetic and the shape of the new product.
- To help the target audience use the product with safety.

[3]

### Commentary

Question 2(b) – This is a low level answer because the responses given are too vague to justify awarding of marks. There is limited referral to market research and therefore the responses give overly generic answers to the question that shows limited understanding of the unit specification or topic of the question. The candidate could improve this response to make it a high level answer by referring more to market research outcomes and giving more specific tangible examples.

Question 2(c) – This is a low level response to the question because the three marks require an example and then a subsequent description of how the target audience influences the function. This response gains one mark as a valid example is given. However, after the example is given, the subsequent descriptions are vague, and do not reference how the function of the example given may be influenced by the target audience. In order to gain more marks and become a higher level response, the candidate would need to take the valid example given and highlight ways that its function could alter based on variations in the target audience.

## Exemplar candidate work

## Questions 2(b) and (c) – High level answers

(b) Give two ways in which market research can be used to update an existing product.

1. If there is another product like this out there how can we better them.
2. There might be a cheaper material out there which does the same job as the one you got.

[2]

(c) Describe, using an example, how the function of a new product could be influenced by the target audience.

If the target audience is older, the product would be expected to do more like a phone. The younger generation wants their phones to do more unlike the older generation they just want to be able to make communications.

[3]

## Commentary

Question 2(b) – This is a high level response because it gives actions that can be taken from market research to update existing products. The candidate has considered how market research will identify key factors that will be raised through the evidence generated from research that can inform product updates. The response has given two, valid examples, ‘identifying improvements’ and ‘new materials.’ Despite the valid examples, which have secured the marks, improvements could be made to the responses. The answers are valid but the level of language could be improved to include more technical terminology.

Question 2(c) – This question requires a three mark response that needs to be constructed of various elements. In the question itself, it explicitly asks for an example. Candidates would lose a mark here if they do not give an example within the body of their response. In addition, the question asks for a ‘description’ so candidates would be expected to give a longer length answer. The response given here gains the marks as the candidate as used an example, discussed variations in the target audience and suggested how the function may vary based on that particular variation in audience. The response could be further improved by using more technical language and specific functions but in essence the response has all the requirements for three marks.

## Questions 3(a) and (b)

3 Fig. 1 shows some children's plastic building blocks.

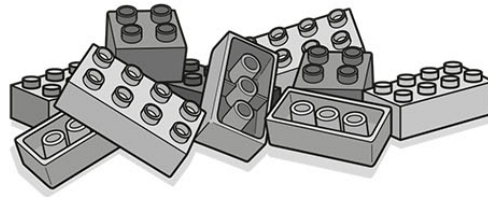


Fig. 1

(a) Give **two** safety factors that should be considered when designing the children's building blocks.

- 1 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) .....
  - 2 • 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) Give **two** reasons why the building blocks have been manufactured using plastic moulding.

- 1 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) .....
  - 2 • 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) .....
  - Repeatability is achieved, as all blocks will be moulded exactly the same (1) .....
  - Plastic can be easily shaped into complex forms using moulding (1) [2]
  - 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)

## Question 3(c)

**(c)\*** Discuss how the manufacturing process has affected the design of the building blocks.

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 within the mould will also ensure no post-mould finishing required.

[6]

### Mark Scheme Guidance

Question 3(b):

Only award reference to 'low cost' or 'cheap' if qualified by 'scale of manufacture' or 'cost per unit.'

Question 3(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 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.

**Examiner comments**

Question number 3a required candidates to give two safety factors that should be considered when designing children's building blocks. Overall, this question was answered well with the vast majority of candidates having a good understanding of safety within the development of child's toys which, was generally applicable to this question. However, in addition to this, candidates on the whole, were able to give responses that were specific to the building blocks with some consideration of how they will be used and the manufacturing process that has created them.

Part b of question 3 required candidates to give two reasons why the building blocks would have been manufactured using plastic moulding. Responses to this question varied but on the whole most candidates were able to achieve some of the marks available in this question. As per the feedback given in previous reports to centres learners are making reference to the associated cost benefit of plastic moulding but do **not** qualify this with the scale of production. Centres are reminded that when candidates consider the cost advantage of plastic moulding they must qualify it by the reduction in cost per unit as the scale of production increases.

Question 3c required candidates to show understanding by assessing their quality of written communication in a discussion question that focused on how the manufacturing process had affected the design of the building blocks.

The quality of answers provided varied dramatically. Where candidates failed to achieve high marks, responses lacked development. Candidates who gave strong responses were able to discuss how plastic moulding has affected the design through material selection, repeatability, quality, accuracy, wall thickness, fillet radii and mould ejection. Some candidates focused on cost of plastic moulding but did not qualify it by considering the rate or scale of production which led to some general responses that could not access the higher marks. In some cases, points were repeated rather than developed and many candidates did not write in extended prose therefore failing to meet the requirement of the extended written response asked for in this type of question. Centres are reminded to ensure they cover the full scope of the specification in depth to ensure candidates achieve maximum marks. As mentioned previously, centres are reminded to develop candidates' ability to write extended responses. Some responses were written in bullet point format and, although some excellent points were made, candidates could not achieve higher marks as they are being assessed on their ability to write extended prose and not just their knowledge of the topic in the question.



Exemplar candidate work  
Question 3 – Low level answer

4

- 3 Fig. 1 shows some children's plastic building blocks.

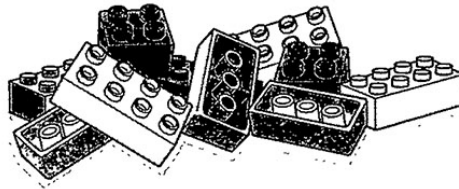


Fig. 1

- (a) Give two safety factors that should be considered when designing the children's building blocks.

1. make sure the child's building block has no sharp ~~ed~~ edges.
2. make sure the blocks are a safe suitable material and make sure they blocks are not heavy. [2]

- (b) Give two reasons why the building blocks have been manufactured using plastic moulding.

1. They can be made in mass-production.
2. It is very cheap to use produce a product using a plastic moulding. [2]

5

- (c)\* Discuss how the manufacturing process has affected the design of the building blocks.

The Designer would have to make a product what can be mass produced for a cheap price. he would also have a look at how that material could affect the environment, for example if the designer is thinking of using plastic that produces carbon dioxide which affects our planet.

[6]

## Commentary

Question 3(a) – This response has managed to achieve one mark for the first point made regarding the sharp edges of the component. The second response given by the candidate has highlighted the material however the candidate has not been specific about what property or factor related to the material ensures it is safe. The candidate has stated that the material should be 'suitable' but this is too vague and does not demonstrate an understanding of safety factors. In order to move this response to a higher level and gain maximum marks the candidate needs to make the second point more specific. For example, if the candidate wanted to still refer to the material they could have exemplified their answer with a particular property that ensured the material was safe for children. For example, 'non-toxic'.

Question 3(b) – This response has not gained maximum marks because only one of the answers given is worthy of credit. The first answer given gains the mark because the candidate has understood that plastic moulding is a suitable process when components need to be mass produced. The second answer does not gain credit because the candidate has stated that plastic moulding is 'cheap'. As a standalone response, 'cheap' will not gain the mark without being exemplified. The plastic moulding process is not a 'cheap' process. In fact it is extremely expensive in the early stages of production due to the capital cost of machinery and tooling. It is only when parts are manufactured in extremely high volumes that the subsequent price per component offsets the investment cost and therefore the price per part becomes cost effective. The candidate's second answer does not demonstrate this level of understanding and can therefore not be awarded the mark. In order to achieve these marks the candidate should have exemplified cheap referencing the cost benefit gained through scale.

Question 3(c) – This is an extended answer question that tests the candidates' quality of written communication. The question is worth up to six marks and candidates are required to develop the points they make through further exemplification and high quality extended writing in order to achieve the highest marks. This is a low level response because the candidate has only made one valid point directly linked to the requirements of the question. The candidate is able to highlight that the mass-produced nature of the process means a cheaper price but, as per the rest of the answer, this is not exemplified any further to gain a development mark. The remainder of the response does not directly answer the question and instead, mentions generic design considerations that are not directly linked to the manufacturing process. In addition, the candidate has not exemplified how or why the points made have had an impact on the design. The candidate's written work is relatively well structured but the content of answers does not support the developed response required to gain marks higher up the range available.

## Exemplar candidate work

## Questions 3(a) and (b) – High level answers

4

3 Fig. 1 shows some children's plastic building blocks.

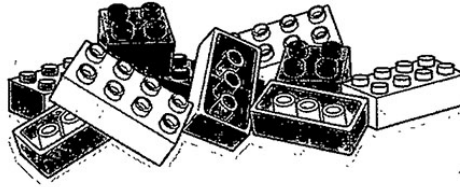


Fig. 1

(a) Give two safety factors that should be considered when designing the children's building blocks.

- 1 It should be big enough so <sup>children</sup> ~~parents~~ don't swallow it.
- 2 the edges need to be smooth so they don't cut themselves. (as the material is plastic so you may get some rough edges) [2]

(b) Give two reasons why the building blocks have been manufactured using plastic moulding.

- 1 Its more cost effective if you mass produce them.
- 2 so you can make multiple versions of the same shape instead of keep changing it. [2]

## Commentary

Question 3(a) – This is a high level answer because the candidate has given two valid safety factors that have to be considered when designing children's building blocks. The candidate has not replicated their responses and therefore has gained maximum marks. In each case the answer is specific with reasons why the design consideration can avoid a certain danger when the child is using them.

Question 3(b) – This is a high level response because the candidate has given responses that are directly correlated to the chosen manufacturing process. In the first response the candidate has been able to highlight the cost advantages of plastic moulding when mass producing components. This demonstrates not just an understanding of the manufacturing process but also that the cost benefit only occurs when the component is mass produced. The second response given by the candidate is not as succinct as the first and could be improved with the use of more technical language, however it does demonstrate an understanding that there will be variations of the building block and that plastic moulding is suitable for this. The answer could be clarified further by referencing what variation. For example, colour variety is easily achieved or additional mould tools could create accurate size variations that would connect accurately with the other blocks in the range.

## Exemplar candidate work

## Question 3(c) – High level answer

5

(c)\* Discuss how the manufacturing process has affected the design of the building blocks.

The manufacturing process has affected the design of the building blocks, for example the holes meant to fit the blocks together are hollow meaning less material is wasted when manufactured. When added added up over time this equates to a huge saving, the design is also fully plastic meaning in manufacture the only process needed is the injection moulding which also speeds up the process as well as cheapening it. As the product is injection moulded, no finish is required saving more time in the process meaning the design can have more intricate parts. [6]

- The inside of the holes meant to fit together are hollow
- The design is fully plastic requiring no other processes besides injection
- No finish is required

### Commentary

Question 3(c) – This is an extended answer question that tests the candidates' quality of written communication. The question is worth up to six marks and candidates are required to develop the points they make through further exemplification and high quality extended writing in order to achieve the highest marks. This is a high level response because the candidate has made valid points associated with how the manufacturing process has directly affected the design. For example, the candidate has highlighted that the manufacturing process is injection moulding and developed this to state that this removes any further finishing processes, saving time. The candidate has also highlighted some of the features of the components are hollowed out, a key feature of injection moulding, and discussed the advantage of saving material. To improve this answer further the candidate could have taken some of the points made above and linked them closer to the geometry of the building block. For example, the hollow nature of the components and the associated thin-walled section are due to the requirements of injection moulding to ensure consistent cooling and stop parts warping. In addition, the candidate has mentioned the 'cheapness' of the process without further exemplification of how this is associated with scale of component production offsetting initial capital investment in tooling and machinery. In addition, a little more care and attention to the grammar and structure of the answer, combined with the additional content or exemplification mentioned previously may have allowed the candidate to achieve maximum marks.

## Question 4(a)

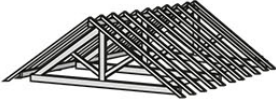
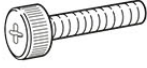



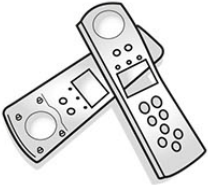
- 4 The use of both standard and of pre-manufactured components is an essential part of modern day manufacturing.

(a) The table below shows a range of standard and pre-manufactured components.

Complete the table by placing a tick (✓) in the correct column to indicate if the component is standard or pre-manufactured.

One of each has been done for you.

One mark for **each** tick in rows 1, 4, 5 and 6

	Component	Component name	Standard component	Pre-manufactured component
1		Roof truss		✓
2		M6 Bolt	✓	
3		Car seat		✓
4		Bearing	✓	
5		Gear	✓	
6		Injection moulded casing		✓

[4]

## Questions 4(b) and (c)

**(b) Give three reasons why pre-manufactured components may be used in production.**

- 1 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) .....
- 2
- 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) .....
- 3
- Regular 'just-in-time' deliveries from suppliers can help to manage stock/inventory levels (1) .....

[3]

**(c) Explain why the scale of manufacture can affect the cost of production.**

- 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]

### Mark Scheme Guidance

Question 4(a):

**No** marks to be awarded for ticks next to components 2 and 3 as these are already given as examples.

Question 4(b):

Accept other feasible and valid responses.

Question 4(c):

Accept other feasible and valid responses.

### Examiner comments

Question 4a required candidates to indicate which components were 'standard' or 'pre-manufactured' from a list of examples. The majority of candidates were able to select the appropriate 'standard' or 'pre-manufactured' components but in some cases it was clear that candidates did not know or understand the difference between a 'standard' or 'pre-manufactured' component.

The development of understanding related to pre-manufactured components was further explored in part b of question 4. Candidates were asked to give three reasons why pre-manufactured components may be used in production. Some of the misunderstanding evidenced in part a of question 4 was also apparent in this part of the question. Candidates in some cases were referring to reasons that would be more associated with 'standard' rather than 'pre-manufactured' components. Those candidates that accessed the vast majority of marks were able to outline the time-savings later in production or ability to guarantee quality from reputable, experienced suppliers. As per responses in previous questions, there is a common response from candidates related to saving money or reducing costs e.g. cheap. This is not always the case and in ALL cases needs to be qualified to gain marks.

Part c of question 4 required candidates to explain how the scale of manufacture can affect the cost of production. Where candidates were able to access most or all of the marks in this question they were able to provide responses that demonstrated understanding of how the cost per component was reduced as scale of manufacture rose despite the additional requirements for labour or machinery. Where candidates did not gain marks they failed to demonstrate this understanding.

## Questions 5(a) and (b)

5 Fig. 2 shows an electric household kettle.



Fig. 2

(a) State **two** ways the working environment has influenced the design of the kettle.

- 1 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) .....  
 2 • 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]

(b) Give **three** aesthetic design features that could be modified to vary the range of kettles.

- 1 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 .....  
 2 be changed (1) .....  
 ... • The size/capacity of the kettle could be increased/reduced. (1) .....  
 ... • The kettle could be minimized to make it look more contemporary (1) .....  
 ... • The design of the exterior could be changed to represent more traditional kettle .....  
 3 designs (1) .....  
 ... • The materials could be changed (1) .....  
 ... • The size/shape of the handle could be adjusted (1) ..... [3]

## Questions 5(c)

(c) Designers may produce virtual or physical prototypes throughout the design development process.

(i) Give **two** methods a designer may use to produce a prototype.

- 1 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) .....  
 2 • A designer may use a 3D printer (1) .....  
 ... • A designer may build a working prototype using manual machining or bench fitting techniques. (1) .....  
 ..... [2]

(ii) Describe **three** ways that a physical prototype can be used to validate a product.

- 1 Three marks from e.g.: .....  
 .....  
 ... • Handle it/see it .....  
 ... • Assess the ergonomics of the design .....  
 2 • Assess its size/dimensions .....  
 ... • Test its functionality/fit/stress/aerodynamics .....  
 ... • Ensure it meets the design specification/standards/legislation .....  
 ... • Assess the suitability of materials .....  
 3 • Check for any errors in the design .....  
 ... • To assist in error proofing the design .....  
 ... • Gain client feedback on the design .....  
 ..... [3]

### Mark Scheme Guidance

Question 5(a):

Accept other valid factors.

Question 5(b):

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.

Question 4(c)(i):

Accept references to virtual/augmented reality.

Question 4(c)(ii):

Accept other valid responses.

### Examiner comments

Question 5a asked candidates to state two ways the working environment has influenced the design of a kettle. This question generated a variety of responses with a mix of quality. In some cases, candidates gave responses that were general, vague or highlighted key design features of the kettle that were not directly related to the working environment. Those candidates that were able to access full marks were able to give design considerations or features that would be included in a kettle as a direct result of its working environment and associated conditions.



Part b of question 5 was generally answered with valid responses that achieved marks and allowed candidates to achieve some, if not all, of the marks. Candidates were able to pick up on key aesthetic changes such as colour or material that would allow designers to modify the aesthetic appearance of the kettle. Responses related to shape were valid if they were qualified by a specific feature or detail associated with the kettle.

Question 5, part c, required candidates to consider the production of virtual or physical prototypes and how they can be used to validate a product. Part ci asked candidates to give two methods that a designer may use to produce a prototype. Generally, this question was answered well with most candidates able to give methods that a designer may use. Responses showed a good understanding of the methods available for prototype production.

## Questions 6(a)

6 Designers may take inspiration from iconic products.

(a) (i) Give **one** example of an iconic product.

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
- Anglepoise lamp
- Spitfire
- Macintosh

[1]

(ii) State **two** reasons why the product you have chosen became iconic.

1 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 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]

## Questions 6(b), (c) and (d)

**(b)** Explain why designers may use iconic products as inspiration when developing new designs.

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]

**(c)** Explain why a designer may apply for a patent.

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)** State the meaning of the term 'trademark'.

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]

## Mark Scheme Guidance

Question 6(a)(i):

Accept any suitable alternative answer.

Do not accept reference to 'phone'/'smartphone'/'touchscreen' phone unless qualified with a specific example e.g. iPhone.

Question 6(a)(ii):

Accept any other valid reasons.

Question 6(b):

Do not give marks for repeated answers from part (a)(ii).

## Examiner comments

Question 6ai required candidates to give an example of an iconic product. The responses given to this question varied greatly with lots of examples given that could be deemed as 'popular' but not necessarily 'iconic.' In many cases candidates referred to products they were familiar with but these products would not necessarily be recognised as iconic designs. In some cases it was clear that candidates had not covered the specification in detail or had limited delivery related to 'iconic' products. Centres are reminded that they should develop a detailed understanding of a range of iconic products that candidates can use to inform their responses within questions such as this one.

Part aii of question 6, required candidates to state two reasons why the product that they have chosen became iconic. Although candidates were recognised for valid responses here, regardless of their response to part ai of this question, some responses struggled to gain marks due to the lack of understanding of 'iconic' products. Some generic responses were given that at times failed to gain marks. Those candidates that gained maximum marks here were able to give specific reasons why a valid iconic product gained recognition and due to its design, gained an iconic status.

Part b of question 6 asked candidates to explain why designers may use iconic products as inspiration when developing new designs. Again, it was tangible where candidates had a developed understanding of iconic products and how these have influenced future designs across a range of future products. Candidates who had this developed knowledge were able to access the maximum marks where as candidates without this developed knowledge gave general or vague responses.

Question 6 part c asked candidates to explain why a designer may apply for a patent. On the whole candidates were able to access the marks available within this question and demonstrated a solid understanding of the reasons why a designer may apply for a patent.

Part d of question 6 required candidates to state the meaning of a 'trademark.' As per part c of this question, candidates on the whole gave valid responses. Where responses did not gain the marks available here, candidates were not explicit about the meaning of a 'trademark' and may instead be referring to copyright or to patents. Centres are reminded to ensure candidates can explicitly differentiate between patents, copyright and trademarks as these questions require a specific understanding of the differences to gain the full marks.



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