

Candidate Style Answers

INCLUDED ON THE
KS4 PERFORMANCE TABLES

OCR Level 1/Level 2

Cambridge National in
Engineering Design

J822

For first teaching in 2022 | Version 1

Unit R038 Principles of engineering design

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About this resource

We have produced this resource using the [sample question paper and mark scheme](#) Cambridge National in Engineering Design J822.

The aim of the resource is to show you how marks or levels could be given and why. Our senior assessors have provided possible candidate responses and then applied the sample mark scheme, adding commentary.

Please note this resource does not constitute an indication of grade boundaries or endorsed answers. In a live series the mark a response gets depends on the process of standardisation, which considers the big picture of the year's scripts. The levels or marks we show in our resource is an estimation of what could be awarded. How levels and marks correspond to grade boundaries is then determined during the Awarding process. This process happens after the marking of scripts and depends on a number of factors including candidate performance across the board.

You can read more about this process in our [guide](#).

Question 1

1 On an engineering drawing what is represented by the line in **Fig. 1**?



Fig. 1

- (a) Centre line
- (b) Hidden detail
- (c) Leader line
- (d) Projection

☐
☐
☐
☐

[1]

Exemplar 1

- (a) Centre line
- (b) Hidden detail
- (c) Leader line
- (d) Projection

☒
☐
☐
☐

[1]

1 mark

Candidates may confuse the centre line with a hidden detail line which also uses a dashed line. However, all the dashes within a hidden detail line are the same length.

Question 2

2 Which product would typically use 'one-off' as a scale of production?

- (a) Car
- (b) Road bridge
- (c) Shampoo bottle
- (d) Smart phone

☐
☐
☐
☐

[1]

Exemplar 1

- (a) Car
- (b) Road bridge
- (c) Shampoo bottle
- (d) Smart phone

☐
☒
☐
☐

1 marks

[1]

Candidates may consider a customised car as a one-off product. However, you can explain that before the car is customised, the car is a mass-produced product that subsequently has added customised features. In contrast, a road bridge is built in situ as a one-off design to fit its surroundings.

Question 3

3 Which type of drawing is shown in **Fig. 2**?

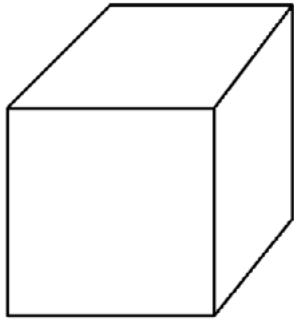


Fig. 2

- (a) Assembly
- (b) Isometric
- (c) Oblique
- (d) Orthographic

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☐
☐
☐

[1]

Exemplar 1

- (a) Assembly
- (b) Isometric
- (c) Oblique
- (d) Orthographic

☐
☐
☒
☐

[1]

1 mark

Candidates may be distracted by answers (d) Orthographic or (b) Isometric. Orthographic drawings use 2D views of a 3D object. Isometric drawings use the same scale on each side or face and show the edge of an object, not the face. An Oblique drawing has the projection lines away from the face of an object as shown.

Question 4

4 Which of these is an example of inclusive design?

- (a) Including a wind-up charger on a radio
- (b) Producing a computer-gaming chair in multiple colours
- (c) Providing a ramp for wheelchair access to a building
- (d) Putting a company logo on a remote control

☐☐☐☐

[1]

Exemplar 1

- (a) Including a wind-up charger on a radio
- (b) Producing a computer-gaming chair in multiple colours
- (c) Providing a ramp for wheelchair access to a building
- (d) Putting a company logo on a remote control

☐☐☒☐

[1]

1 mark

Candidates may wrongly consider answer (b) but only answer (c) is related to inclusive design in this context.

You can help candidates understand the difference by explaining the term 'inclusive design' means a design that provides access to products (or services) for users with specific needs. Another example of an inclusive design is a large keypad telephone.

Question 5

5 Which of these statements best describe planned obsolescence?

- (a) A product created to last indefinitely
- (b) A product that can be repaired
- (c) A product that is created to last a limited time
- (d) A product that is recyclable

☐
☐
☐
☐

[1]

Exemplar 1

- (a) A product created to last indefinitely
- (b) A product that can be repaired
- (c) A product that is created to last a limited time
- (d) A product that is recyclable

☐
☐
☒
☐

[1]

1 mark

Candidates will need to understand the term 'obsolescence' to correctly answer this question.

You can give candidates examples of planned obsolescence products such as mobile telephones, laptop computers and other equipment that require replacements to perform to the latest specifications.

Question 6

- 6 On an engineering drawing which of the following mechanical features is shown in Fig. 3?

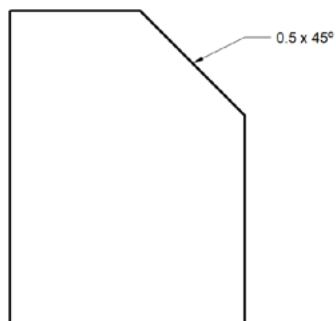


Fig. 3

- (a) Chamfer
- (b) Countersink
- (c) Hole
- (d) Thread

☐
☐
☐
☐

[1]

Exemplar 1

- (a) Chamfer
- (b) Countersink
- (c) Hole
- (d) Thread

☒
☐
☐
☐

[1]

1 mark

Most candidates should recognise that the correct answer is (a) Chamfer, which usually features on an edge as shown, whereas a countersink is usually associated with a hole or drilling.

Question 7

7 Which of these modelling methods is typically used for electronic circuits?

- (a) Block
- (b) Breadboarding
- (c) Card
- (d) 3D printing

☐
☐
☐
☐

[1]

Exemplar 1

1 mark

- (a) Block
- (b) Breadboarding
- (c) Card
- (d) 3D printing

☐
☒
☐
☐

[1]

Breadboarding is a unique term for a method of physically creating and prototyping electronic circuits and it is unlikely that many candidates will be distracted by the other possible answers.

Question 8

8 What does the letter **M** mean in the product analysis tool ACCESS FM?

- (a) Materials
- (b) Mechanical
- (c) Modelling
- (d) Motor

☐
☐
☐
☐

[1]

Exemplar 1

- (a) Materials
- (b) Mechanical
- (c) Modelling
- (d) Motor

☒
☐
☐
☐

[1]

1 mark

Candidates could potentially be distracted by answer (c), making links between the terms 'analysis' and 'modelling'.

Question 9

- 9 Which **type** of manufacturing process involves removing material by machining to create a product?

- (a) Assembly
- (b) Finishing
- (c) Shaping
- (d) Wasting

☐
☐
☐
☐

[1]

Exemplar 1

- (a) Assembly
- (b) Finishing
- (c) Shaping
- (d) Wasting

☐
☐
☐
☒

[1]

1 mark

Candidates could be distracted by answer (c) shaping.

You can teach candidates that shaping does not always involve removing material. An example is moulding.

Question 10

10 A dimension is $10 \pm 0.2\text{mm}$. Which of these would be within tolerance?

- (a) 9.8mm
- (b) 10.3mm
- (c) 10.4mm
- (d) 9.5mm

☐
☐
☐
☐

[1]

Exemplar 1

- (a) 9.8mm
- (b) 10.3mm
- (c) 10.4mm
- (d) 9.5mm

☒
☐
☐
☐

[1]

1 mark

Candidates who understand how tolerances are written will recognise that the dimension will be either 0.2mm greater or less than 10mm. Through a basic calculation of adding or subtracting 0.2mm, they will work out that the correct answer is 9.8mm.

You can encourage candidates to check their maths when answering questions involving a calculation and avoid guessing, or just choosing an answer that looks about right.

Question 11 (a)

- 11 (a) A design brief sets out what is required by a user. State **two** types of information that may be included in a design brief.

1.....
.....
2.....
.....

[2]

Exemplar 1

2 marks

1 *Product function*.....
.....
2 *Materials the product will be made from*.....
.....

In this example the candidate has given two valid responses. Understanding the difference between a design brief and design specification is important to make sure specification points are not used in place of what would be included in the design brief. Two marks would be awarded.

Exemplar 2

1 mark

1 *Materials*.....
.....
2 *Price*.....
.....

The candidate has given one correct response, 'Materials'. However, 'Price' is incorrect. The budget and/or material cost may be included in the specification but not the design brief. One mark in total for this answer.

Question 11 (b)

(b) State **two** aesthetic factors that can influence a user's opinion of a product.

- 1.....
.....
- 2.....
.....

[2]

Exemplar 1

2 marks

- 1 *The colour*.....
- 2 *The shape of the product*.....

The mark scheme only requires candidates to provide a correct single word or short statement for each of the available marks. 'Colour' is included in the mark scheme. Although 'shape' is not in the mark scheme, it is essentially the same as 'form'. The candidate would therefore achieve 2 marks for this question part.

Exemplar 2

1 mark

- 1 *What colour the product is.*.....
- 2 *What size the product is.*.....

'Colour' is included within the mark scheme therefore 1 mark is given. Size is not an aesthetic factor and therefore no mark can be given for that response.

Question 11 (c)

(c) State the meaning of 'market pull'.

.....

.....

[1]

Exemplar 1

1 mark

Customer demand for a new product.

.....

[1]

Exemplar 2

0 marks

Market is pulled towards buying a product.

.....

[1]

Customer/consumer demand is not exactly the anticipated answer as shown within the mark scheme. However, if this appeared in a candidate's response prior to the standardisation meeting it is likely the mark scheme would be amended to accommodate this response as it demonstrates understanding by the candidate. One mark is given for this response.

This response is incorrect and demonstrates that the candidate does not understand the meaning of the term.

Market Pull (and technology push) is an area of the specification that some candidates can find difficult to understand. You can help candidates understand market pull by explaining that market pull is a type of consumer/market demand – new products are made to meet what customers say they want. i.e. consumers want bigger 'phone screens, so designers design larger screens that can do more.

Question 11 (d)

- (d) Explain **one** way in which ergonomic design could improve the use of a computer mouse.

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

Exemplar 1

2 marks

The mouse design fits the hand comfortably and can be operated without hurting the wrist.

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

Exemplar 2

1 mark

The mouse can fit the hand

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

For this type of question, candidates should give a valid expansion to develop their first point. This candidate has made a point and expanded it and therefore should be credited the full 2 marks.

The candidate has given a simple but valid response worth 1 mark.

You could get candidates to practise techniques in answering this type of question to develop their answers. For example, for the answer given, why is it important that the mouse can fit in the hand? By tasking candidates to practise questioning their own answers, they will be able to consider how to develop and expand the answer further. i.e. 'The mouse can fit in the user's hand (1 mark), so that it is does not become uncomfortable to use' (1 mark).

Question 11 (e) (i), (ii) and (iii)

(e) Fig. 4 shows the initial stages of a linear design process.
Complete the flowchart by inserting the missing stages.

| | |
|-----------------|----------------------|
| Missing stages: | Test prototype |
| | Production plan |
| | Generate ideas |
| | Research the problem |

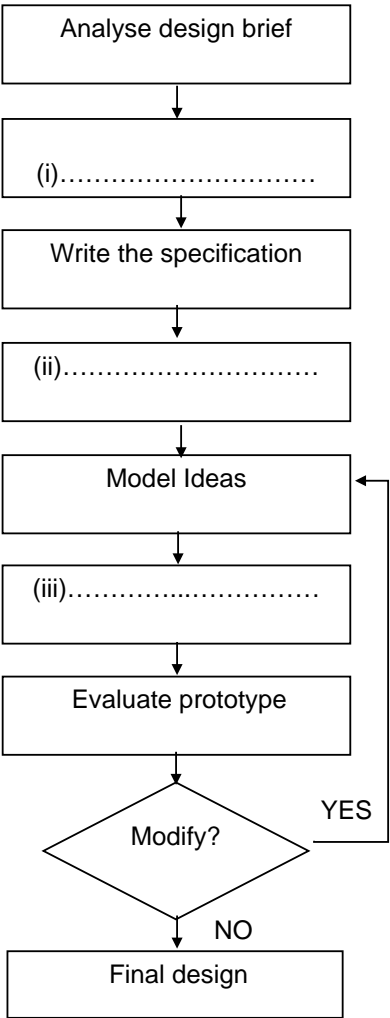


Fig. 4

[3]

Exemplar 1

3 marks

- (i) *Research the problem*
- (ii) *Generate ideas*
- (iii) *Test prototype*

The candidate has correctly stated each of the three correct answers in the correct order for 3 marks.

Exemplar 2

1 mark

- (i) *Generate ideas*
- (ii) *Research the problem*
- (iii) *Test Prototype*

This candidate has selected the correct three stages of the four possible stages given. However, only one stage, 'Test prototype' is in the correct order so 1 mark is achieved.

Question 12 (a)

- 12 (a) State what the symbol in **Fig. 5** represents in an orthographic drawing.

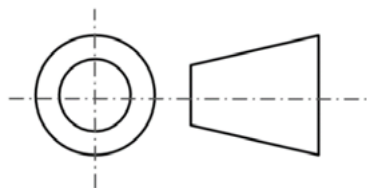


Fig. 5

.....
[1]

Exemplar 1

1 mark

Third Angle Projection

.....[1]

Exemplar 2

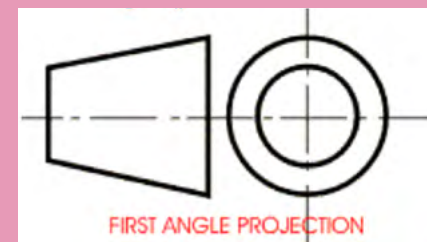
0 marks

Top view

.....[1]

There is only one possible correct response, with the candidate correctly naming the symbol as third angle projection (the 'orthographic' reference perhaps less important). This candidate has been given 1 mark.

Teaching note: You may find that some students have come across 'first angle projection' which uses the same symbols reversed. First angle projection is not in the specification due to the UK, and most other countries, adopting third angle projection although some international regions use first angle projection. You may have corrected students during class teaching for using the first angle projection symbol instead of third angle.



Although an incorrect response, Plan View (i.e. viewed from the top) is one of six views possible with orthographic projection. However, for this question, the response the candidate has given is irrelevant to the response required. No marks are awarded.

Question 12 (b)

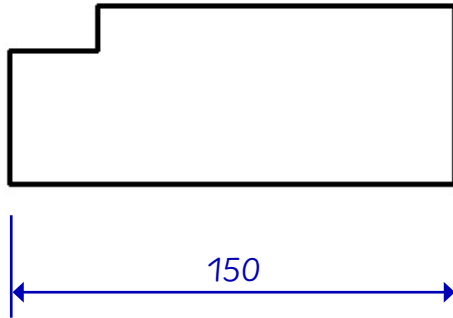
- (b) A component has a length of 150 mm. Complete the drawing in **Fig.6**, using standard conventions, placing the following items in the correct location:

- Leader lines
- Arrows
- Dimension

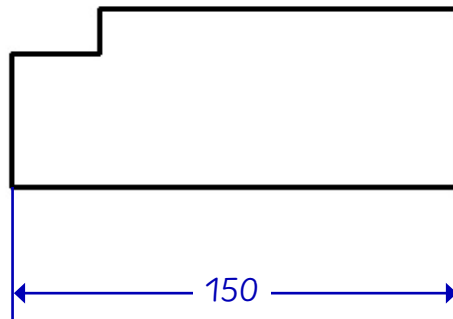


Fig. 6

[4]

Exemplar 1**4 marks**

The drawing completed by the candidate matches the mark scheme perfectly. This candidate has correctly placed the dimension measurement in the centre of the shape above the dimension line and has drawn the leader lines ensuring these do not touch the component shape. The correct arrow heads have been used on the dimension line. The full 4 marks are awarded.

Exemplar 2**2 marks**

The candidate has the dimension in the centre of the component shape. However, this has not been placed above the dimension line but in the middle of the line. The candidate has drawn the leader line on the left side of the side so it is touching the component. Two marks in total awarded.

Question 12 (c)

- (c) A component has a drilled hole with a diameter of 30 mm. Show this on the drawing using standard conventions in **Fig. 7**.

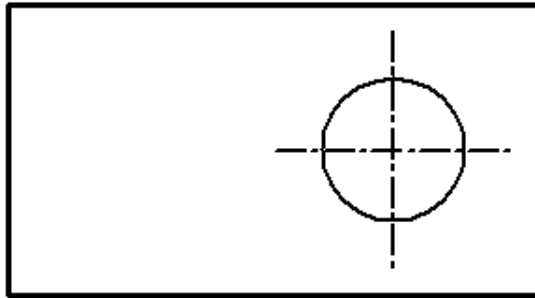
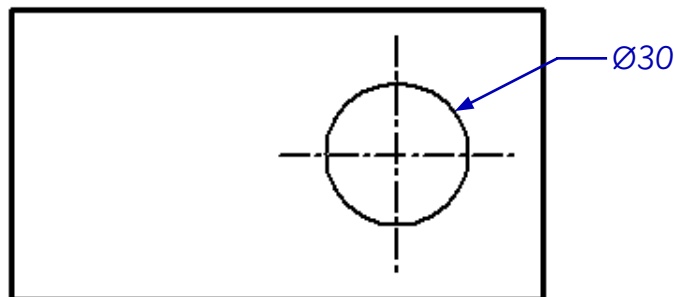


Fig. 7

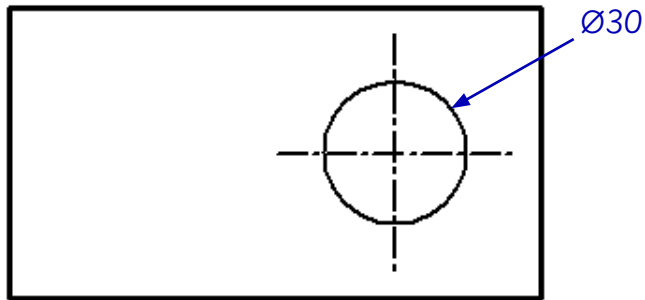
[2]

Exemplar 1

2 marks



The drawing completed by the candidate matches the mark scheme perfectly. This candidate has correctly drawn the arrow of the leader line outside of the circle leading out of the square and the correct diameter symbol and value have been placed at the start of the leader line. The full 2 marks are awarded.

Exemplar 2**1 mark**

The candidate has correctly drawn the leader line just touching the outside of the circle and leading outside of the square allowing a mark to be given. However, the leader line has not been extended and the dimension value has been drawn hovering above the leader line which cannot be given the mark. One mark total is given.

Question 12 (d)

(d) State the name of each mechanical feature used in engineering drawings.
Write your answer in **Table 1**.

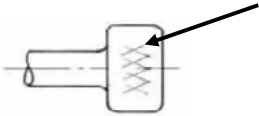
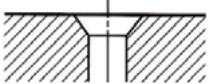
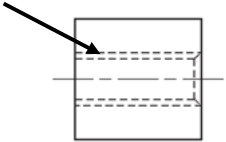
| Mechanical feature | Name |
|--|------------|
| (i)  | (i)..... |
| (ii)  | (ii)..... |
| (iii)  | (iii)..... |

Table 1

[3]

Exemplar 1

3 marks

- (i).....*Knurl*.....
- (ii).....*Countersink*.....
- (iii).....*Thread*.....

The candidate has correctly named each of the three features shown.

Although (i) shows a diamond knurl pattern which is commonly used, candidates should also be taught to recognise other knurl patterns such as angular and straight patterns knurls.

Exemplar 2

1 mark

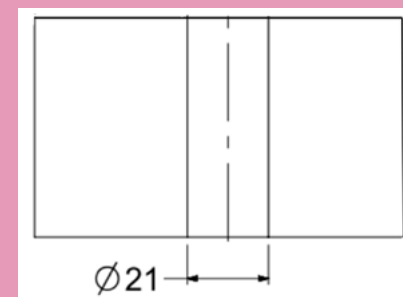
(i) *Cross pattern*.....

(ii) *Countersink*.....

(iii) *Bore/hole*.....

This candidate has achieved one of the available marks for the response given for part (ii) 'Countersink', but the other two answers are incorrect.

Candidates can confuse the convention for drawing a thread for a through hole which looks similar. The convention for a through hole has a centre line and a single solid line on each side of the hole as shown below.



Question 13 (a) (i)

13 Fig. 8 shows a group of electric scooters (e-scooters). Many cities around the world provide rentable e-scooters to decrease traffic pollution. The e-scooters are made from a variety of metals and plastics, are powered by rechargeable batteries and users must be over 16 years of age.



Fig. 8

(a) Explain how the following requirements could influence the design of an e-scooter as shown in Fig. 8.

(i) Aesthetics
.....
.....
.....
.....[2]

(ii) Ergonomics
.....
.....
.....
.....[2]

(iii) Sustainability
.....
.....
.....
.....[2]

Question 13 (a) (i)

- (a) Explain how the following requirements could influence the design of an e-scooter as shown in **Fig. 8**.

Exemplar 1

2 marks

- (i) Aesthetics *The e-scooter will have bright colours to improve visibility so users feel safe.*
-
-[2]

The candidate has given an appropriate aesthetic point related to the design of the e-scooter and explained their response for the second available mark. Two marks total are given.

Exemplar 2

1 mark

- (i) Aesthetics *The scooter is made to look modern.*
-
-
-[2]

This candidate has provided an appropriate aesthetic point as a simple response statement worth 1 mark. However, the candidate has not expanded on their response to enable the second available mark to be given.

You can work with candidates in practising answering this type of question by getting the candidate to first state an aesthetic feature and then for the second mark, asking why it matters/ what makes the aesthetic feature important for the design.

Question 13 (a) (ii)

- (a) Explain how the following requirements could influence the design of an e-scooter as shown in **Fig. 8**.

Exemplar 1

2 marks

- (ii) Ergonomics *The scooter is wide enough to stand on comfortably, so you don't feel like you are going to fall off.*

This candidate has provided an appropriate ergonomic point and expanded their response with a follow up point, together worth 2 marks.

.....[2]

Exemplar 2

1 mark

- (ii) Ergonomics *You can fit both of your feet on it.*

In this example, the candidate has provided an appropriate but simple 1 mark response without further expansion. One mark total awarded.

You can work with candidates so they learn to recognise that the space given for the response and marks available often gives some indication of the expected scope of the response. For example, a single response line suggests a one or two word response is required, whereas several response lines indicates that more than a simple statement will be required to gain the 2 available marks

.....[2]

Question 13 (a) (iii)

- (a) Explain how the following requirements could influence the design of an e-scooter as shown in **Fig. 8**.

Exemplar 1

2 marks

(iii) Sustainability *The scooter can be repaired with new parts so this will extend the life of the scooter.*
.....
.....
.....[2]

This is a good example of a response worth 2 marks. The first point made explains what the sustainable requirement is i.e., 'can be repaired' and the second mark point can be awarded for 'will extend the life of the scooter'.

Exemplar 2

1 mark

(iii) Sustainability *The scooter will be made from recyclable aluminium.*
.....
.....
.....[2]

This candidate has provided a simple statement worth 1 mark without an expansion of how recyclable materials contributes to sustainability. Adding another simple response such as 'reusing finite materials and reducing extraction', would have been worthy of the second mark. One mark total is awarded.

Question 13 (b)

- (b) An engineering design specification (EDS) for an e-scooter could contain information about the aesthetics, cost and the environment.

State **two** other items of information that would normally be given in an EDS for an e-scooter, giving a reason for each.

1.....

.....

.....

2.....

.....

.....

[4]

Exemplar 1

4 marks

1 *Size of the e-scooter because the scooter will suit different sizes and ages of customers.*

.....

2 *What materials the e-scooter is made from. The e-scooter needs to be able to be used in all weather conditions.*

.....

This candidate has given two expanded responses worth 4 marks total. One mark is given for the specification point 'Size' and 1 mark for the expansion.

For the second answer, 1 mark is given for 'what materials...' and the second mark for the expansion. 4 marks total are awarded.

Exemplar 2**2 marks**

1. *The size of the scooter.*

.....
.....

2. *What materials the scooter is made out of.*

.....
.....

This question requires candidates to give two expanded responses but in this example the candidate has only given the specification point in each response, without any reasoning. The specification points given are in line with those in the mark scheme and therefore this candidate is awarded 2 marks total.

Question 14 (a)

14 **Fig. 9** shows a 3D printing machine.

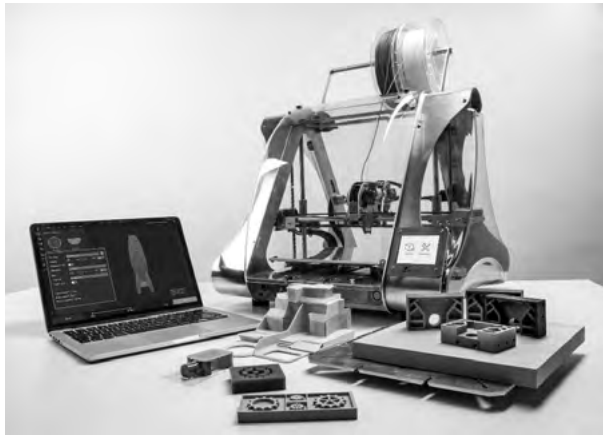


Fig. 9

(a) Describe the printing process using a 3D printer.

.....[6]

Exemplar 1**6 marks**

The process starts with having a completed model designed using CAD. The CAD design will need to be converted to a suitable programme file called an STL file. The printing plastic material is put into the printer. When the printing starts it slowly builds up layers one after another to create the product shape. Once the printing is completed, the finished part will need to be left to cool down. Once cooled the printed parts can be separated from the supports stands. You will probably need to sand or smooth the 3D printed object ready for painting.

[6]

Exemplar 2**4 marks**

The process starts with having a CAD design drawn. The CAD is uploaded on to the computer. The design is converted into programme file and sent to the 3D printer. The correct material is loaded into the 3D printer, depending on which type you are using. The printing programme is started and the printer will begin printing in the order the programme tells it to in a layer of material. When the printing is finished the printed parts can be separated from the sprue.

[6]

The candidate has correctly described a range of stages in the 3D printing process in a structured description. Each stage of the process is presented in the logical and correct order that takes place in the process. Although the mark scheme includes a greater number of possible responses that can be used, this candidate's response has adequately covered six valid points, clearly demonstrating understanding of the 3D printing process.

This is an example of a 4 mark response.

The candidate's response shows an adequate understanding of the process presented in a logical order. Marks would be achieved for the following points described within the response:

The design is converted into programme file and sent to the 3D printer, material loaded into the 3D printer, printing in the order the programme tells it to in layers, printed parts can be separated from the sprue.

Not every stage of the process is covered within this response meaning the candidate missed out on some marks. For example, including a description of how the printing process starts and continues to produce layers of the material repeatedly to build up the form would have covered two further mark points within the mark scheme.

To practise answering this type of question, you could use videos of similar processes in class as a resource and ask students to describe the end-to-end process including each stage and in the correct sequence order.

Exemplar 3

2 marks

You put the printing material in the 3D printer. After a while the printer has finished, and you have produced a 3D printed part you drew on the computer. You need to sand it to finish the product.

[6]

This is an example of a low-level response, with two valid points described.

Mark points are: 'put the printing material in the 3D printer' and, 'You need to sand it to finish the product.'

The candidate has mentioned the work before printing had been completed i.e., 'drew on the computer' but has not been specific enough to demonstrate knowledge that CAD is used to create a 3D model as stated within the mark scheme.

In the final point described by the candidate, they have not included the reason why the printed product requires sanding, which would have gained another mark point identified within the mark scheme.

You can emphasise to students that they should learn to present their responses in a logical order which will help them consider if they have covered each stage of the process in this type of question where possible.

Question 14 (b)

(b) Explain **one** advantage and **one** disadvantage of using 3D printers.

Advantage

.....

.....

.....

Disadvantage.....

.....

.....

.....

[4]

Exemplar 1

4 marks

Advantage *Parts can be created quickly in a single step, without the expense of making a mould.*

.....

.....

Disadvantage *There are a limited number of materials that can be used for 3D printing, that might not be suitable for testing the final product.*

.....

.....

[4]

This candidate response is given the full 4 marks. The candidate correctly explains the advantage and disadvantage and provides further expansion of their explanation.

Although the candidate's response in relation to a mould is not specifically included within the mark scheme, this is a valid response. The mark scheme would make provision for other valid responses to be awarded marks in the build up to the standardisation process.

Exemplar 2

2 marks

Advantage *You only need one machine to make the product.*

.....

.....

Disadvantage *3D printing produces lines that need smoothing.*

.....

.....

.....

[4]

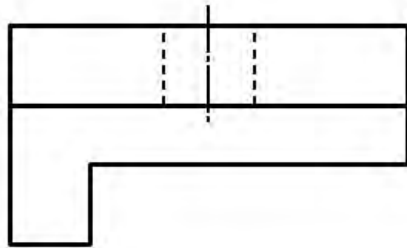
This candidate gives a basic response without explaining the advantage and disadvantage. Therefore, 1 mark for each response is given for a total of 2 marks.

20

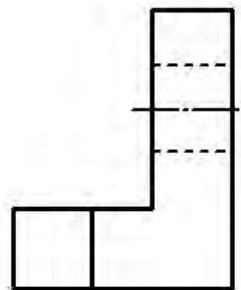
Question 15 (a)

15 (a) Fig. 10 is a drawing of a shelf bracket.

In the space provided complete the third angle orthographic projection by adding a **front view**.



PLAN VIEW

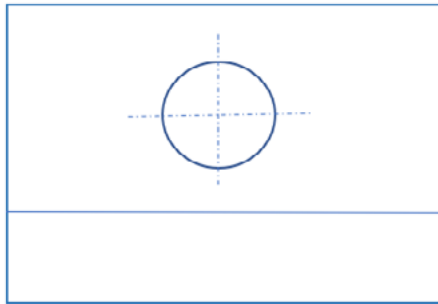


SIDE VIEW

FRONT VIEW

[2]

Fig.10

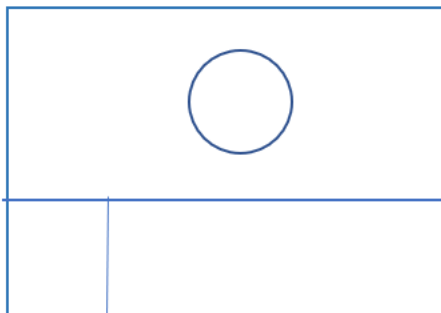
Exemplar 1

FRONT VIEW

2 marks

The drawing of the front view of the shape is not quite correct. The drawing by the candidate shows the front as a consistent shape along the front view whereas there is actually a removed section shown in the plan and side view. However, the candidate has drawn the shape correctly aligned to the plan and side views including the hole through the shape.

Although the mark scheme does not include a specific mark for hole through the bracket, it is good practice for candidates to draw all the details shown in other views to make sure they can achieve the maximum marks available. As there are three possible ways that candidates can be given the marks in this question, this candidate has been able to access both of the available marks despite the error in drawing the shape. The full 2 marks are awarded.

Exemplar 2

FRONT VIEW

1 mark

The candidate has correctly drawn the shape including the removed section. However, the candidate has not aligned their front view drawing to the plan and side views and therefore can only be given the mark for the correct shape. The candidate has not drawn the centre line of the hole which is shown on the plan and side view. Although there were no marks for drawing the centreline within the mark scheme on this exam paper, future exam questions may award marks for this detail. Ideally, candidates will draw all details shown in the given views to make sure they do not lose marks for omitting details.

In contrast to using on-screen resources, giving candidates exercises to draw on paper, the different views of components with specific details and dimensions can help them prepare for exam questions like this one, where alignment to other views and correctly identifying and including details is important to achieve the available marks. 1 mark is awarded.

Question 15 (b)

- (b) State the meaning of the following abbreviations used on engineering drawings.

(i) DIA[1]

(ii) MATL.....[1]

Exemplar 1

2 marks

(i) DIA *Diameter*[1]

(ii) MATL *Material*[1]

The candidate gives two correct responses so gains the full 2 marks.

Exemplar 2

1 mark

(i) DIA *Diameter*[1]

(ii) MATL *Metal*[1]

'Diameter' is correct; however 'Metal' is incorrect. You can help candidates learn about the standard abbreviations used within engineering drawings by asking candidates to research these and include abbreviations each time they are producing an engineering drawing.

Question 15 (c)

(c) State **one** purpose of isometric drawings.

.....[1]

Exemplar 1

1 mark

To make a drawing in 3D.

.....[1]

The candidate's response is correct for 1 mark.

Exemplar 2

0 marks

To see what the top, side and front look like.

.....[1]

This candidate has described an orthographic drawing instead of an isometric drawing, demonstrating that in this case the candidate has confused the two types of drawing. No marks are given.

Question 15 (d)

(d) Recycle and Repair are two of the 6Rs of sustainable design.

State **three** of the other 6Rs of sustainable design.

- 1.....
- 2.....
- 3.....

[3]

Exemplar 1

3 marks

1. *Reuse*
2. *Reduce*
3. *Rethink*

[3]

Exemplar 2

1 mark

1. *Recycle*
2. *Reuse*
3. *Renew*

[3]

All three responses are correct for the full 3 marks.

In this example the candidate has only given one correct response, 'Reuse'. 'Renew' is not a valid response and 'Recycle' is an invalid answer as the question asks for any of the 6Rs *other* than Recycle and Repair. The candidate could have used correct responses such as Refuse, Rethink or Reduce to be given the remaining 2 marks. One mark is awarded.

For questions that assess knowledge or recall of the 6 Rs, you can encourage candidates to write out each of the 6 Rs in an additional response page or space to remind themselves of these where necessary, crossing out those already given in the question.

Question 15 (e)

- (e) Give **one** reason why an engineering company might implement relevant British Standard for its products.

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

Exemplar 1

2 marks

*So the customer knows the product is a good quality product
and the product is safe to use.*

.....[2]

The candidate gave two correct points in their response that are included in the mark scheme 'good quality' (high quality) and 'safe'. The candidate is awarded the full 2 marks for this response.

Exemplar 2

1 mark

To show it is safe.

.....[2]

The candidate gave one correct point worth 1 mark but needs to expand their response to include a second point. One mark is awarded.

Question 16 (a)

16 (a) Describe **one** method of evaluating a design idea, other than making a model.

.....

.....

.....

.....[2]

Exemplar 1

2 marks

*Comparing it to the design specification to make sure it covers
all of the points that the customer asked for.*

.....

.....[2]

Exemplar 2

1 mark

Use a score card to check it meets the design specification.

.....

.....

.....[2]

The candidate's response is awarded the full 2 marks. The first part of the candidate's response 'Comparing it to the design specification' is correct and closely aligned to a response given in the mark scheme. The second part of the candidate's response 'make sure it covers all of the points that the customer asked for' is sufficient to be awarded the second mark.

It will be beneficial to teach candidates that it is best to not to use the terms 'client' and 'customer' interchangeably as 'client' in the context of this question will be the client providing the designer with the design brief and 'customer' would be the consumer of the completed product. This question relates to a stage early in the design cycle before the product design has been approved, therefore 'client' should be used to avoid ambiguity.

The candidate's response as a brief statement is enough to be awarded 1 mark. The response lacks detail and a reference to either the design brief, the client or how the results could be used.

Question 16 (b)

- (b) Describe **one** method of measuring the linear dimensions of a completed product.

.....

.....

.....

.....[2]

Exemplar 1

2 marks

*Using a ruler or a vernier calliper to check the product length
dimensions match the design.*

.....

.....[2]

Exemplar 2

1 mark

Checking it with the callipers to see if it is OK.

.....

.....

.....[2]

The candidate has correctly named an appropriate measuring tool (vernier calliper) and given an example of what is being measured. The candidate's response has been given the full 2 marks.

The candidate has correctly named an appropriate measuring tool ('calliper' accepted) but does not give a response that includes how the tool and or the measurements will be used.

You can ask candidates to practise answering this type of question observing that the question is worth 2 marks and therefore the candidate will be required to give a two-part response to access both marks. The candidate should identify what is to be measured to determine what type of measuring tool is suitable and how they can use the measurement.

(c) An engineering company is proposing to move from manually creating drawings of products to producing all drawings using CAD software.

..... [6]

Exemplar 1

Level 3

There are many advantages when designing products using CAD drawings software which can be used for 2D and 3D drawing and modelling. The advantages are that drawings can be much more accurate and modified without starting from scratch. CAD design views can be rotated through various angles unlike static manually drawn methods. CAD designs can be used for creating files such as STL for 3D printers. This means that if design measurements change such as like a tolerance, the changes can easily be reprogrammed into the production machinery. A disadvantage is that the company will have to purchase software, and train staff how to use the software, so the initial start-up cost can be expensive.

In this example response, the candidate has provided a detailed discussion showing clear understanding of the advantages and disadvantages of the proposed change to using CAD referring to the difference of what is possible through the use of CAD as a comparison to manually drawn methods. The candidate has structured their response into a discussion and developed several points further to support the identified advantages.

Specialist terms have been used appropriately and correctly. This candidate has been awarded Level 3 for their response.

Exemplar 2

Level 2

CAD drawings make design easier, and you can alter the design on screen easily. You can email the design when it is finished to show the customer to check if the design meets their requirements. One advantage of CAD drawing software is you can send the design to a laser cutter or 3D printer to make the product. The company will need to buy software and train staff to be able to use it which will take time and cost the company money.

In this example response, the candidate has provided an adequate discussion showing an understanding of the advantages and disadvantages of the proposed change to using CAD.

The candidate has included some specific advantages to gain marks and has named specific types of production equipment typically used to produce products from CAD drawings.

The candidate has provided some structure within their response by clearly stating what they consider to be an advantage. The overall structure of the response could be improved by setting out a range of advantages and developing a discussion. For example, 'An advantage of using CAD is..., however...'

You could encourage candidates to develop the examples within their response to show a greater understanding. For example, 'CAD files can be shared electronically as the design is being developed. This means that designers can be located within another part of the company or remotely anywhere in the world'

Exemplar continued on the next page

Exemplar 3

Level 1

CAD is an easy and cheap way to make your design once you know how to use it. The disadvantage is you need to learn how to use it before you can make a good design.

and be able to contribute to the design as it develops.’ Where the candidate can continue with ‘...This means that...’ they have presented a justification for the identified advantage, showing a clear understanding of the positive impact of the stated advantage. Level 2 is awarded.

Time constraints and allocated space for the response will not allow such development within the response for every part of the explanation or discussion candidates give in their response. However, two well developed points will help to demonstrate clear understanding and knowledge.

You can encourage candidates to use specialist terms that show further detailed knowledge and understanding.

In this example response, the candidate has given a basic discussion response showing limited understanding of the advantages and disadvantages of the proposed change to using CAD. The candidate has identified one valid mark point for ‘you need to learn how to use it’. This response given for this question part is Level 1.

To gain higher marks, the candidate could include specific examples explaining what the advantages of using CAD are compared to manually creating drawings of products. Presenting responses as a comparison of the advantages and disadvantages starts to build the response into a discussion rather than a description. However, you should discourage candidates from presenting a list of bullet points as this would not provide the structure of a discussion necessary for this type of question response.

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