

CAMBRIDGE NATIONALS

Examiners' report

ENGINEERING DESIGN

J831, J841

R105 January 2021 series

Contents

Introduction	3
R105 series overview.....	4
Question 1 (a).....	5
Question 1 (b).....	5
Question 1 (c).....	6
Question 2 (a) (i).....	6
Question 2 (a) (ii).....	7
Question 2 (b) (i).....	8
Question 2 (b) (ii).....	8
Question 2 (c).....	9
Question 3 (a).....	10
Question 3 (b).....	10
Question 3 (c).....	11
Question 3 (d).....	12
Question 4 (a) (i).....	13
Question 4 (a) (ii).....	13
Question 4 (b).....	14
Question 5 (a).....	15
Question 5 (b).....	16
Question 5 (c) (i).....	16
Question 5 (c) (ii).....	17
Question 5 (d).....	17
Question 6 (a) (i).....	18
Question 6 (a) (ii).....	19
Question 6 (a) (iii).....	20
Question 6 (b).....	20
Copyright information	21

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers are also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

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R105 series overview

R105 is the examined unit for the Cambridge National Award and Certificate in Engineering Design and contributes 50% and 25% respectively towards the final qualification. The papers and associated specification provide theoretical underpinnings to the internally assessed units of the qualification.

In recent series, the maturity of the specification has demonstrated that centres are preparing candidates for the paper more effectively, resulting in candidates being able to access the paper well and gain marks on the vast majority of topics covered in the specification.

As mentioned in previous examiners' reports following past series, 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 candidates for the examination using the past papers for the examination. This should allow candidates 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. There are particular examples of this that will be explained in detail throughout this report.

<i>Candidates who did well on this paper generally did the following:</i>	<i>Candidates who did less well on this paper generally did the following:</i>
<ul style="list-style-type: none"> • Candidates who did well on the paper showed by their responses that they had read the question correctly and could respond using their knowledge and understanding of the specification. • These candidates tended to give the required response to the question i.e. when an explain or describe question was asked responses tended to be given in a paragraph or extended with examples given to support the reasoning behind the candidates thinking. • Specific answers were given to questions rather than a generic response. This was particularly evident in Q2(a)(i) when the candidates were required to name three iconic products responses were seen such as; iPhone, mini cooper, Dyson vacuum cleaner. • When a specific word was required to describe a statement it was evident that a good understanding of key terms was evident with candidates able to identify the description of ergonomics and anthropometrics in Q5(c)(i) and 5(c)(ii) respectively. 	<ul style="list-style-type: none"> • Candidates who did less well on this paper usually missed out answers showing a lack of subject knowledge or an understanding of the question. Many times they did not fully answer the question giving a response that was not required or gave a vague response. • 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' candidates are answering with one-sentence answers. This limits their ability to access the full marks available for the question. • Candidates tended to give one word answers to some questions where two aspects were required, e.g. Q4(a)(i) responses required were to consider the user and aesthetics several candidates responded to this question in a single word; or shape without any further consideration for the aesthetics element or the user's needs. • When specific answers were required to a question generally generic terms were used such as in Q2(a)(i) when the candidates were required to name three iconic products responses were seen such as; phone, car, pen. • With Q4b a discussion is required regarding the topic of the question. As this is where the quality of the candidates written communication is also assessed it is important that the response is in the form of a paragraph and not just a few lines or a list of bullet points.

Question 1 (a)

1 Designers need to consider design for disassembly when developing new products.

(a) The table below shows a range of fixing methods.

Complete the table by placing a tick (✓) in the correct column to indicate if the fixing method makes disassembly easier or not.

One has been done for you.

Fixing method	Helps disassembly	Does not help disassembly
Welding		
Screws		
Adhesive/glue		
Nut and bolt with washer		
Rivets		✓

[4]

This question required candidates to place a tick in the correct column to show which fixing method could make disassembly easier or not. On the whole candidates were able to place ticks in the correct box and achieve maximum marks on the question. Where candidates were not credited with the maximum mark, a tick had been omitted or candidates had identified welding and/or adhesive/glue as a method that helps disassembly. Overall the question provided a positive opening to the paper.

Question 1 (b)

(b) Give **two** advantages of designing products for disassembly.

- 1
-
- 2
-

[2]

This question generated strong responses from candidates with a large number being able to gain maximum credit for the question.

Candidates clearly understood the term disassembly and that it offered advantages of the product being able to be taken apart in order to access parts for maintenance as well as allowing the reuse or recycling of parts.

In cases where candidates did not gain maximum credit, responses were vague and did not identify an advantage of product disassembly.

Question 1 (c)

(c) Explain why design for disassembly should be considered in a Life Cycle Analysis (LCA).

.....

.....

.....

.....

.....

.....

..... [4]

This question required candidates to detail why it is important for disassembly to be considered in a Life Cycle Analysis. Most candidates were able to gain some credit through responses that highlighted how disassembly allowed resources to be saved. Some responses were able to develop this further by explaining that consideration should be given to separating materials and how they can be reprocessed or reused. Extended responses explained how product life could be extended through maintenance.

Where candidates did not gain maximum credit, responses were not developed or were vague and did not demonstrate a solid understanding of why disassembly should be considered in a Life Cycle Analysis.

Question 2 (a) (i)

2 Iconic products can influence the development of new designs.

(a) (i) Name **three** iconic products.

1

2

3

[3]

A large majority of candidates were able to gain some credit for this question by naming examples such as Concorde, Dyson vacuum cleaner and iPhone.

Where candidates did not gain full credit, they gave responses that were not specific such as car and phone or they identified a company such as Apple, Samsung and Sony.

In addition where candidates lost marks, many gave responses that were repeats of a single category, for example multiple types of car.

Question 2 (a) (ii)

(ii) Give **two** reasons why products can become iconic.

- 1
-
- 2
-

[2]

On the whole candidates were able to gain some credit on this question. Most candidates were able to give reasons why products become iconic. Candidates clearly understood that iconic products would have global recognition and be an integral part of a culture or fashion trend.

In cases where candidates did not gain maximum credit, responses were vague or the response could have been applicable to many everyday products.

Exemplar 1

- 1 The market like a particular design
-
- 2 The market like the shape
-

[2]

The exemplar provided shows a vague response as to why products become iconic. The answer could relate to many everyday products which may not be deemed iconic.

This response gained no credit.

Question 2 (b) (i)

(b) (i) Designers and companies want to protect (safeguard) iconic designs using copyright.

Draw the copyright symbol in the space below.

[1]

Overall this question was answered well with most candidates able to gain the credit available. The quality of drawing varied greatly but a large number of candidates were able to show a capital C inside a circle.

Where candidates did not gain credit their representation of the symbol was not accurate enough or in some cases, candidates drew other symbols for example the CE mark or Trademark.

Question 2 (b) (ii)

(ii) State **one** other method of protecting a design.

..... [1]

Candidates were on the whole able to gain credit by naming one other method of protecting a design. Where credit could not be given candidates gave answers that repeated copyright, which was given in part (b) (i) of the question or gave other responses such as the use of a company logo or kitemark.

Question 2 (c)

(c) Explain why protecting a design is an advantage for a company.

.....
.....
.....
.....
.....
..... [3]

Overall candidates were generally able to gain credit on this question and demonstrated good understanding of why protecting a design was an advantage for a company. Candidates presented good responses that demonstrated advantages such as preventing other companies from copying ideas and gaining credit for them. They also explained that if the company did protect their design then that would give them control of the market, maximising sales of the product.

In some cases, candidates did not gain full credit because they did not explain the point made or did not give a variety of reasons to support why protecting a design is an advantage for a company.

Exemplar 2

It's an advantage for a company when you protect a design as no one can copy your product so you make 100% profit from your product, if anyone does copy your product you can sue them for copyright and make even more money and if somebody tries to sue the company for a faulty product the product and company are protected from law suits, [3]

The exemplar provided shows a good understanding of why protecting a design is an advantage to the company. The response is well-structured with the candidate giving reasons why the design should be protected and explaining how this supports a company.

This response gained maximum credit.

Question 3 (a)

3 (a) Standard components can be used when manufacturing products. Name **three** standard components.

1

2

3

[3]

This question generated strong responses from candidates with large numbers being able to gain maximum credit for their responses.

Candidates clearly had a good understanding of the term standard components and were able to name three different types.

In cases where candidates did not gain maximum credit, responses were incomplete or materials and equipment were identified.

Question 3 (b)

(b) Give **two** reasons why standard components can help control the budget for a new product.

1

.....

2

.....

[2]

This question required candidates to give reasons why the use of standard components can help control the budget of a new product. Candidate responses to this question varied. Able candidates gave responses that demonstrated an understanding that purchasing from another supplier prevented the need to purchase additional machinery to manufacture the parts and once they were supplied they could be fitted using standard tools. Many candidates gave responses related to easy to purchase or mass produced and readily available however this did not gain credit as these were vague and not developed enough to be considered in terms of controlling the budget for a new product.

Exemplar 3

1 don't have to waste money making
 the standard component in a factory

2 everyone knows the standard components
 and have the equipment to use them

The exemplar provides two reasons for the use of standard components to control the budget for a new product. In response 1 reference is made to saving money as the factory does not have to make the components and in response 2, no extra equipment needs to be provided/purchased to use the components.

This response gained maximum credit.

Question 3 (c)

(c) State **one** other way of controlling the budget when manufacturing a new product.

.....
 [1]

Candidate responses to this question varied. Able candidates gave responses that demonstrated an understanding of the question regarding controlling the budget while manufacturing. Their responses included references to minimising waste through quality control procedures as well as recycling waste that was produced during manufacture. Managed delivery schedules and controlling the use of energy during manufacturing were also given as appropriate responses.

Many candidates gave responses related to using cheaper materials or using recycled materials and/or components however these did not gain any credit as they were not directly linked to the question of the process of manufacturing a new product.

Question 3 (d)

- (d) Explain why it is important to discuss the budget with the client when developing a design brief.

.....

.....

..... [4]

A large number of candidates were able to gain at least partial credit for their responses.

Higher ability candidates were able to state and explain that discussion was important so that the product could be delivered within budget and that if the budget was not understood then costs for the end product could become unaffordable. Many candidates showed some understanding that if budget considerations were not discussed then this could affect the final product and may result in it not being completed to specification and therefore not making it to market therefore affecting business sales and profits.

Where candidates did not gain credit, responses were either vague or focused on aspects that were not budget and financial considerations.

Question 4 (a) (i)

4 Fig. 1 shows a bicycle helmet.



Fig. 1

(a) Explain how each of the following user needs has been considered in the design of the bicycle helmet.

(i) Aesthetics

.....
 [2]

Candidate responses to this question varied. The question required candidates to explain how aesthetics had been considered in the design of the bicycle helmet. Higher ability candidates gave responses that demonstrated a solid understanding of aesthetics and related their response to the user. Many candidates gained some credit as they gave responses that related to aesthetics but did not consider the needs of the user.

Where credit could not be given, candidates responses were not specific enough or did not address aesthetics such responses related to comfort or were vague stating the helmet was unique or aesthetically pleasing.

Question 4 (a) (ii)

(ii) Product safety

.....
 [2]

This question required candidates to explain how user needs had been considered from the product safety aspect in the design of the bicycle helmet. Most candidates were able to gain some credit by giving responses related to safety elements referring to materials that had been used to manufacture the helmet, others identified the chin strap that was included as part of the design. More able candidates supported these responses by explaining how the features identified would protect the user in the case of an accident or when the strap was identified as a safety feature candidates supported this by saying the strap would keep the helmet firmly on the user's head.

Where credit could not be given, candidates responses were not specific enough or were vague giving a description of the helmet, such as it was hard.

Question 4 (b)

(b)* Discuss the relationship between a design brief and a design specification.

.....
.....
..... [6]

Candidates were required to show an understanding of the relationship between a design brief and a design specification through a discussion that assessed their quality of written communication.

The QWC question often did not elicit detailed and coherent responses from candidates. Candidates' demonstrated limited understanding of the relationship between design briefs and a design specification and did not always correctly suggest which aspects appear in each.

Higher ability candidates developed a discussion that clearly defined the relationship between the design brief and specification, stating how a client and designer could work together to develop a design need. Candidates could explain both a design need and a design specification, showing an understanding that the specification developed from the initial design brief. They were able to discuss that a specification was more detailed than the design brief and provided a set of criteria that the final product can be assessed against.

Where candidates did not gain higher levels of credit in their responses, they focused on a description of a design brief and a specification without developing the relationship between the two.

Where candidates gained minimal credit they did not write in extended prose therefore failing to meet the requirement of the extended written response asked for in this type of question.

Question 5 (a)

5 Fig. 2 shows a backpack.

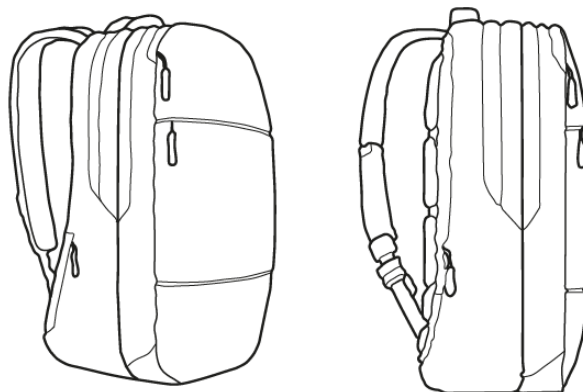


Fig. 2

(a) Give **two** ways the designer could change the appearance of the backpack.

- 1
- 2

[2]

This question required the candidate to consider how the designer could change the appearance of the backpack. Candidate responses to this question varied. Higher ability candidates gave responses that demonstrated a solid understanding of how the appearance could be changed by altering the material used or using different colours and adding logos or branding. Where credit could not be given, candidate answers were not specific enough or they gave responses related to redesigning the backpack which was not the focus of the question.

	Misconception	Some candidates confused changing the appearance as in how does the product look. They interpreted changing the appearance with changing the design, which led to alterations in size and shape as well as additional items being added to the backpack.
--	----------------------	--

Exemplar 4

1 There could be only one pocket
at the front

2 There could be side pockets
for ~~change~~ drinks

The exemplar provides an example of the misconception of this question. The candidate has interpreted changing appearance to changing the design and therefore has suggested adding features to the backpack.

This response gained no credit.

Question 5 (b)

(b) Describe how cultural and fashion trends may influence the design of the backpack.

.....

.....

.....

.....

.....

..... [3]

The vast majority of candidates were at least able to gain partial credit from their responses.

A large number of candidates were able to demonstrate an awareness of cultural trends influencing the design of the backpack; different colours or logos should be considered, and; because some symbols or colours have different meanings in different cultures. When considering fashion trends candidates demonstrated their awareness of influences on the backpack; design is inspired by trends that have become popular or appealing to the customers, and; so designers may want to incorporate the designs into the product.

Where candidates did not gain full credit their responses were vague or limited failing to describe how trends had influenced the design.

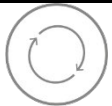
Question 5 (c) (i)


(c) Complete the statements below with the correct **two** terms:

(i) Designers will try to ensure their products are comfortable to use and that the user can interact with them effectively. This is called [1]

The vast majority of candidates were able to gain credit by identifying ergonomics as the correct term "...to ensure that products are comfortable to use....".

Where credit could not be given candidates gave no response (NR) or confused the question with anthropometrics.

	AfL	Centres are reminded to make sure that they cover the specification in detail and that candidates fully understand the meaning of the terms listed in the specification.
---	------------	--

	Misconception	Some candidates confused the statement "designers will try to ensure their products are comfortable to use and that the user can interact with them..." with a description for anthropometrics.
---	----------------------	---

Question 5 (c) (ii)

(ii) Designers may also use measurements of the human body to help with their design.

These measurements are referred to as [1]

The vast majority of candidates were able to gain credit by identifying anthropometrics as the correct term, "Use measurements of the human body"

Where credit could not be given candidates gave no response (NR) or repeated the answer ergonomics from 5(c) (i), others referred to it as human measurements.

Question 5 (d)

(d) Explain why designers may have assessed the strengths and weaknesses of competitors' products when designing the backpack.

.....
.....
.....
.....
.....
..... [3]

A large number of candidates were able to gain some credit for this question by identifying why designers assess the strengths and weaknesses of competitors products, stating strengths could be noted and included in their design, with weaknesses reviewed and improved on. Higher ability candidates related the assessment of strengths and weakness as an opportunity to increase sales ensuring a successful product.

Where candidates did not gain credit, their responses were vague sometimes repeating the question and not demonstrating a solid understanding of why designers assessed competitors' products.

Exemplar 5

designers will assess other backpacks that are all ready on the market. They will look at reviews of other products and see what would be better. This will help designers produce a backpack that people like. A Backpack will sell more [3] if it is fashionable and different to others.

The exemplar shows that the candidate has a solid understanding of why designers assess the strengths and weaknesses of competitors' products. The response shows that the candidate has identified reasons why the product is assessed and explained the benefits that such assessment brings to the designer.

This response gained maximum credit.

Question 6 (a) (i)

6 Sustainable design is a consideration of designers when developing new products.

(a) For each of the products below, explain one feature that makes it sustainable.

(i) Reusable shopping bag



Fig. 3

.....
 [2]

This question required candidates to explain a feature of the reusable shopping bag that makes it sustainable. Candidate responses to the question varied. Where candidates did not gain some or all of the credit, points that were made were vague or repeated the wording of the question; reuse or reusable without explaining why a feature of the bag allowed it to be sustainable. Other responses were concerned with environmental issues rather than sustainability; throwing away into landfills is harmful to the environment; it won't end up in the sea killing wildlife.

Question 6 (a) (ii)

(ii) Electric car

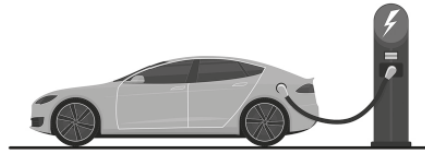


Fig. 4

.....
..... [2]

A large number of candidates were able to gain some credit for this question by identifying that the car was powered by energy other than fossil fuels. More able candidates developed their response by explaining that electricity used to charge the car could be generated from sustainable sources.

Where candidates did not gain credit, their responses were not explained or were vague; car is rechargeable. Other responses did not relate to sustainability but were concerned with environmental issues; the car does not create pollution, and; less emissions, also; greenhouse gases cause global warming.

Exemplar 6

Electricity can be farmed by wind turbines.....
No oil/petrol is being used..... [2]

The exemplar shows how the candidate has considered electricity being used instead of fossil fuels and that electricity can be provided from a sustainable source: wind turbines.

This response gained maximum credit.

Question 6 (a) (iii)

(iii) LED lamp



Fig. 5

.....
..... [2]

Most candidates were able to gain at least partial credit in this question by providing valid points that explained a feature of the LED lamp that made it sustainable: more energy efficient and last longer than a filament lamp.

Where candidates did not gain credit, their responses were vague and did not demonstrate a consideration for the sustainability of resources but were financial related; saves money.

Question 6 (b)

(b) Explain how companies can ensure manufacturing is sustainable.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

This question required candidates to explain how companies can ensure manufacturing is sustainable. A large number of candidates were able to gain some credit with this question, showing an understanding that companies could use renewable energy sources to power machinery and that materials from sustainable resources should be used in the manufacture of the product.

Where candidates did not gain credit responses referred to issues concerned with the finished product and not the manufacturing process, which was the focus of the question. In other cases responses were vague, lacked clarity and did not define manufacturing as being sustainable rather they explained delivery methods and the design or use of a sustainable product.

Copyright information

Question 6 (a) (i), Fig 3 Image of reusable carrier bag, © Janine Lamontagne, iStock, www.istockphoto.com

Question 6 (a) (ii) Fig 4 Image of an electric car, © NorbertSobolewski, iStock, www.istockphoto.com

Question 6 (a) (iii) Fig 5 Image of an LED light bulb, © Ivan Kmit / Alamy Stock Photo

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