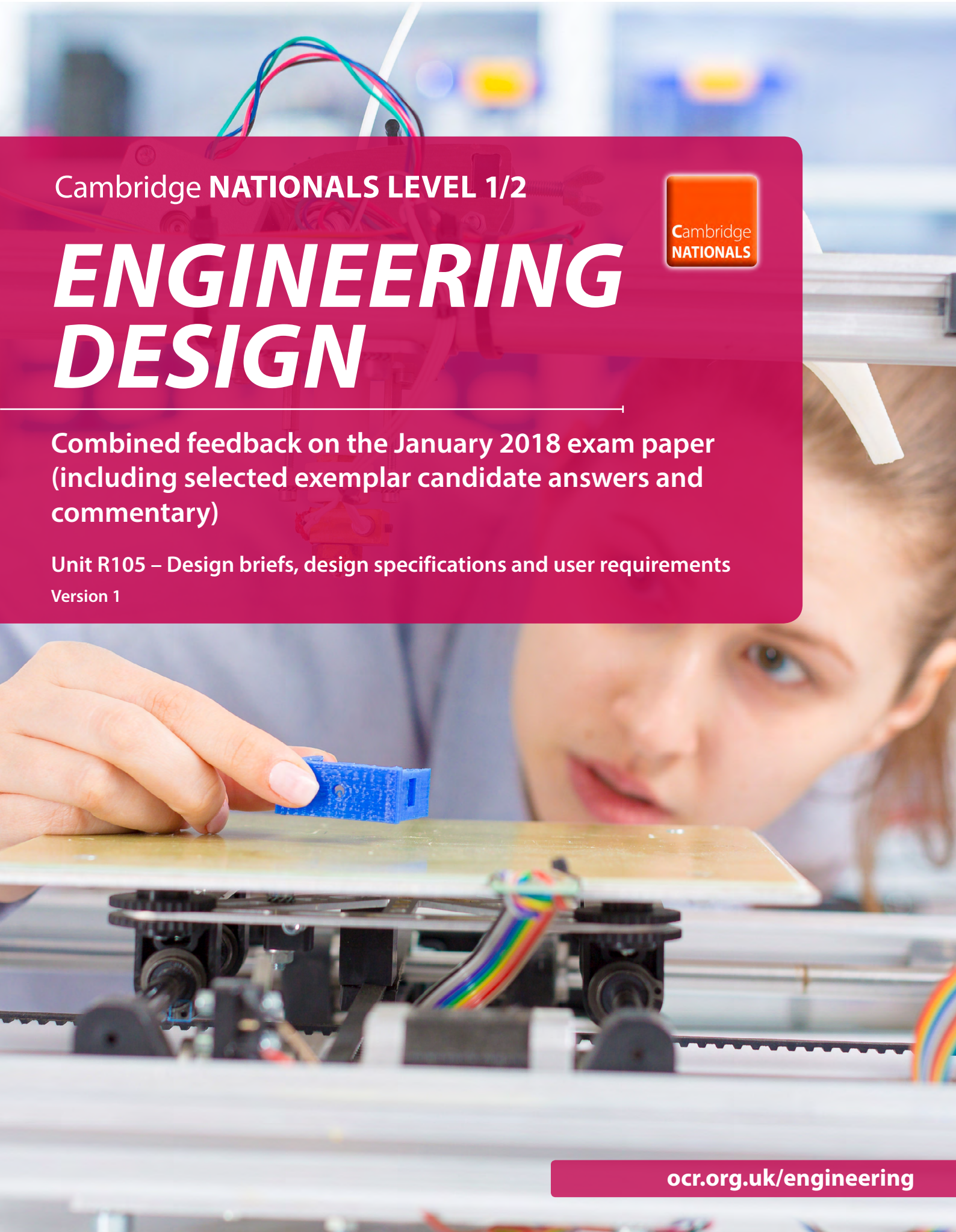
OCR
Oxford Cambridge and RSA



Cambridge **NATIONALS LEVEL 1/2**

Cambridge NATIONALS

ENGINEERING DESIGN

Combined feedback on the January 2018 exam paper (including selected exemplar candidate answers and commentary)

Unit R105 – Design briefs, design specifications and user requirements

Version 1

ocr.org.uk/engineering

CONTENTS

INTRODUCTION

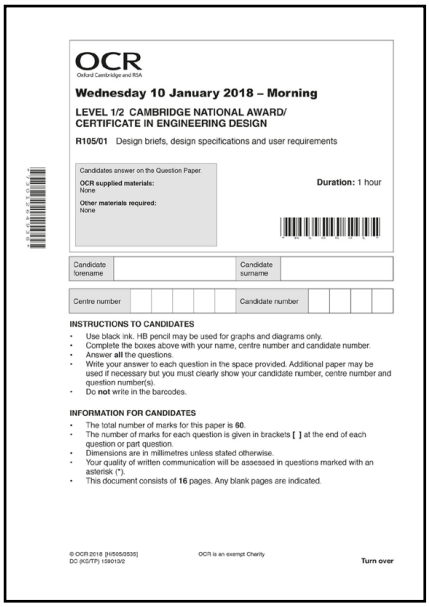
This resource brings together the questions from the January 2018 examined unit (Unit R105), the marking guidance, the examiners comments and the exemplar answers into one place for easy reference.

We have also included exemplar candidate answers with commentary for Questions 2(c), 2(d), 5(a)(i) and 6(b).

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



OCR
Oxford Cambridge and RSA

Wednesday 10 January 2018 – Morning

LEVEL 1/2 CAMBRIDGE NATIONAL AWARD/ CERTIFICATE IN ENGINEERING DESIGN

R105/01 Design briefs, design specifications and user requirements

Candidates answer on the Question Paper.
OCR supplied materials: None
Other materials required: None

Duration: 1 hour

Candidate forename | Candidate surname
Centre number | Candidate number

INSTRUCTIONS TO CANDIDATES

- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- 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).
- Do **not** write in the barcodes.

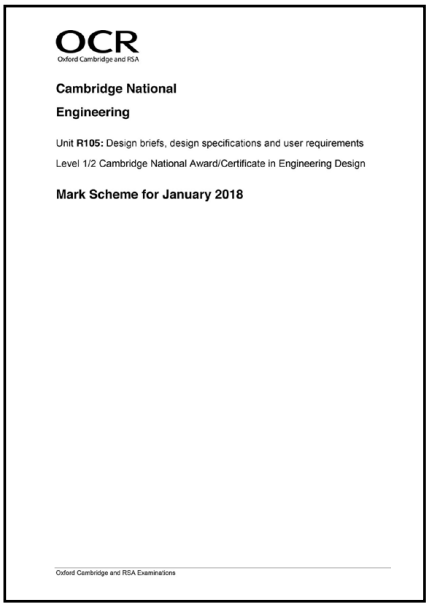
INFORMATION FOR CANDIDATES

- The total number of marks for this paper is **60**.
- The number of marks for each question is given in brackets **[ ]** at the end of each question or part question.
- Dimensions are in millimetres unless stated otherwise.
- Your quality of written communication will be assessed in questions marked with an asterisk (*).
- This document consists of **16** pages. Any blank pages are indicated.

© OCR 2018 [H/505/0535]
DC (KG/TP) 158013/3/0

OCR is an exempt Charity

Turn over



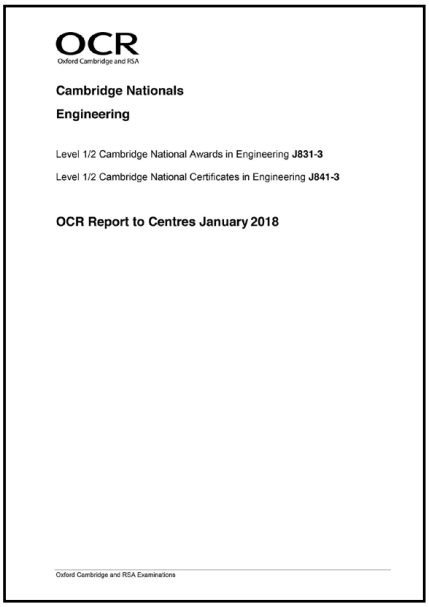
OCR
Oxford Cambridge and RSA

Cambridge National
Engineering

Unit **R105:** Design briefs, design specifications and user requirements
Level 1/2 Cambridge National Award/Certificate in Engineering Design

Mark Scheme for January 2018

Oxford Cambridge and RSA Examinations



OCR
Oxford Cambridge and RSA

Cambridge Nationals
Engineering

Level 1/2 Cambridge National Awards in Engineering **J831-3**
Level 1/2 Cambridge National Certificates in Engineering **J841-3**

OCR Report to Centres January 2018

Oxford Cambridge and RSA Examinations

GENERAL EXAMINER COMMENTS ON THE PAPER

It is worth reiterating the point that has been included in the report to centres for almost all previous 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 students for the examination using the specimen papers and, with growing availability, the past papers for the examination. This should allow students 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.*' This was evident in most of the previous series and has been clearly evident again in January 2018.

With less frequency than previously, but still apparent in some cases, candidates are not always 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' candidates are answering with a one-sentence answer which limits 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/

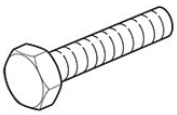
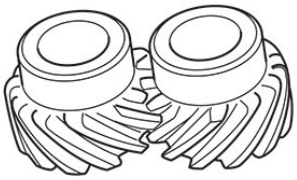
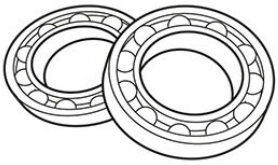
Question 1(a)

Answer **all** the questions.

1 The table below shows five standard components.

(a) (i) Complete the table by naming the standard components.

One has been done for you.

	Component image	Component name
1		Washer/spacer(s)
2		**M8 Hex Head Bolt**
3		Gear/cog(s)
4		Self-locking nut/nut
5		Bearing(s)

[4]

(ii) Name **one** other standard component.

One mark for a valid example of a **standard** component e.g.:
- Screws (1)
- Rivets (1)
- Pins (1)
- Hinges (1)
- Metal profiles (1)
- Springs (1)
- Seals (1)
- O-rings (1)
- Bulbs (1)
- Nails (1)
- Fuse (1)

. **[1]**

Mark Scheme Guidance

Question 1(a)(i):

Accept 'Ball bearing' or reference to other bearings.

Accept 'nut'.

Do **not** accept 'Piston rings'.

Accept reference to 'gear' even if specific gear type is incorrect.

Question 1(a)(ii):

Accept suitable alternative answers of standard components.

Do **not** accept answers already stated in part (i)

Do **not** accept bolt or variation of bolt as this is stated in part (i).

Do **not** allow pre-manufactured items.

Examiner comments

Part 1ai of this question required candidates to complete a table, identifying common standard components. On the whole, the question was answered well, with a large majority of candidates achieving full marks.

In part 1aii, candidates had to name one other standard component. The vast majority of candidates were successful in this question. It is important for centres to emphasise to candidates that one 'other' component means a repetition of any component in part i would result in no marks.

Questions 1(b) and (c)

(b) Give **two** reasons why designers would use standard components in the development of new products.

1. .....

2. .....

Award one mark for each valid reason e.g.:
- Guaranteed quality (1)
- Less expensive to purchase/cheaper (1)
- Compatible with standard tools/no specialist tools required (1)
- Readily available/widely used/large quantities (1)
- Easily replaceable (1)
- Standards understood globally (1).

[2]

(c) Explain how standard components can improve the sustainability of new products.

.....

.....

.....

.....

.....

Award up to three marks for an explanation e.g.:
- Standard components can improve the sustainability of new products as they allow the product to be disassembled easily (1) at the end of its life, allowing materials/ components to be separated (1) and recycled (1).
- Standard components can improve the sustainability of new products as they allow the product to be taken apart, (1) allowing for maintenance to be carried out and components to be repaired/replaced (1). This can extend the products life (1).
- Standard components are durable extending the products life (1).

[3]

Mark Scheme Guidance

Question 1(b):

Accept suitable alternative answers.

Do NOT accept 'they are easy to make/not complex to make.'

Only award 'easier to understand' if qualified by 'global standards'/'compatible with standard tooling' or similar.

Question 1(c):

Only award up to a maximum of two marks if written in bullet format and not continuous prose.

Answers related to 'mass production' or 'continuous production' can only be awarded if qualified by the associated 'availability' allows for 'repair' or parts to be 'replaced' extended the products life.

Examiner comments

In part 1b, candidates were required to give two reasons why designers would use standard components in the development of new products. This was generally answered well, with most candidates able to give suitable reasons why designers would use standard components in the development of new products. Candidates clearly have a good understanding of why standard components assist product development and manufacturing.

In part c of question 1, candidates needed to develop their knowledge of standard components further by explaining why standard components improve the sustainability of new products. Many candidates were able to give responses that achieved marks, in most cases candidates were able to consider how standard parts allow for disassembly and disposal of materials. Some candidates managed to gain marks by considering the reusability of standard parts although these responses were inconsistent and sometimes vague. The strongest responses, gaining maximum marks, clearly understood how standard components allow for the easy disassembly for maintenance and repair or separation of materials for disposal and recycling.

Questions 2(a) and (b)

2 Regulations and safeguards are an important consideration for designers and manufacturers.

(a) Give **two** reasons why regulations and safeguards are important when developing new products.

1 ....

2 ....

Award one mark for each valid reason e.g.:
- Ensure product safety (1)
- It is a legal requirement (1)
- Ensure products are fit for purpose/in tolerance (1)
- Ensure products meet customers expectations/expected quality (1)
- To meet environmental responsibilities (1)
- To allow for trade/sale (1)
- To meet EU law (1)
- Marketability (1)

[2]

(b) **(i)** Draw the symbol for the 'European Conformity' mark below.

Award one mark for the correct symbol:

CE

[1]

(ii) State **two** other examples of symbols that may be included on a product.

1 ....

2 ....

Award one mark for each valid symbol e.g.:
- Recycling symbol (1)
- Age guidance e.g. not suitable for children under 3 (1)
- Flammability/toxicity (1)
- Disposal instructions (1)
- Trademark (1)
- Registered Trademark R (1)
- Copyright (1)
- Patent (1)
- Safety (1)
- Fair trade (1)
- British toy and hobby association (LION mark) (1)
- British Standards/ISO (1)

[2]

Mark Scheme Guidance

Question 2(a):

Accept other valid responses.

Do NOT accept 'in case something goes wrong' alongside 'safety'.

Do NOT award repetitions.

Do Not accept reference to 'protecting ideas' as this is confused with patents, trademarks or copyright.

Question 2(b)(i):

Only accept the symbol in this mark scheme. Not variations e.g. EC. Letters should be capitals, curved, and in the correct order 'CE'.

Do NOT award marks if the E is not curved.

Award:

Do NOT award:

Question 2(b)(ii):

Award other valid examples.

Do NOT accept 'European Standard' as repeat of (b)(i).

Examiner comments

In question 2a candidates were asked to give two reasons why regulations and safeguards are important when developing new products. On the whole candidates were able to access marks here by giving valid responses. Candidates understood that regulations and safeguards ensure products are safe, meet relevant standards and are subsequently allowed to be sold.

Question 2bi required candidates to draw the symbol for the 'European Conformity' mark. Responses to this answer varied. Candidates were only awarded marks for representations close to the symbol below.

In part ii of question 2b, candidates then had to name two other examples of symbols that may be included on a product. Most candidates were able to identify at least one, if not two symbols, that would be used on a wide range of products. This was, on the whole, a well answered question.

Questions 2(c) and (d)

(c) State what is meant by the term 'registered' design.

A registered design:
- protects the shape (1) of a design
- protects the configuration (1) of a design
- protects the appearance (1) of a design
- stops other companies from copying (1) the design
- registers the design to a person/company (1)
- prevents others from using it without your permission (1)
- allows legal action to be taken against other companies if the design were to be copied (1)
- A patent can be granted by a sovereign state (1) and is recognised internationally (1) but registered designs
- may only apply in the country of origin (1).

..... [2]

(d) Explain the difference between a registered design and a patent.

Award up to three marks for an explanation of the difference between a registered design and a patent e.g.:
- A registered design protects the appearance of a product whilst a patent protects inventions/processes (1).
- A patent stops other companies copying the way something works or is carried out whilst a registered design only protects the appearance or shape of a design (1).
- A patent lasts for 20 years from the date it is approved (1). A patent should be renewed every year after its fourth year (1). A registered design has to be renewed every 5 years/ up to a total of 25 years (1).

..... [3]

Mark Scheme Guidance

Question 2(c):

Up to two marks for each point stated.

Award marks for reference to 'shape'.

Only award one mark for reference to 'copying a design' / 'protects a design' unless qualified with 'shape', 'appearance' or 'configuration.'

Question 2(d):

Award maximum of one mark for reference to preventing the copy of a design but no more unless the distinct difference between 'registered design' and 'patent' is made.

Examiner comments

Part c of question 2 required candidates to state what is meant by the term 'registered' design. Answers varied dramatically. On the whole, candidates have some understanding of registered design, but cannot be specific about the differences between a 'registered' design, 'copyright', 'trademark' or 'patent'. This continued in part d of the question which required this distinction. It is clear that candidates do not know the major differences between 'registered' designs and 'patents'. Centres are reminded to cover the specification in detail and ensure that in areas such as this one, candidates can discriminate between similar areas of content within the specification.

Exemplar Candidate Work

Question 2(c) – low level answer

(c) State what is meant by the term 'registered' design.

A registered design is a design that can not be copied [2]

Commentary

This is a low-level answer because the candidate has not outlined specifically what a 'registered design' is. The candidate has given a generic answer related to a 'registered design' as preventing designs from being 'copied.' However, this could also be true for 'patents' and 'copyright' and therefore does not demonstrate a complete understanding of what a 'registered design' is. In order to make this a medium level answer the candidate would need to ensure that either two separate valid points are made, or the single point made is expanded upon to include the application of a 'registered design.'

Question 2(d) – low level answer

(d) Explain the difference between a registered design and a patent.

A ~~reg~~ registered design is to protect a new design while a patient is to protect an invention.

[3]

Commentary

This is a low-level answer because it does not have sufficient development to meet the requirements for a full mark 'explanation' style question. The answer given makes two points but the first of these is vague. The candidate states that a 'registered design' is to protect a 'new' design but is not specific about exactly what a 'registered design' protects. The statement could equally be applied to an answer related to 'copyright' or a 'patent' and therefore, understanding and knowledge cannot be deemed to be demonstrated. The candidate does gain credit by identifying that a 'patent' protects an 'invention' which is specific to 'patents' and demonstrates a good level of knowledge. To improve this answer, and make it a medium level answer, the candidate would have to make clear distinction of the differences between a 'registered design' and a 'patent' by expanding the point related to 'registered designs.' Additionally, the candidate could further expand their explanation demonstrating a developed understanding of the original statements.

Exemplar Candidate Work

Question 2(d) – high level answer

(d) Explain the difference between a registered design and a patent.

A patent is where a product can be patented so that other companies cannot steal the idea. The patent can be for a certain amount of time before getting renewed. But the registered design is where the design is registered to be sold. **[3]**

Commentary

This response is a high-level response because the candidate has demonstrated a good understanding of 'patents.' Multiple points are made by the candidate related to how a 'patent' can stop other companies 'stealing' an idea, and also that patents only last for a certain amount of time. Both points are valid and show a high level of understanding of the use and specific features of 'patents.' To improve this answer and ensure that the response becomes a full mark high level answer, the candidate would need to demonstrate more detailed knowledge of 'registered designs' and make the comparison to 'patents' which is not currently shown in the response.

Questions 3(a), (b) and (c)

3 Fig. 1 shows an image of a USB cable plug.

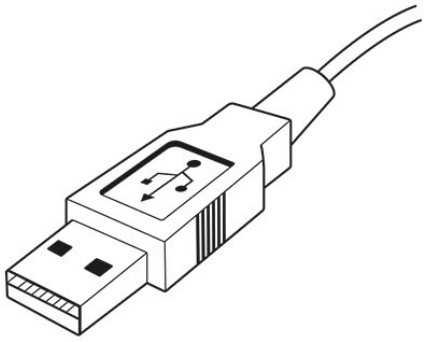


Fig. 1

(a) Explain how the USB plug has been designed with consideration of error proofing.

Award up to three marks for an explanation e.g.:
- The USB plug has been designed in such a way that it can only be put into a USB socket in one way (1). This stops incorrect operation during use (1) preventing the adaptor being placed in the wrong socket or causing damage due to misuse.(1).
- The insulating casing prevents any electric shocks (1) that may harm the user (1).
- The USB plug has an arrow/symbol on the top (1) which identifies the correct way to insert the plug (1) stopping the user putting the USB plug in incorrectly (1).
- The USB plug has grips on the side of the casing (1) this allows the USB to be correctly inserted or removed (1) without damaging the USB or associated device (1).
- The USB plug has a hard casing that prevents damage during operation (1) in addition to rubber protection around the cable that prevents excessive damage during constant use (1).

[3]

(b) State which phase of the design cycle would include testing of a product.

Award one mark for the correct phase.
- Validate phase (1)

[1]

(c) State **three** considerations that a designer could include in a manufacturing plan for a new product.

1 .....

2 .....

3 .....

Award one mark for each consideration e.g.:
- Health and safety during production (1)
- Order of operations (1)
- Production setup/production setup costs (1)
- Production location/supply chain (1)
- Quantity required/scale of production (1)
- Time taken for each stage of manufacture/efficiency of manufacture (1)
- Tolerances at each stage (1)
- Components required at each stage/standard components required (1)
- Material required at each stage/material availability (1)
- Size of material required at each stage (1)
- Tools/workers required at each stage (1)
- Processes/Process instructions (1)
- Machinery required (1)
- Assembly processes (1)
- Surface finish (1).

[3]

Mark Scheme Guidance

Question 3(a):

Only award marks when 'error proofing' is explained in the context of 'stopping the product being used in the wrong way'/'preventing errors/issues during operation.'

Do NOT award marks for 'testing' or 'removing errors in production.'

Question 3(c):

Accept other valid responses.

Do NOT accept reference to areas such as, sustainability, ergonomics etc. Answers should reference the the topics in a manufacturing plan.

Do NOT accept 'cost' or 'size' unless qualified with 'material' or 'tooling' for example.

Examiner comments

Question number 3a required candidates to explain how a USB plug has been designed with consideration of error proofing. Candidate responses to this question were generally strong, demonstrating a vastly developed understanding of error proofing when compared to previous series. Candidates were able to explain how the USB plug could only be inserted one way whilst also considering subtle design features that aided its operation. Where candidates did not achieve marks here, error proofing was still associated with 'testing' which failed to gain marks.

Part b required candidates to state which phase of the design cycle would include testing of a product. Surprisingly, responses to this were varied. Testing is clearly stated in the 'validate' phase of the design cycle within the specification.

Part c required candidates to give three considerations that a designer could include in a manufacturing plan for a new product. Response to this varied in quality and therefore marks achieved also varied. Where candidates achieved multiple or maximum marks they were able to give responses related to 'manufacture' and therefore differentiate between 'manufacture' and 'design'. Where candidates did not achieve marks their responses were focused on more generic design considerations, e.g. ergonomics, and not considerations at the stage of manufacturing.

Question 3(d)

(d) Explain why designers may validate a design before final production commences.

Award up to 3 marks for an explanation e.g.:
- Designers would test a design to ensure all elements of the product function correctly (1). This will stop issues during production (1) which, could be costly to the manufacturer (1).
- Designers will want to ensure that the design meet expected requirements/ standards (1) before it goes into production to avoid costly modifications (1).
- Production setup costs are extremely high (1). Designers would want to ensure that all errors are removed from the product prior to commencing production (1) to ensure costly changes or delays in the production process are avoided (1).
- Designers will want to check the design to ensure it functions properly (1), is safe to use (1) and is ready to be produced on a large scale (1).

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

Mark Scheme Guidance

Answers must refer to final production issues. Issues such as ergonomic, aesthetic issues would have been addressed prior to this part of the process. Award marks for reference to function.

Examiner comments

In question 3d, candidates were asked to explain why designers may validate a design before final production commences. The vast majority of candidates were able to achieve marks here with some understanding that testing or checking of the final design was important to ensure that large amounts of investment was not lost during production due to a faulty or substandard product.

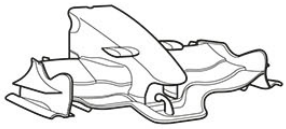
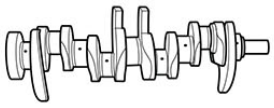
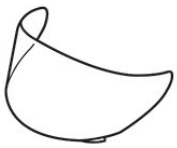
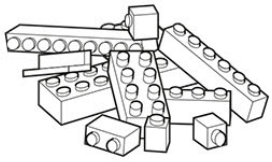
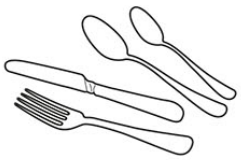
Question 4(a)

4 The table below shows a range of different products and the material they are made from.

(a) Complete the table below by adding the most appropriate function:

Lightweight and strong
Forged and hardened to resist wear
Hygienic and resistant to corrosion
Non-toxic and easy to mould
Impact resistant and transparent

One has been done for you.

	Product	Material	Function
1	 **Formula 1 Front Wing**	**Carbon fibre**	Lightweight and strong
2	 **Engine Crankshaft**	**Cast alloy steel**	Forged and hardened to resist wear
3	 **Motorcycle Helmet Visor**	**Polycarbonate**	Impact resistant and transparent
4	 **Building Blocks**	**ABS**	Non-toxic and easy to mould
5	 **High-performance Bicycle Brake Lever**	**Aluminium billet**	**Lightweight metal, easy to machine**
6	 **Cutlery**	**Stainless steel**	Hygienic and resistant to corrosion

[5]

Examiner comments

Question 4a required candidates to complete a table by adding the most appropriate function to products made from specific materials. Candidates demonstrated good decision skills in this question, clearly supported by a sound knowledge of material properties and applications. The vast majority of candidates were able to gain marks in this question.

Questions 4(b) and (c)

(b) State **two** reasons why manufacturers should consider the supply chain during the development of a new product.

1 .....

2 .....

Award one mark for each valid reason e.g.:
- To ensure that the supply chain can meet demand/ensure availability of materials (1)
- To negotiate delivery times (1)
- To assist the calculation of production quantities (1)
- To calculate overall production costs/manage the budget (1)
- To consider the environmental impact of transportation (1)
- To collaborate on design when subcontracting production to specialist suppliers (1)
- To ensure suppliers can deliver required quality (1).

[2]

(c) Explain why the availability of a material might have an impact on the design of a new product.

.....

.....

.....

.....

.....

.....

Award up to three marks for an explanation e.g.:
- The availability of a material might have an impact on the design of a new product because this could affect the material choice available to the designer (1). This could be limited by cost if the material is rare (1) which in turn could make the selling cost of the product to expensive for the target market (1).
- The availability of a material might have an impact on the design of a new product because a certain material may not be available in sufficient quantity to meet production demand (1). This would require a different material to be selected so that customer demand can be met (1) increasing sales for the business (1).

[3]

Examiner comments

Part b of question 4 required candidates to state two reasons why manufacturers should consider the supply chain during the development of products. The vast majority of responses here focused on the cost of material, which did ensure candidates gained some marks. The wider areas of supply chain involvement during development, not just production, were not as regularly observed despite their importance.

In part c, the availability of materials was considered, and candidates had to explain how availability may have an impact on design. Again, as per part b of this question, the vast majority of candidates focused on cost. The rarer a material the more expensive. Although there are elements of this that would gain marks, only a few candidates were able to consider how material availability would impact on available manufacturing processes and the subsequent design geometry associated with this. This was a question that highlighted some high-level understanding of the relationship between design and manufacture in some candidates.

Questions 5(a) and (b)

5 The sustainability of new products is an important consideration for engineering designers.

(a) (i) Explain what is meant by the term 'sustainable design.'

Award up to three marks for an explanation e.g.:
- Sustainable design is generally considered as the design of products that minimise their impact on the environment (1). This might mean the use of materials that are recyclable (1) or that the product uses minimal energy during use (1).
- Sustainable design is the design of a product that considers the impact the product has on its environment (1). This can be associated with its operation, production or end of life (1) but could also be associated with the economic or social impact of a product (1).

[3]

(ii) Give **two** ways that designers can improve the sustainability of products.

1 ...

2 ...

Award one mark for each valid response e.g.:
- Use recycled materials in its design/production (1)
- Ensure the product can be disposed of/disassembled with minimal environmental impact at the end of its life (1)
- Ensure the product uses renewable energy sources in its operation (1)
- Design products that are durable/modular/can be upgraded so their life with the user is extended (1)
- Develop products that can be maintained (1)
- Monitor the supply chain to calculate overall environmental impact.(1)
- Ensure materials are gathered from a sustainable source (1) and can be recycled at the end of life (1).

[2]

(b) State **two** environmental pressures that designers should consider when developing new products.

1 ...

2 ...

Award one mark for each valid response e.g.:
- Requirement to reduce the use of fossil fuels (1)
- Reduce emissions when manufacturing (1)
- Global warming/CO_2 emissions (1)
- Minimise transportation of material/product (1)
- Safe disposal of products at the end of their life (1)
- Recycling of materials/products (1)
- Gather materials from a renewable source (1)
- Carbon footprint of products (1)
- Avoid the use of toxic materials (1)
- Regulations and fines on r (1)
- Minimise impact on the areas where materials are sourced/deforestation/wildlife/pollution (1).

[2]

Mark Scheme Guidance

Question 5(a)(i):

Exemplar; 'Sustainable design means that the energy and materials used in the manufacturing is offset by the lifespan.'

Question 5(a)(ii):

Accept other valid responses.

Do NOT award marks for 'standard components' unless qualified by 'ease of disassembly' or 'improved maintenance.'

Do NOT award repetition e.g. 'use of renewable materials' and 'use of sustainable materials.'

Question 5(b):

Do NOT accept 'minimise effect on the environment' or similar as this is vague.

Do NOT award repetition.

Examiner comments

Question 5ai asked candidates to explain what is meant by the term 'sustainable design.' On the whole, candidates were able to achieve some marks here. There were some examples of higher level responses, achieving maximum marks, which demonstrated an in-depth understanding of what 'sustainable design' means. Most candidates were able to demonstrate some understanding. In some responses that achieved lower marks, candidates only associated sustainability with 'long lasting' products, which although partly accurate, failed to demonstrate the breadth of considerations associated with sustainable design. This continued into part 5aii, which required candidates to give two ways that designers could improve the sustainability of new products. Some candidates considered the wider areas of sustainability whilst others focused on the perceived strength of materials and subsequent lifespan. In part, this was true, but did not result in these candidates gaining maximum marks.

Part b of question 5 required candidates to state two environmental pressures that designers should consider when developing new products. This was well answered by most candidates, with the vast majority of responses achieving marks.

Exemplar Candidate Work

Question 5(a)(i) – low level answer

5 The sustainability of new products is an important consideration for engineering designers.

(a) (i) Explain what is meant by the term 'sustainable design.'

if your design is sustainable then that means it can last long with good conditions and it will keep working for a very long time ~~and~~ ~~would~~

[3]

Commentary

The response is a low-level answer because the candidate has only demonstrated very limited knowledge of the term 'sustainable design.' The candidate has made the point that a 'sustainable design' may last a long time so ensuring that it subsequently is not sent to landfill for example. This, however, is only a small element of the complex considerations that are taken by designers when considering how to make a design sustainable. Considerations such as the ability to recycle or reuse components or materials at the end of the products' life have not been addressed. Additionally, areas such as energy usage during manufacture and during the products' life, and the source of the materials used within the products' construction could be considered. Further, exemplification of similar points to these would have allowed for a greater depth of understanding to be demonstrated in the explanation ensuring that the answer moved to a medium level response.

Exemplar Candidate Work

Question 5(a)(i) – high level answer

5 The sustainability of new products is an important consideration for engineering designers.

(a) (i) Explain what is meant by the term 'sustainable design.'

This is when a designer has considered that a design is damaging the environment and is looking for alterate solution to stop it from doing so also they could have designed something that can be used mutible times which would extend the product life span [3]

Commentary

This is a high-level answer because the candidate has made multiple points that are relevant to the development of sustainable designs. The candidate has explained the primary principle of sustainable design which is to minimise the impact of the design on the environment. The candidate subsequently states how the multi-use nature of the product expands the product life span. To improve this answer, and ensure it becomes a full mark high level answer, the candidate could have further expanded the point related to the 'products' life span'. This could be done by giving examples of how this could be achieved through specific options such as using reusable parts or ease of maintenance. Additionally the candidate could have explored some of the wider areas of 'sustainable design' such as energy usage during manufacture or during product use and the sourcing or end of life considerations related to materials.

Question 5(c)

(c) Explain how designers can ensure products do not contribute to environmental pressures.

Award up to three marks for an explanation e.g.:

- Designers can ensure that they do not contribute to environmental pressures by ensuring that they only use materials in their products that can be recycled at the end of their life (1). They could also ensure these materials are from sustainable sources (1) and use minimal energy in their creation (1).
- Designers can ensure that they do not contribute to environmental pressures by ensuring that the products they manufacture use energy from renewable sources during their use (1). They could also ensure that their factories are powered from renewable energy sources (1) minimising the use of fossil fuels within the lifecycle (1).

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

Mark Scheme Guidance

Award marks for reference to 'recycling', 'carbon footprint' or 'pollution'.

Examiner comments

Part c of this question required candidates to expand on their understanding of environmental pressures by explaining how designers can ensure they do not contribute to them. Candidates could generally build on their initial responses from part b and give valid responses that gained marks.

Question 6(a)

6 Scale of production can have an impact on the design of new products.

(a) (i) State **two** different scales of production.

1 .....

2 .....

Award one mark for each valid response.
- One-off (1)
- Batch (1)
- Mass/continuous production (1)

[2]

(ii) Give **two** reasons why the scale of production should be considered during the design phase.

1 .....

2 .....

Award one mark for each valid reason e.g.:
- Scale of production may define what manufacturing process can be used (1)
- Scale of production may affect the final selling price/cost of production (1)
- Is the material / materials being used in appropriate supply (1)
- Design geometry would depend on the manufacturing process requiring consideration during development (1)
- Designs need to consider the manufacturing process and therefore scale of production to ensure they can be produced (1).

[2]

Mark Scheme Guidance

Question 6(a)(ii):

Do NOT award marks for 'to know how many they need to make.'

Examiner comments

Question 6ai required candidates to state two scales of production. Almost all candidates were able to access this question and subsequently gain marks.

Question 6aii, required candidates to develop their understanding of scales of production by giving reasons why these would be considered during the design stage. This question gave more varied responses than part i. Candidates focused on cost again without giving consideration to how the scale of production, and associated manufacturing method, would impact on component geometry.

Question 6(b)

(b)* Discuss how the scale of production can have an impact on material selection.

Examples and relevant points could include.

- The scale of production can limit the suitability of certain manufacturing processes. For example, components that are required to be made from plastic would require a large scale of production to offset the cost of the investment in tooling.
- Some components that use advanced/modern materials such as carbon fibre or titanium are expensive to produce in very large quantities and therefore may not be suitable for mass produced products that need to appeal to a target market that cannot afford their sale price.
- Increased consideration of the sustainability of products and their associated lifecycle is important. Products that are mass-produced must consider how the materials and components used in their design can be safely disposed of.
- Custom products or one-off designs will generally be more expensive for the consumer to purchase. This exclusivity may mean that the consumer is willing to pay for more exotic materials, allowing the designer to use processes and materials that may not be possible if the scale of production is high.
- Mass production processes such as injection moulding, casting or CNC machining require components to be designed with geometry that is suitable for the manufacturing process. Designers must consider this during design or the design will not be able to be produced at the scale required or with the process selected to meet the production numbers.
- The target market may require large quantities of the product. This may have an impact on the process that is selected for production so that the scale of production can meet the consumer demand.

[6]

Mark Scheme Guidance

Award up to six marks for a discussion on how the scale of production can have an impact on material selection.

Points MUST be exemplified. Do NOT accept responses related to 'one-off' being expensive or 'mass' being cheap unless properly qualified.

Level 3 (5–6 Marks)

Learners provide a thorough discussion of how the scale of production can have an impact on material selection.

They show a clear understanding of the required question material. Specialist language and terms are used in the appropriate areas being discussed and the required information will be well structured in its presentation.

Good examples used to discuss how the scale of production can have an impact on material selection.

Learners will demonstrate an accurate level of spelling, punctuation and grammar.

Level 2 (3–4 Marks)

Learners provide an adequate discussion of how the scale of production can have an impact on material selection.

Some examples used to illustrate how the scale of production can have an impact on material selection.

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 scale of production can have an impact on material selection.

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 6b required candidates to show understanding of how the scale of production can have an impact on material selection. The quality of answers provided varied dramatically. Very few candidates gave responses that understood how the scale of production would define a production method, an associated material and therefore, design geometry. Where candidates failed to achieve high marks, responses lacked development. Candidates who gave strong responses were able to discuss how certain high-volume manufacturing processes used certain materials and could subsequently provide high quality, large scale output. A large number of responses were focused on the fact that small scale production used expensive materials and that high-volume production used inexpensive materials. This is not always the case, and candidates need to understand this. Some high-volume production uses expensive materials and the process is what makes it efficient. In addition, 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 which, 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 6(b) – low level answer

(b)* Discuss how the scale of production can have an impact on material selection.

Scale production can have an impact because:

- If there it a designer uses a cheap materal this means the product product can be in larger quantitys
- If the Designer uses an expensive materal the product maybe in a smaller quantity than if a cheap materal was used.
- The process of making the materal could be cheaper like injection moulding but that means the final product will not be as strong and durable.
- The process of making the material maybe expensive which means the final product will be very durable.
- On the market and in shops the products that are made in mass-production are cheap to buy [6]
- The products that are made in small quantitys are more expensive to buy in shops.

Commentary

The primary reason that this response is a low-level answer is because the candidate has not written their answer in continuous prose. The use of a bullet pointed list means that the answer cannot progress from a low-level response and gain higher credit. The candidate has made some valid points related to the question but needs to demonstrate that they have developed understanding of these points, not just knowledge to enable them to progress to the higher levels of credit that can be awarded here. The candidate has, through many of the responses, mentioned the cost or 'cheapness' of the product based on its material. There is no further exemplification of how this is associated with scale of component production, offsetting initial capital investment in tooling and machinery, or linked to the complexity of manufacture associated with mass production. Ultimately the candidate needed to take the points they have made, develop them further with additional discussion, and combine this with continuous written prose to develop the answer into a medium or high-level response.

Exemplar Candidate Work

Question 6(b) – medium level answer

(b)* Discuss how the scale of production can have an impact on material selection.

If the product is being mass produced they are going to be producing a lot. This means that they are going to need a stable and consetant supply of materials. If they ~~do~~ will not be able to have a consetant supply of materials, then they will go back to the clients and say we need to change the material because we will not be able to supply it at a rapid enough rate. If it is small scale production then they are not going to need loads of material if their is only going to be one hundred to two hundred made so it wont be a big issue if they do not have loads.

[6]

Commentary

Question 6b is an extended answer question that tests the candidate's 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 to achieve the highest marks.

This is a medium level answer because the candidate has written their response in continuous prose and shown development of their answer throughout the initial part of the response. The candidate does however, only focus on the possible shortage of material having a negative impact on the manufacturers ability to produce the item. Upon exemplifying the first element of the response, the candidate's further additions to the answer demonstrate knowledge but do not progress these to show further depth of response required to gain credit at a high level.

The candidate clearly understands how a shortage of material may have a detrimental impact on a company's ability to produce a product or component in large quantities, but there are other factors that could have allowed the candidate to gain further credit such as consideration of the component geometry to accommodate mass production processes e.g. injection moulding or machining. Additionally, if the component is mass manufactured then the range of suitable materials may change due to how quickly they can be processed. These examples could have been utilised in the latter part of the answer thereby allowing for further development of the points to be made so securing more credit as a high level response.

Exemplar Candidate Work

Question 6(b) – high level answer

(b)* Discuss how the scale of production can have an impact on material selection.

If the scale of production is small, such as one off production, the user will usually spend more money on the product thus will expect a high grade of material. For example the spoiler on an F1 car, the team will want a high grade material such as Carbon Fibre and not something quite unreliable such as Acrylic. If the material is quite high in price the larger scales of production, such as mass production, may be quite difficult to do so due to the high price ~~extortion~~ main aspect of buying large amounts of the material. If the scale of production is again quite large (mass production) you will want a material that is easy to work with so the product can be made at a fast pace. **[6]**

Commentary

Question 6b is an extended answer question that tests the candidate's 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 to achieve the highest marks. This is a high-level response because the candidate has made valid points associated with the scale of the manufacturing process and how this can have an impact on material selection. They have also developed these points with valid examples that demonstrate a strong knowledge of the question topic. This knowledge is developed with explanations and justification of the responses which allows for the awarding of a high-level answer. To improve this answer further, the candidate could have moved away from issues associated with the cost of the material. For example, they could have discussed how the design may be affected due to the requirements of mass production using particular processes, including associated geometric restrictions that occur because of this. The candidate begins to discuss this at the end of their answer as they consider how 'easy' the material is 'to work with.' A development of this, as demonstrated earlier in the answer, would have allowed for a full mark high level answer to be awarded.

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: *the small print*
OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

OCR acknowledges the use of the following content:
Square down and Square up: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk/engineering
OCR customer contact centre

Vocational qualifications
Telephone 02476 851509
Facsimile 02476 851633
Email vocational.qualifications@ocr.org.uk

OCR is part of Cambridge Assessment, a department of the University of Cambridge. *For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.*

Cambridge Assessment

LLOYD'S REGISTER · LRQA
ISO 9001
UKAS MANAGEMENT SYSTEMS
001