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June 2019

GCE Design and Technology 9DT0 01

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Introduction

The new A Level in Design and Technology (Product Design) has an externally assessed exam reflecting 50% of the qualification assessment. This represents a significant change from the 40% examination weighting in the legacy specification. This increase in weighting is also reflected in the 'theory' content of the specification as well as the increase in the examination time from 1.5 hours to 2.5 hours.

The new content broadly covers the content of the legacy resistant materials and graphic product specifications together with additional content to cover textiles and updated industrial practice.

The overall paper now includes several types of questions which include; short, medium and long open response questions, calculations and drawings. This provides increased rigour over the legacy specification examinations as candidates need a wider skill set in order to access the different types of question.

There is a new 3 mark 'explain' type question which requires a candidate to give a fact (sometimes knowledge in isolation and sometimes related to a specific context) and follow it up with a justification which leads to further conclusion or a further consequence.

The drawing question, on this paper, is a conversion of a net into a two point perspective drawing and will be a familiar type of question to people involved in the legacy specification 6GR02.

The mathematics questions are new to the external assessment of GCE Design and Technology with a 3, 5 and 8 mark mathematics question included on this paper. Additionally an element of the marks in the drawing question can be considered as mathematics marks to cover measurement, scaling and proportion.

The long response essay questions together with the drawing question are now assessed by use of a levels based mark scheme. This type of mark scheme will reward more able candidates who can now go into greater depth and be awarded for knowledge and deep understanding and will limit the marks of less able candidates who often provide bulleted lists of recall without effective discursive elements or evaluative comments.

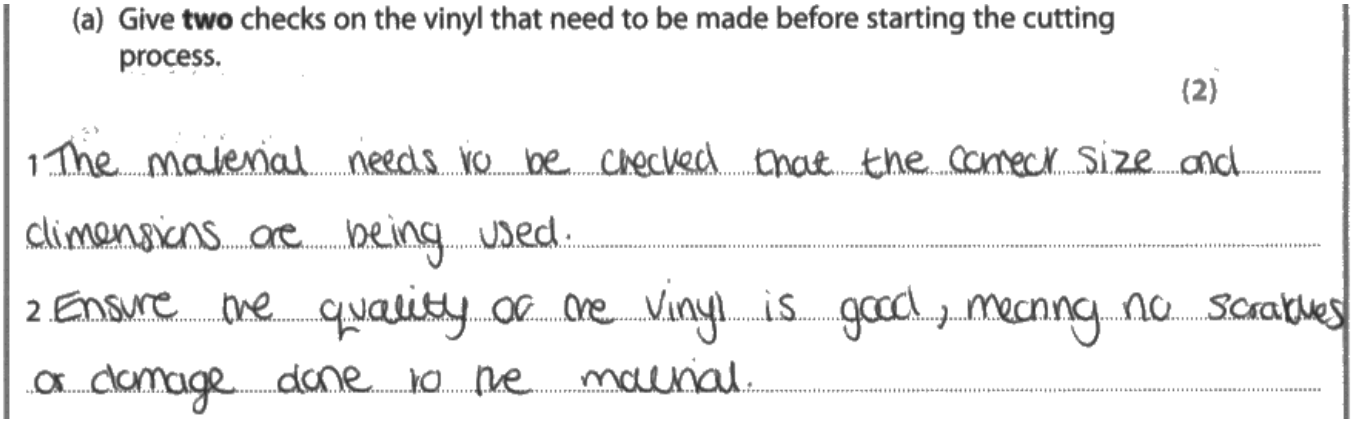
The feedback on individual questions will follow together with commentaries on individual responses.

Question 1 (a)

Question 1 has an overall focus on a cycling helmet with an outer shell manufactured from carbon fibre. This part of the question required candidates to give two checks that need to be made on the vinyl before starting the cutting process.

The key focus here is on the material and not on the machine setup. Most candidates did very well on this introductory question with common correct responses relating to checking for correct colour, size, thickness or specification.

Common incorrect responses related to machine setup, such as: feed rate, depth of cut, checking correct file upload etc.



(a) Give **two** checks on the vinyl that need to be made before starting the cutting process.

(2)

1 The material needs to be checked that the correct size and dimensions are being used.

2 Ensure the quality of the vinyl is good, meaning no scratches or damage done to the material.

ResultsPlus
Examiner Comments

This is a clear response that was awarded two marks for checking for correct size and checking for damage.

ResultsPlus
Examiner Tip

Carefully read the question to ensure that you know the exact focus of the question and what is expected of you.

(a) Give **two** checks on the vinyl that need to be made before starting the cutting process.

(2)

1 That the correct file has been sent to the CNC vinyl cutter.

2 The the correct thickness and dimension vinyl has been used appropriate to the CNC vinyl cutter.

ResultsPlus
Examiner Comments

Here, two marks were awarded. There is nothing worthy of credit in part 1 as this relates to machine setup rather than checks on the material. However in part 2, marks were awarded for checking the correct thickness and dimensions of the vinyl.

(a) Give **two** checks on the vinyl that need to be made before starting the cutting process.

(2)

1 How intense the laser or the cutter needs to be.

2 How fast the vinyl cutter goes / speed.

ResultsPlus
Examiner Comments

This response was awarded zero marks as both parts relate to machine setup rather than checks on the material.

ResultsPlus
Examiner Tip

Remember to check the focus of the question so that you are sure of how to respond.

(a) Give **two** checks on the vinyl that need to be made before starting the cutting process.

(2)

1 the correct cutting bit needs to be installed and this should be ensured before cutting.

2 the correct dimensions should be inputted on the [redacted] computer.

ResultsPlus
Examiner Comments

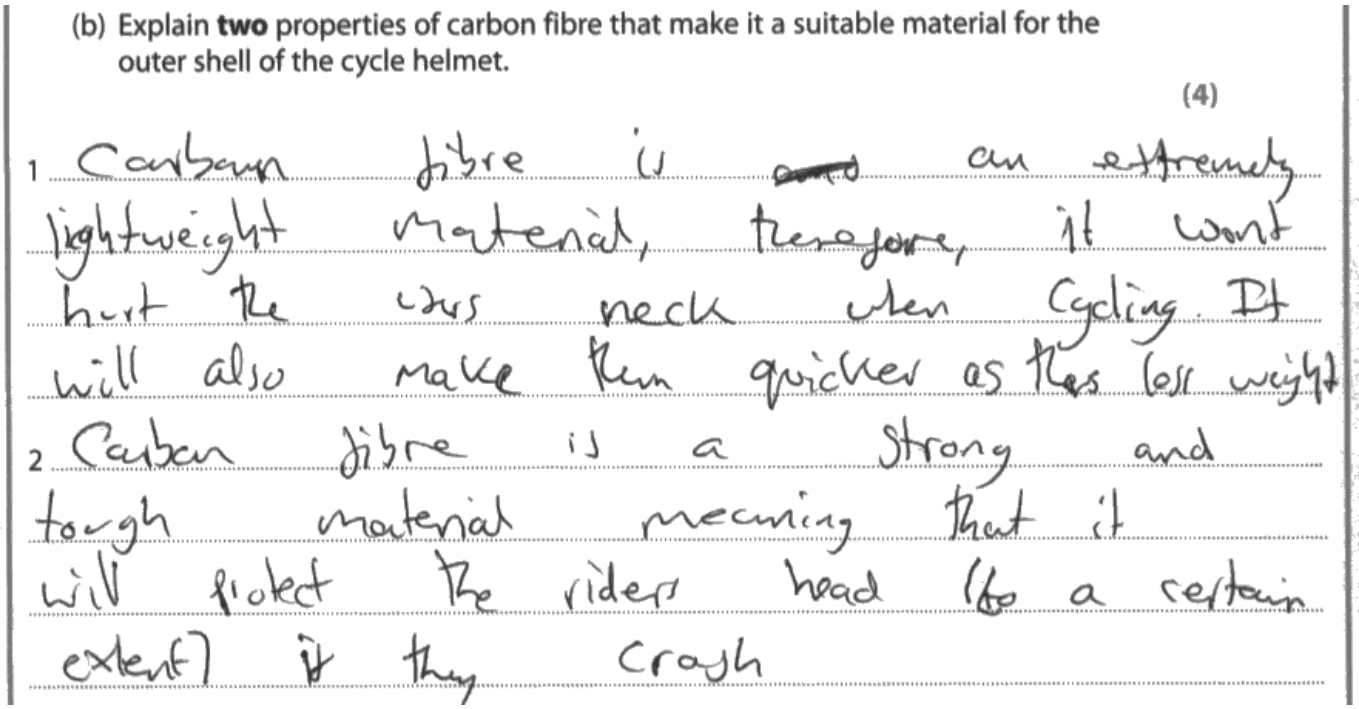
Here, zero marks were awarded as both parts of the response relate to machine setup because the reference to dimensions relates to computer input and not to checks on the material.

Question 1 (b)

This part of the question required candidates to explain two properties of carbon fibre that make it a suitable material for the outer shell of the cycle helmet.

The command verb here is 'explain' so candidates need to provide a linked two-part response identifying a valid property and then give a reason why the property is appropriate to the product or the expected use of the product.

Candidates did very well on this part of the question with the most common linked responses relating to lightweight, tough and hard.



(b) Explain **two** properties of carbon fibre that make it a suitable material for the outer shell of the cycle helmet.

(4)

1 Carbon fibre is ~~and~~ an extremely lightweight material, therefore, it won't hurt the users neck when cycling. It will also make them quicker as they lose weight

2 Carbon fibre is a strong and tough material meaning that it will protect the riders head (to a certain extent) if they crash

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Examiner Comments

This is a good response that was awarded the full four marks.

The first part of the response gained two marks for 'lightweight', therefore comfortable to wear/use. The second part of the response was awarded two marks for 'tough', therefore protects the head.

(b) Explain **two** properties of carbon fibre that make it a suitable material for the outer shell of the cycle helmet.

(4)

1 Carbon fibre is durable and so it will last a long time without needing to be replaced.

2 Carbon fibre is malleable during production so it can be bent into the desire shape and maintain that shape without going back into its original form

ResultsPlus
Examiner Comments

This response was awarded zero marks as 'durable' is not on the mark scheme.

In the context of this question, durable may be appropriate as a linked response because the durability is provided by another property or combination of properties e.g. hardness, toughness or strength. Here, in the first part of the response, the candidate has merely explained the meaning of the word durable.

In the second part of the response, the candidate has considered malleability which is an incorrect response in the context of carbon fibre as it relates to the hammering, rolling or extrusion of metals.

Question 1 (c)

This final part of question 1 requires candidates to explain two properties of carbon fibre that make it a suitable material for the outer shell of the cycle helmet. This was generally answered well with the most common answers relating to higher strength, toughness and hardness.

You will note that 'lightweight' is not in the mark scheme as, for both materials, the thinness of the outer shell means that it would only weigh a few grams so is not considered a relevant comparison. Some higher-level responses gained credit for carbon fibre not degrading under UV light and marketing opportunities provided by the use of carbon fibre, which is perceived as being used in high-end products.

(c) Explain **one** advantage of using carbon fibre rather than polyvinyl chloride (PVC) for the outer shell of the cycle helmet.

(3)

Carbon fibre has a higher strength to weight ratio meaning that due to the resilient, tough and strong weaved carbon within a resin, the material can handle a much harder impact than PVC which would break on high impact, meaning consumers would need to buy a new one. Carbon fibre is more durable so only one would last a lifetime.

ResultsPlus
Examiner Comments

This is a good response that was awarded three marks for the identification of toughness providing durability and implied economies with the phrase 'one would last a lifetime'.

(c) Explain **one** advantage of using carbon fibre rather than polyvinyl chloride (PVC) for the outer shell of the cycle helmet.

(3)

Carbon fibre has interlocking fibres which improve the strength in all directions where as PVC fibres are not interlocking and so will be more likely to break under pressure than those of carbon fibre.

ResultsPlus
Examiner Comments

This response was awarded three marks for 'interlocking fibres improving strength in all directions', so is therefore 'less likely to break'.

(c) Explain **one** advantage of using carbon fibre rather than polyvinyl chloride (PVC) for the outer shell of the cycle helmet.

(3)

Carbon fibre can have graphics on top of it. This is to enhance the aesthic of the helmet, attraqth consumers to buy. The carbon fibre that can contain graphics can be form follow function, increase it appealing to the users. Carbon fibre can absorb the ink and colour, it can sustain the sticker without falling off

(Total for Question 1 = 9 marks)

ResultsPlus
Examiner Comments

This response was awarded zero marks as it could apply to either material and has incorrect elements relating to the absorption of ink.

(c) Explain **one** advantage of using carbon fibre rather than polyvinyl chloride (PVC) for the outer shell of the cycle helmet.

(3)

Carbon fibre, can be shaped alot easier compared to pvc, therefor, the process of creating this outer shell is alot faster.

ResultsPlus
Examiner Comments

This response was awarded zero marks as the forming / shaping processes are very different and once formers are made, the manufacturing using carbon fibre would be a slower process.

Question 2 (a)

A relatively straightforward question where candidates had to state two properties of redwood that make it a suitable timber for use in a roof truss.

The command verb here is 'state', so lengthy descriptions or explanations are not necessary, for example 'stable material' would be perfectly acceptable as one of the answers.

Most candidates scored well on this question, however the most common mistake was to identify a characteristic of the property such as aesthetics which is not a property nor is it relevant to the scenario because a roof truss, in this case a trussed rafter, is not seen as it is covered with tiles on the outside of a building and hidden by the ceiling on the inside of the building.

2 Figure 2 shows a roof truss manufactured from redwood. The roof truss is designed to support the weight of the roof tiles and any additional loads.

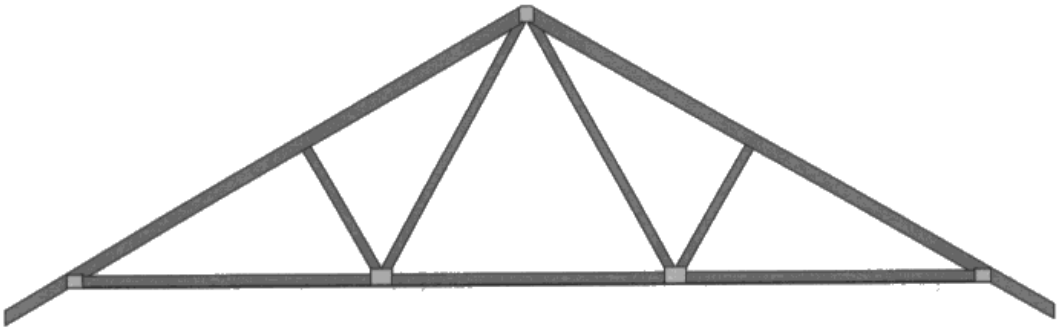


Figure 2

(a) State **two** properties of redwood that make it suitable for the roof truss.

(2)

1 doesn't warp or split

2 has good tensile strength

ResultsPlus
Examiner Comments

This response was awarded two marks. 'Doesn't warp' is covered in the mark scheme under stable material and 'good tensile strength' is an appropriate specific recognition of strength.

ResultsPlus
Examiner Tip

Remember to avoid generic answers! In the case of 'strength', what type of strength is appropriate to the scenario?

2 Figure 2 shows a roof truss manufactured from redwood. The roof truss is designed to support the weight of the roof tiles and any additional loads.

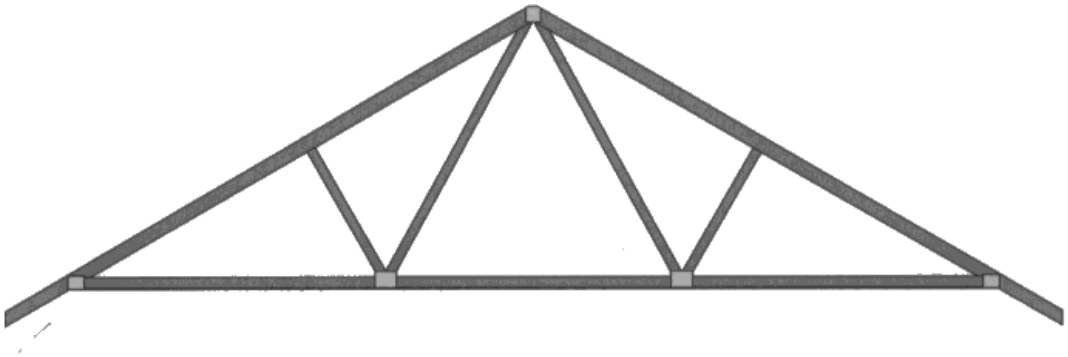


Figure 2

(a) State **two** properties of redwood that make it suitable for the roof truss.

(2)

1 Redwood is not prone to warping, meaning that if moisture is present the wood will not warp

2 The wood is easy to work with, allowing screws and fixings to be used.

ResultsPlus
Examiner Comments

This response was awarded one mark for 'not prone to warping' as a recognition of 'stable material' covered by point 4 of the mark scheme. Easy to work etc is a characteristic rather than a property.

2 Figure 2 shows a roof truss manufactured from redwood. The roof truss is designed to support the weight of the roof tiles and any additional loads.

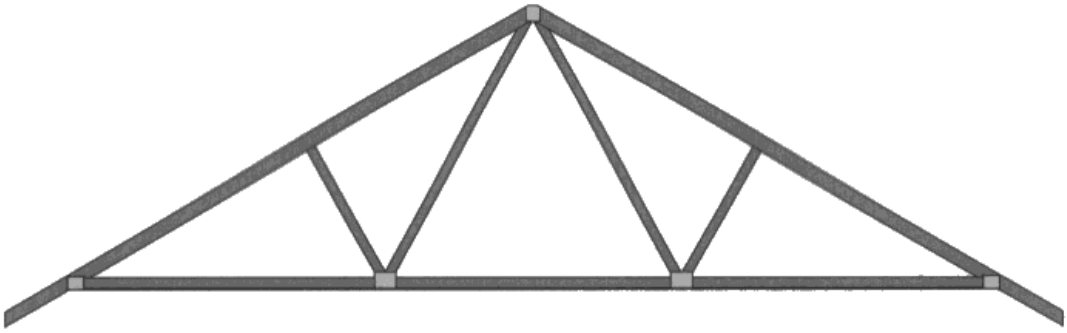


Figure 2

(a) State **two** properties of redwood that make it suitable for the roof truss.

(2)

1 Strong

2 Inexpensive

ResultsPlus
Examiner Comments

This response received zero marks as 'strong' (or strength) is not specific enough. The candidate would need to respond with: compressive strength, tensile strength or good strength to weight ratio.

'Inexpensive' did not receive a mark as this is not a property.

ResultsPlus
Examiner Tip

Check what the question asks!

Think: 'do I need to state a property or a characteristic of the material'?

Question 2 (b)

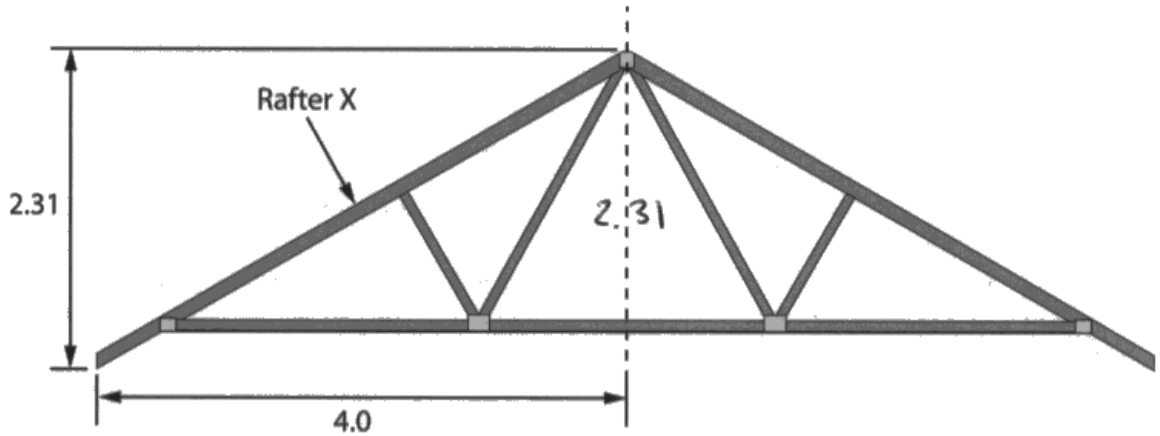
This is a question that requires the use of mathematics to calculate the length of a rafter.

The most obvious method is to use Pythagoras Theorem, although use could be made of trigonometrical methods.

Candidates just need to show the correct answer to get full marks but are advised to show working in case errors are made, because credit can still be given under 'error carried forward'.

This question was answered well by the majority of candidates who were then able to achieve the full five marks.

(b) Figure 3 shows some of the dimensions of the roof truss.



All dimensions are shown in metres

Figure 3

In order to check that you have the correct lengths of timber in stock you need to check the length of the rafters.

Calculate the length of rafter X.

Give your answer to two decimal places.

Show all of your workings.

(5)

$4^2 + 2.31^2 = 21.3361$

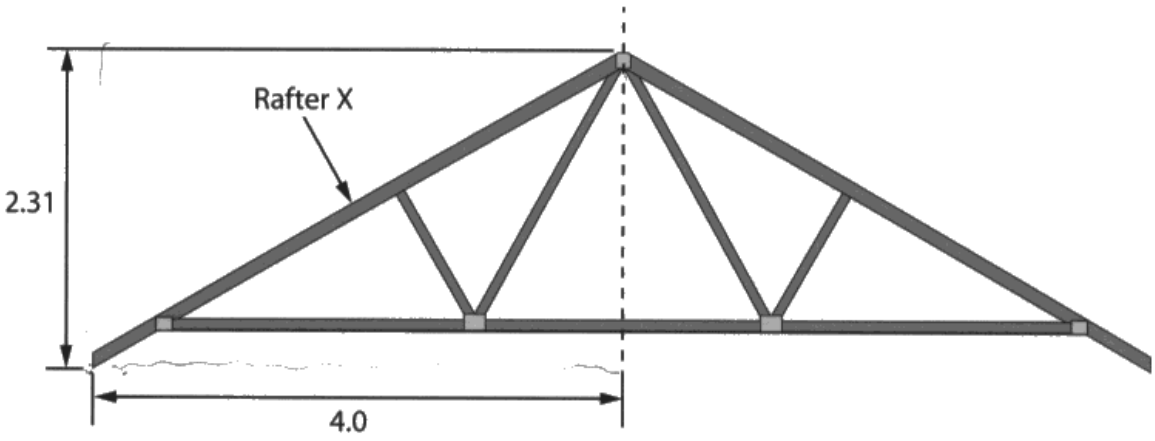
$\sqrt{21.3361} = 4.62$

Answer 4.62 m

The full five marks were awarded for the correct answer. The candidate has used Pythagoras Theorem and has provided clear, well laid out calculations.

Well laid out and neat working out like this make the response easy to follow!

(b) Figure 3 shows some of the dimensions of the roof truss.



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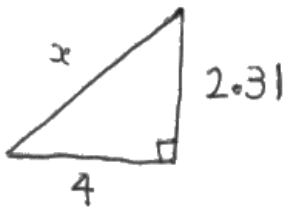


$a^2+b^2=c^2$

$X = \sqrt{4^2+2.31^2}$

$= 4.62m$

Answer 4.62 m

ResultsPlus
Examiner Comments

Here, the full five marks have been awarded for arriving at the correct answer via the use of Pythagoras Theorem.

Question 3 (a)

This was a relatively straightforward question.

The command verb is 'explain', so the candidate needs an identification of a property followed by an explanation of why that property makes folding boxboard a suitable material for the packaging of commercial products.

The most common mistake was to state 'easily folded' which does not receive any credit because 'folding' is given in the name of the material and hence is in the question.

3 The packaging of commercial products often uses boards with graphics applied to the surface.

(a) Explain **one** property of folding box board that makes it a suitable material for the packaging of commercial products.

(2)

can be scored easily, ~~the~~ then when creating the box it is easy to create the lines where needed to fold.

ResultsPlus
Examiner Comments

This response was awarded two marks for 'can be scored easily' and 'when creating the box it is easy to create the lines where needed to fold'.

3 The packaging of commercial products often uses boards with graphics applied to the surface.

(a) Explain **one** property of folding box board that makes it a suitable material for the packaging of commercial products.

(2)

folding box board has a smooth, shiney surface making it easy to print on and aesthetically pleasing for consumers, meaning they're more likely to purchase the product.

ResultsPlus
Examiner Comments

This response was awarded the full two marks for identifing a good smooth printing surface and linking that to potential aesthetics and increased sales potential.

3 The packaging of commercial products often uses boards with graphics applied to the surface.

(a) Explain **one** property of folding box board that makes it a suitable material for the packaging of commercial products.

(2)

Folding box board is extremely easy to work, meaning folds and cut-outs of the material are easily achieved useful for packaging commercial situations.

ResultsPlus
Examiner Comments

This response was not awarded any marks because it is not specific enough! Why is it easy to work?

The candidate needed to include 'easily bent', 'scored' or 'creased'.

ResultsPlus
Examiner Tip

Remember generic responses are unlikely to gain credit.

Read the question carefully and consider your response - what specifically is the question asking?.

Question 3 (b)

Candidates either knew the flexography process or confused flexography with other methods of printing.

This question was a good discriminator allowing candidates who had revised thoroughly and effectively to score marks.

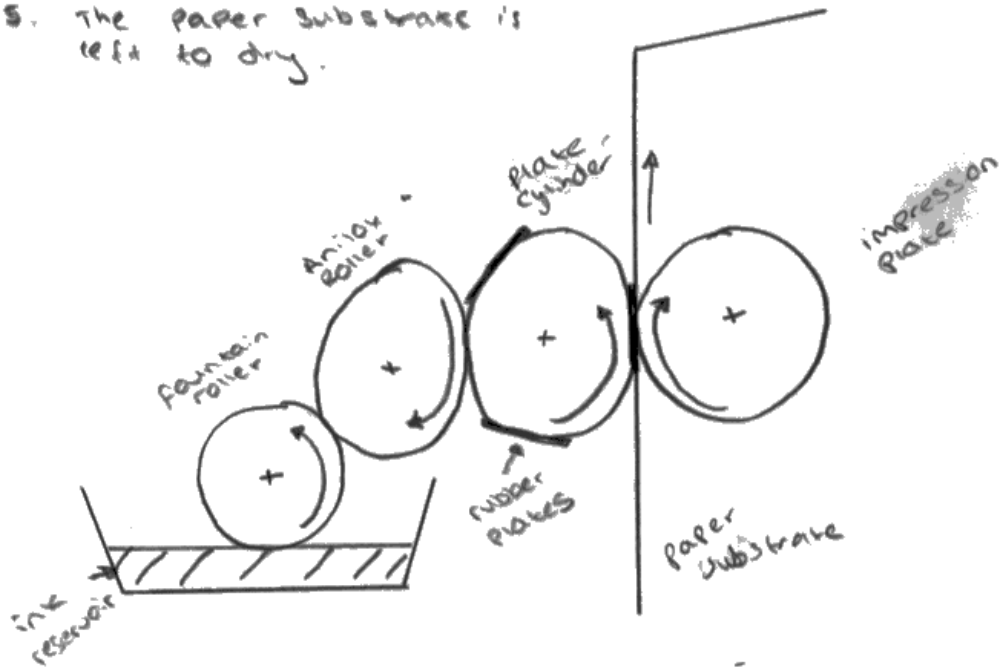
The mark scheme did, however, provide the flexibility to enable awarding of appropriate marks when the process was incomplete or only partially detailed.

Candidates needed to provide a sketch with appropriate labels and annotations to be awarded full marks.

(b) Describe, using annotated sketches, the process of printing using flexography.

(4)

1. The ink goes onto the fountain roller.
2. It then moves onto the Anilox roller where it is evenly spread.
3. The anilox roller presses the ink onto the rubber elevated printing plates, which are attached to a plate cylinder.
4. The ink is pressed into the paper using the impression plate. This is on the opposite side to the circular plate.
5. The paper substrate is left to dry.



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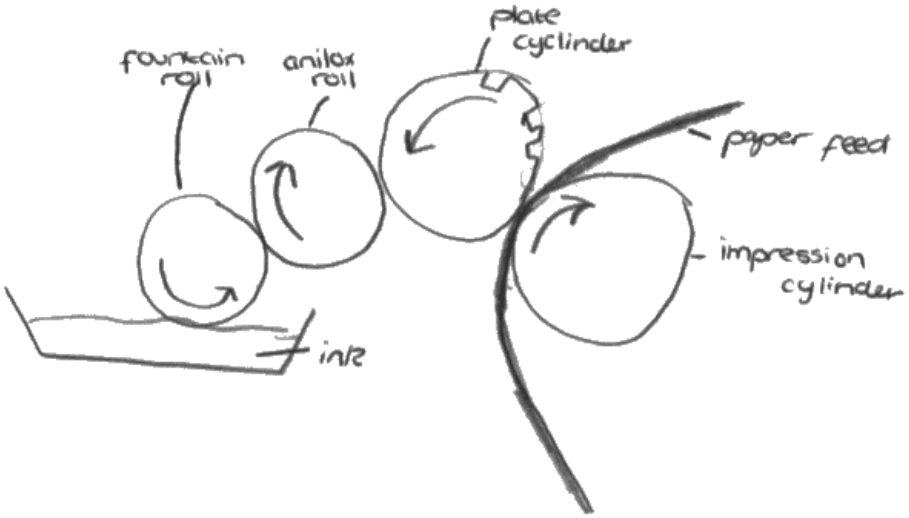
Examiner Comments

This is a very good candidate response awarded the full four marks. The only thing missing is the doctor blade which removes the excess ink, but the candidate had hit five other points in the mark scheme so could be awarded the full four marks because both sketches and appropriate notes/annotations are present

(b) Describe, using annotated sketches, the process of printing using flexography.

(4)



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Examiner Comments

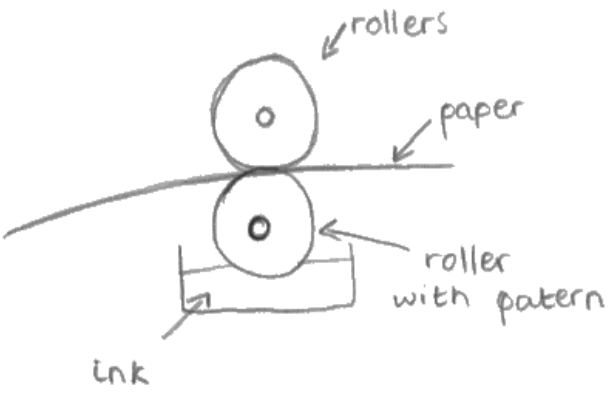
This is a good diagram with only the doctor blade missing, however only three marks were awarded because more annotations are needed to describe the process such as: 'ink is transferred to the plate cylinder using rollers' and 'ink is transferred to the media by pressure applied by the impression cylinder'.

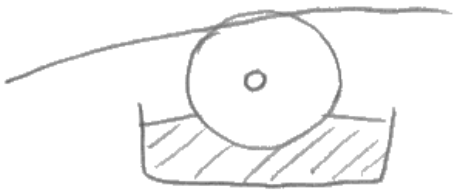
ResultsPlus
Examiner Tip

Remember: if you are asked to 'describe using notes and sketches', you must include a sketch and appropriate annotations - simple labelling or naming the parts on the sketch is not enough.

(b) Describe, using annotated sketches, the process of printing using flexography.

(4)





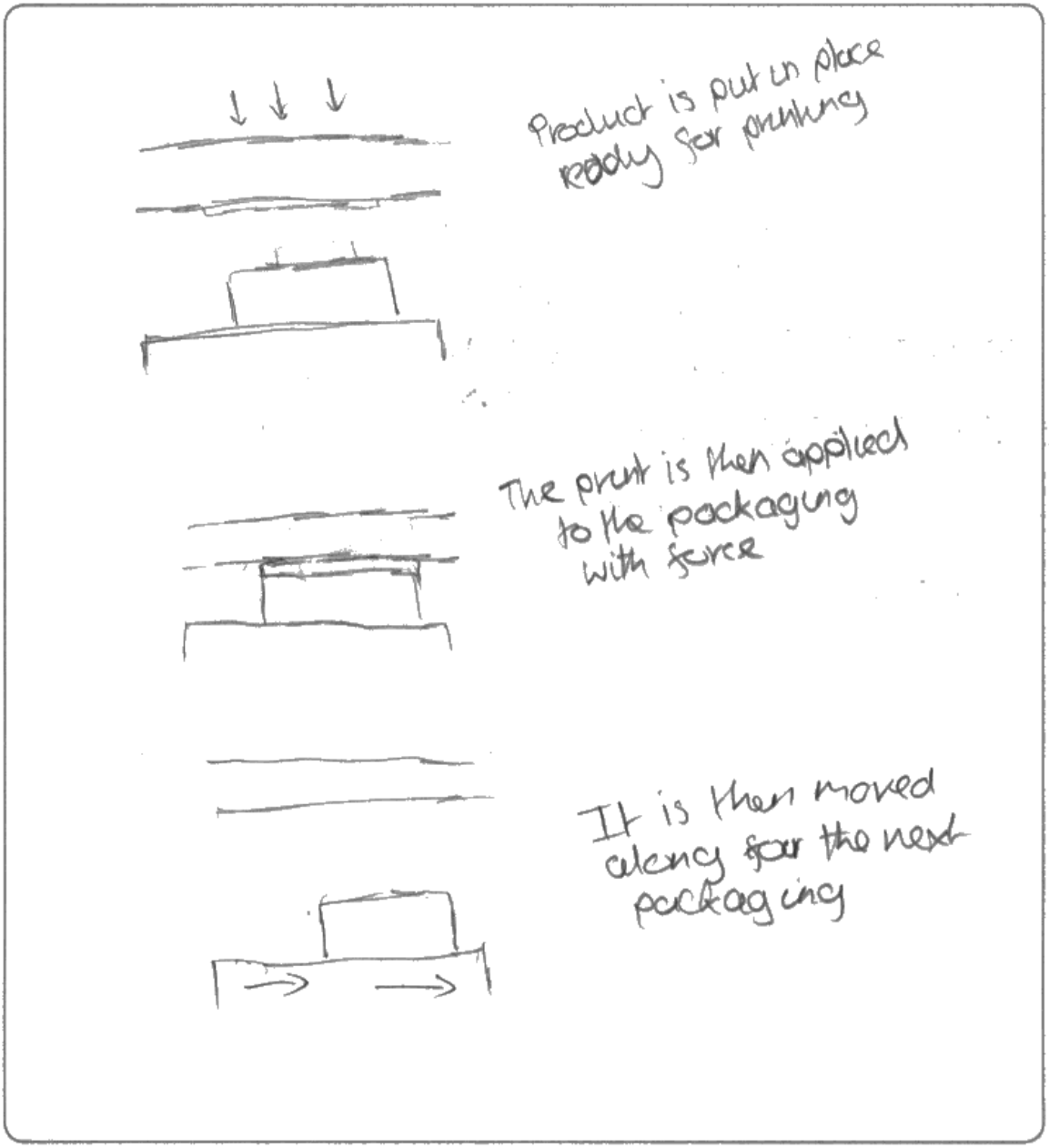
The roller has patterns which are covered in ink continously from a pool below. Which rolls up and prints on the paper between the two rollers with the pattern

ResultsPlus
Examiner Comments

This response was awarded zero marks. The response is very generic with no application to a specific printing process and gained no credit under the mark scheme.

(b) Describe, using annotated sketches, the process of printing using flexography.

(4)



ResultsPlus
Examiner Comments

This response was awarded zero marks. This was a common mistake where the candidate appears to possibly be describing hot foil blocking rather than a printing process.

Question 3 (c)

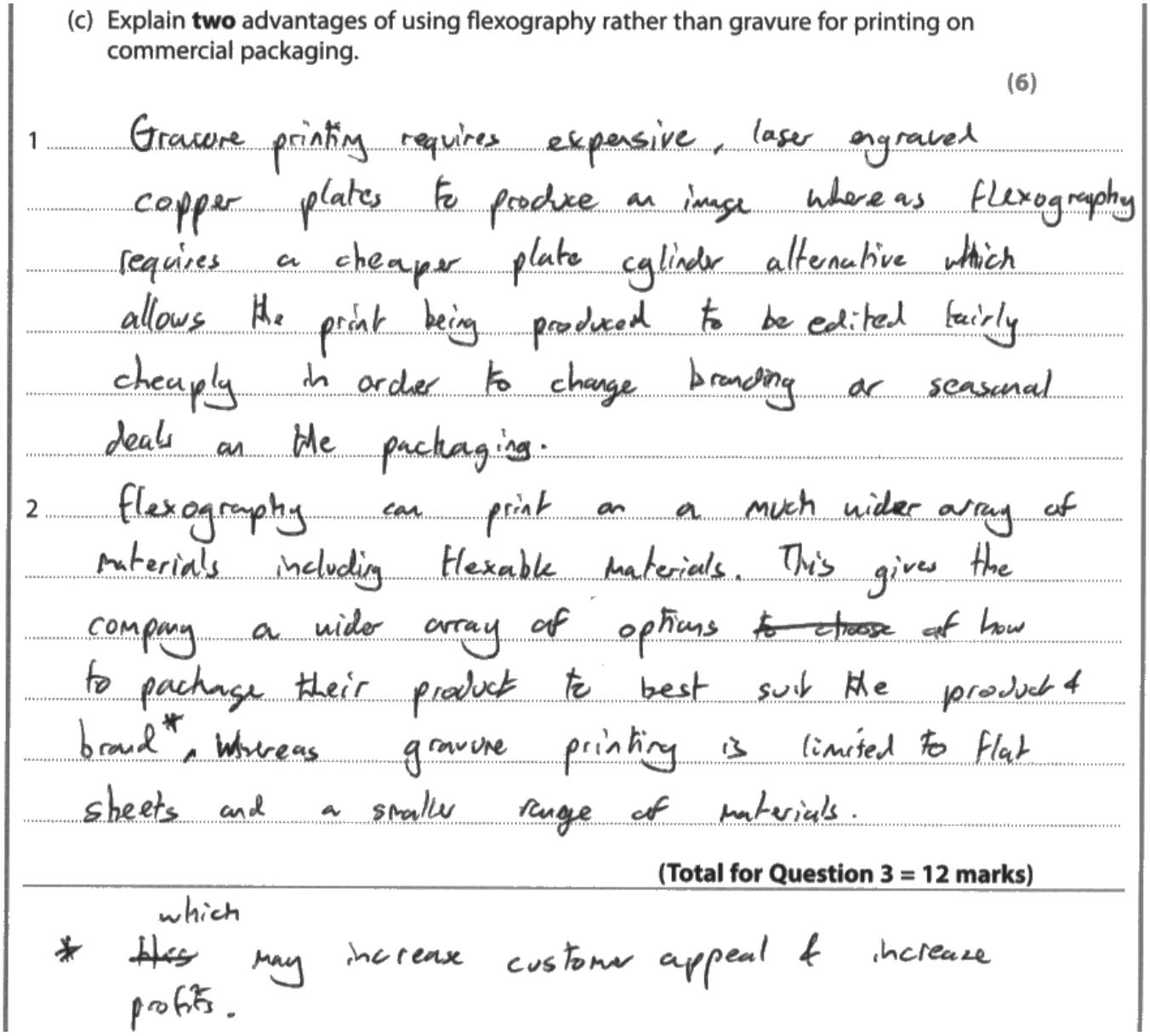
This question required candidates to explain two advantages of using flexography rather than gravure for printing of commercial packaging.

This was a good discriminator because both processes can operate at speed and produce good quality outcomes, so the comparison is very specific and discreet.

The question requires two explanations both worth three marks so, in each case, an identified advantage is required with two associated expansions explaining the advantage.

Many candidates struggled to consider the differences between flexography and gravure.

Common mistakes included providing generic speed and cost responses where these need to be related to start up times and initial plate costs.



(c) Explain **two** advantages of using flexography rather than gravure for printing on commercial packaging.

(6)

1 Gravure printing requires expensive, laser engraved copper plates to produce an image whereas flexography requires a cheaper plate cylinder alternative which allows the print being produced to be edited fairly cheaply in order to change branding or seasonal deals on the packaging.

2 flexography can print on a much wider array of materials including flexable materials. This gives the company a wider array of options ~~to choose~~ of how to package their product to best suit the product & brand*, whereas gravure printing is limited to flat sheets and a smaller range of materials.

(Total for Question 3 = 12 marks)

* ~~this~~ which may increase customer appeal & increase profits.

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Examiner Comments

This response was awarded the full six marks for recognising the impact of the printing plates on cost and manufacturing flexibility and the fact that flexography can be used on a range of media/surfaces.

(c) Explain **two** advantages of using flexography rather than gravure for printing on commercial packaging.

(6)

1 Flexography uses cheaper printing surfaces so the manufacturing set up cost is lower leading to higher profits

2 Flexography takes less time to set up as the rollers do not need to be so meticulously crafted. This means that the printed product can be printed, and therefore sold, sooner

ResultsPlus
Examiner Comments

This response was awarded three marks. Overall the response relates to less expensive printing plates leading to lower initial start up costs/increased profits and a shorter lead time.

(c) Explain **two** advantages of using flexography rather than gravure for printing on commercial packaging.

(6)

1 flexography is a continuous production line whereas gravure printing is a batch process, so commercial packaging can be printed much faster to meet the consumer demand.

2 flexography is able to use pre-mixed inks which are colour accurate to the design, whereas gravure uses a mix of inks whilst printing so you would get mixed results.

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Examiner Comments

This response was awarded zero marks as there is no credit to be gained under the mark scheme.

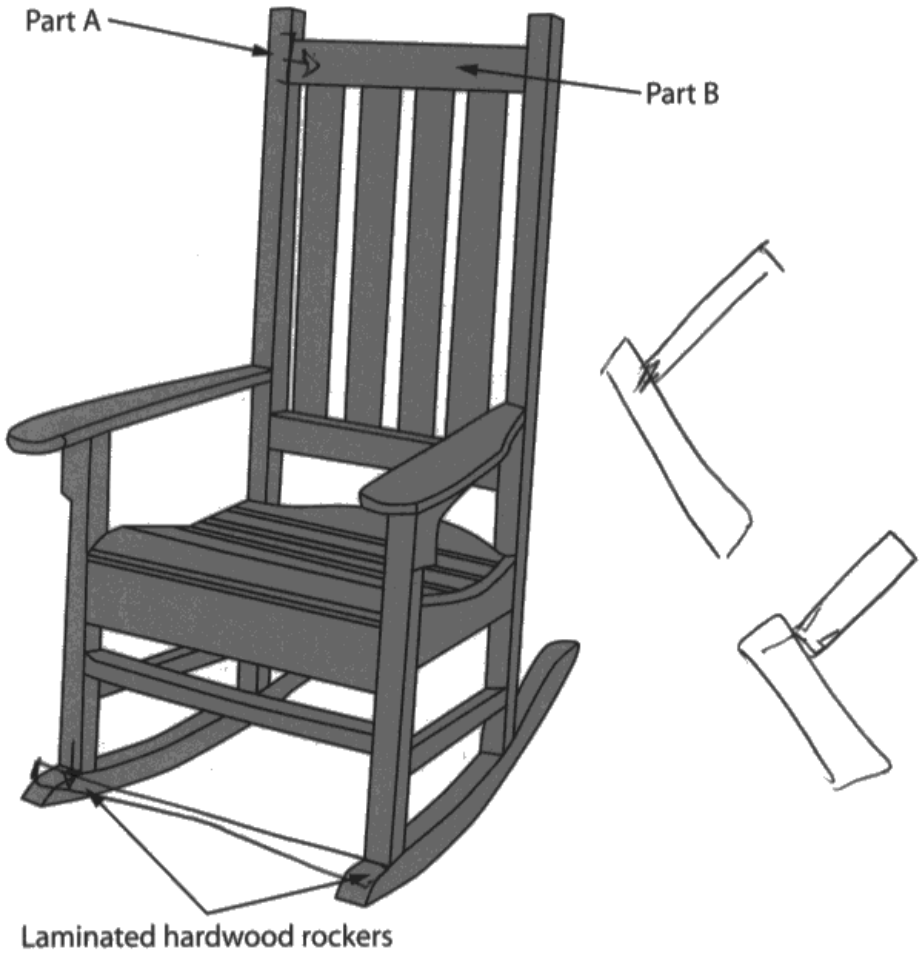
In part one, the candidate appears to be mistaking the gravure process for a slower less commercial process whereas both flexography and gravure are high speed commercial processes.

In part two, the candidate is referring to differences in inks when both proceeses can use the same inks.

Question 4 (a)

Here, candidates were required to name three joints that could be used to join two identified parts of the chair. The joints selected would therefore need to be discreet and maintain the appearance of the chair i.e. not be seen on the outer front surface, as no joints are visible on the image.

4 Figure 4 shows a bespoke rocking chair with laminated hardwood rockers.



dovetail x
mortise tenon
Dowl

Figure 4

(a) Name **three** joints that could be used to join part A to part B.

(3)

1 mortise and tenon joint (with pva glue)

2 Dowl joint (with pva glue)

3 Screws /nails

ResultsPlus
Examiner Comments

Here, the candidate was awarded three marks for three correct and appropriate joints as indicated in the mark scheme.

4 Figure 4 shows a bespoke rocking chair with laminated hardwood rockers.

Figure 4

(a) Name **three** joints that could be used to join part A to part B.

(3)

1 Comb joint

2 Dowell joint

3 Butt joint

ResultsPlus
Examiner Comments

Here, the candidate was awarded one mark for correctly naming a dowel joint as a joint appropriate for the given scenario.

4 Figure 4 shows a bespoke rocking chair with laminated hardwood rockers.

Figure 4

(a) Name **three** joints that could be used to join part A to part B.

(3)

1 Butt Joint

2 Dovetail Joint

3 Finger Joint

ResultsPlus
Examiner Comments

Here, the candidate named three wood joints but none of them are appropriate for joining the two parts of the chair.

ResultsPlus
Examiner Tip

Remember: if a question requires you to recall some facts, you may still need to make a further selection to make sure your answer is appropriate for the scenario.

Question 4 (b)

Here, the candidates were required to outline the process used for laminating the hardwood rockers.

Guidance was provided in the stem of the question to indicate that the lamination process produces the curved shape.

The candidates had to cover six of the stages, in the correct order, out of nine in the mark scheme, to be awarded the full six marks.

Many candidates did very well on this question however, a common mistake was to describe a process of adding a laminate finish or plastic encapsulation to the rockers rather than laminating to form the curved shape.

The hardwood rockers have been laminated to produce their curved shape.

(b) Outline the process used for laminating the hardwood rockers.

(6)

Hard wood veneers are cut to size. A mould is created in the shape of the rockers (male part). The veneers are layered together with a glue like PVA inbetween the layers and then they are put over the mould. They are then compressed to the shape of the mould, either by using a vacuum bag or by using a female half of the mould and clamps to secure it. Once compressed any excess glue is removed and it is left to set/cure. It can then removed and finished ~~to the standard required~~ and shaped as required

ResultsPlus
Examiner Comments

This response was awarded the full six marks for including a minimum of six stages in the correct order and only missing out the pre-soaking of the timbers and the use of a release agent.

ResultsPlus
Examiner Tip

Remember: if you need to outline a process and six marks are available, you will need to cover six stages.

The hardwood rockers have been laminated to produce their curved shape.

(b) Outline the process used for laminating the hardwood rockers.

(6)

a First the wood needs to be prepared ~~first~~ for example making sure it is cleaned and ready to be covered. Cover the material with a transparent material then use a UV light over the wood. The UV light makes the transparent material secure a bond with the wood. Allow the wood to dry and set then attach the piece to the rest of the chair. Laminating creates an extra layer of protection.

ResultsPlus
Examiner Comments

This response was awarded zero marks as it describes a process of covering the rockers with a transparent material rather than the process of forming the curve.

ResultsPlus
Examiner Tip

Read the stem of the question as there may be some clues. Here, the stem indicates that lamination is being used to form a curved shape.

The hardwood rockers have been laminated to produce their curved shape.

(b) Outline the process used for laminating the hardwood rockers.

(6)

The hardwood rockers are first measured and cut into shape. After being filed and sanded down the hardwood rockers are covered in a certain plastic and then heated up in a certain way, where the plastic melts on to the hardwood rockers whilst slowly bending.

ResultsPlus
Examiner Comments

Here, zero marks were awarded. Whilst the candidate has realised that the questiion is about forming the bend or curve to the rocker, the candidate has not been able to describe the correct process.

Question 4 (c)

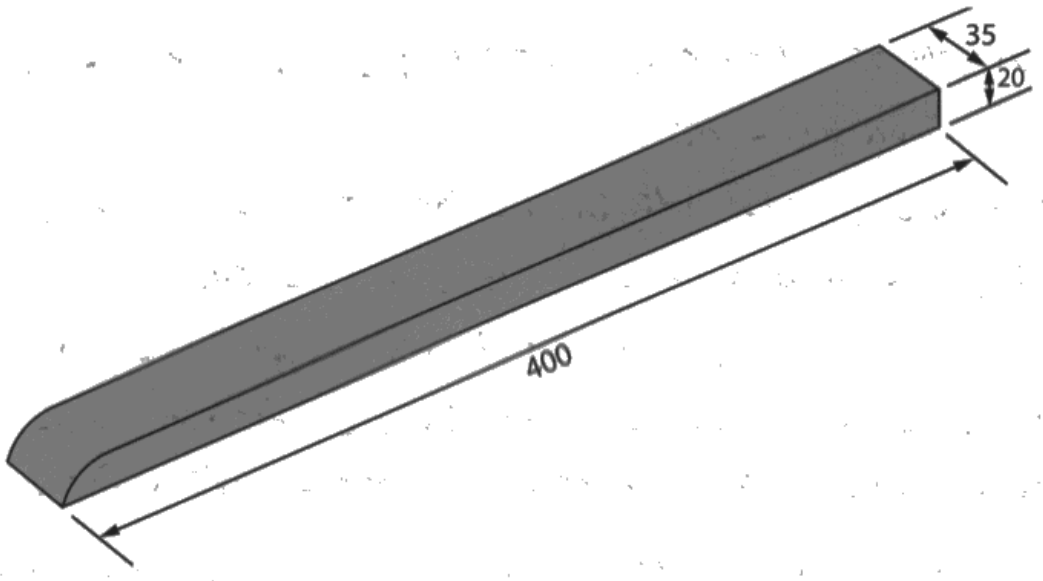
This was a mathematics question requiring the calculation of a compound surface area and then the application of coverage rates to arrive at a quantity of varnish.

Many candidates managed to access full marks and because the surface area is made up of a series of individual surface areas, the majority of candidates were able to access marks if not arriving at the final overall correct answer.

The most common mistake was the incorrect conversion of units resulting in an answer of 9801 rather than 9.8 and, in this instance with a single mistake, seven marks were awarded.

Figure 5 shows one of the pieces of hardwood used to make the base of the seat.

The cutting list shows the total number of pieces required for a batch of chairs.



Each piece has a 20mm radius on one end
All dimensions are shown in millimeters

Figure 5

Cutting List				
Description	**Length**	**Width**	**Thickness**	**Quantity**
Seat base	400	35	20	2400

(c) Calculate the volume of varnish required, in litres, to coat the hardwood pieces.

1 litre of varnish covers 11m^2.

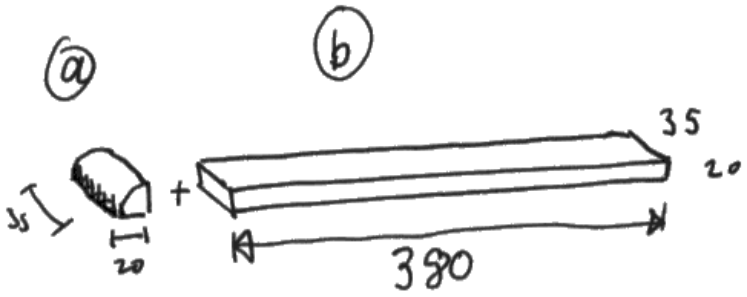
- Area of a circle = πr^2
- Circumference of a circle = $2\pi r$
- Use π = 3.142

'3.141592653589

Show all of your workings.

surface area of 1 piece

(8)



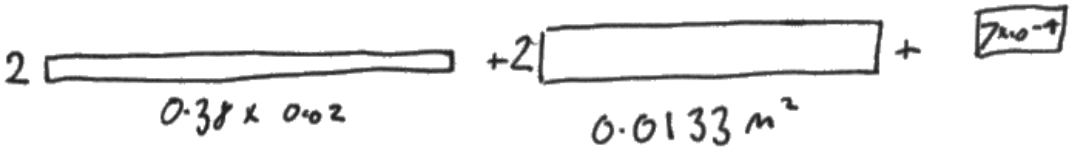
Area of Part (a)

$\frac{(\pi \times 0.02 m^2)}{4}$

$3.142 \times 10^{-4} m^2$ $7 \times 10^{-4} m^2$ $0.035\left(\frac{2 \times \pi \times 0.02}{4}\right) = 1.40 \times 10^{-3} m^2$

TOTAL AREA OF (a) = $2.428 \times 10^{-3} m^2$

Area of (b)



0.38×0.02

$7.6 \times 10^{-3} m^2$

$0.0133 m^2$

= TOTAL area (b) = $0.0425 m^2$

TOTAL area of Area = (a) + (b)

$(0.0425 m^2) + (2.428 \times 10^{-3})$

~~= 0.044~~

$0.045 m^2$ × Quantity

= Total area of cutting list

= $107.8272 m^2$

= Total number of buckets of paint

= 9.802

Answer 9.802 L

ResultsPlus
Examiner Comments

This candidate was awarded the full eight marks for an answer that correctly rounds to 9.8 litres.

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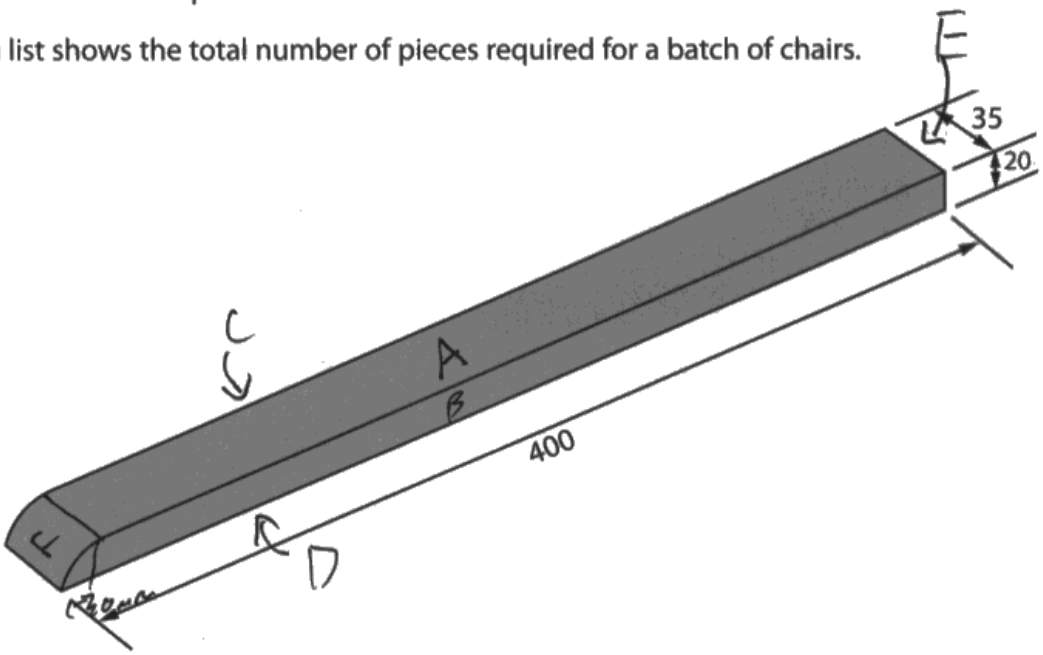
The cutting list shows the total number of pieces required for a batch of chairs.



Each piece has a 20mm radius on one end
All dimensions are shown in millimeters

Figure 5

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- Circumference of a circle = $2\pi r$
- Use $\pi = 3.142$

Show all of your workings.

(8)

Split into 6 Sections A, B, C, D, E, F

A: $35 \times (400-20) + \frac{1}{4}(2)(3.142)$

$= 13300\ mm^2$

B: $20 \times 380 + \frac{1}{4}\pi(20)^2$

$7600 + 314.2$

$7914.2\ mm^2$

C: $C = B$

$C = 7914.2\ mm^2$

D 面: $400 \times 35 = 14{,}000\ mm^2$

E: $35 \times 20 = 700\ mm^2$

F: $\frac{1}{4}(2\pi rh)$

$\frac{1}{4}(2)(3.142)(20)(35)$

$\frac{1}{4}(4398.8) = 1099.7$

$A+B+C+D+E+F$

$13300 + 2(7914.2) + 14{,}000 + 700 + 1099.7$

$= 44928.1\ mm^2 = 0.0449\ m^2$

$0.0449 \times \frac{1}{11}$

$= 4.08 \times 10^{-3} L$

$4.08 \times 10^{-3} \times 2400$

$= 9.8025 L$

$\approx 9.80 L$

~~4.08 mL~~

Answer .....

ResultsPlus
Examiner Comments

This candidate was awarded the full eight marks for a correct answer of 9.8 litres. The work is clearly laid out and labelling the faces A to F has helped the candidate to lay out their calculations with clarity.

ResultsPlus
Examiner Tip

The candidate here has labelled the six faces of the shape A to F. Doing this helps to make sure that you don't miss part of the calculation.

Figure 5 shows one of the pieces of hardwood used to make the base of the seat.

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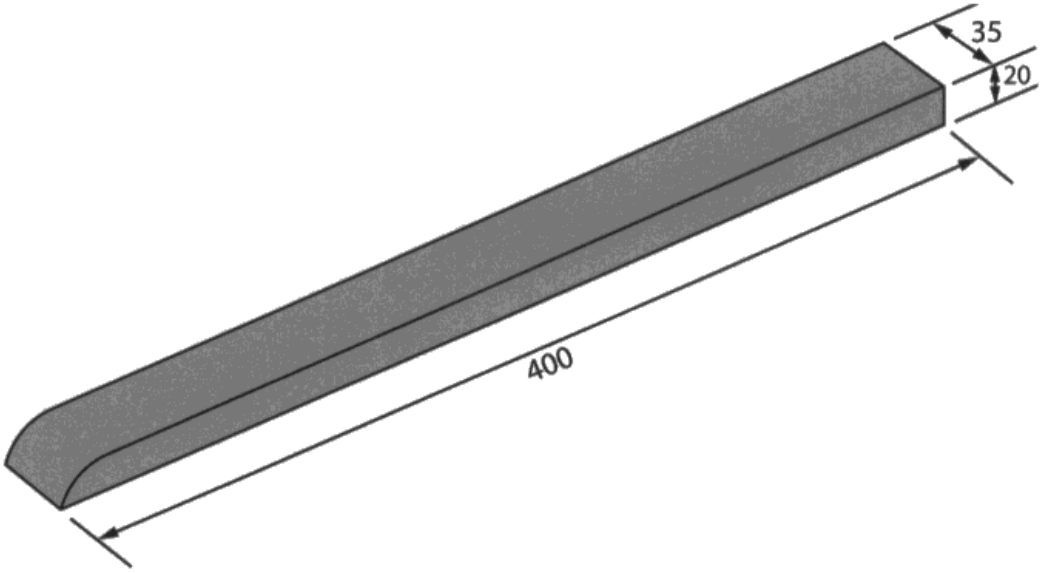

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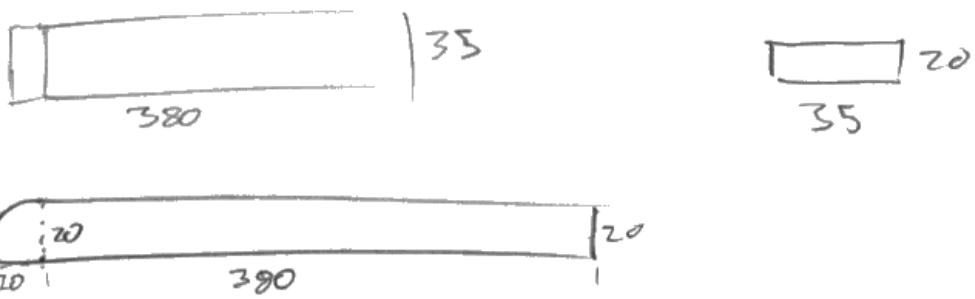
- Use $\pi = 3.142$

Show all of your workings.

(8)



Side surface area $= 0.38 \times 0.020 + \frac{1}{4} \times \pi \times 0.02^2$

$= 7.91 \times 10^{-3}\ m^2$

Top SA $= 0.38 \times 0.035 + \frac{1}{4} \times 2 \times 3.142 \times 0.02 \times 0.035$

$= 0.0144\ m^2$

Back SA $= 0.035 \times 0.02 = 7 \times 10^{-4}\ m^2$

Bottom SA $= 0.4 \times 0.035 = 0.014\ m^2$

Total SA for 1 piece

$= 2 \times 7.91 \times 10^{-3} + 0.0144 + 7 \times 10^{-4} + 0.014$

$= 0.04492\ m^2$

Total SA for 2400 pieces

$= 0.04492 \times 2400 = 107.808\ m^2$

Varnish

$\frac{107.808}{11} = 9.80$ litres.

Answer 9.8 litres

ResultsPlus
Examiner Comments

In this response, the candidate was awarded the full eight marks and has clearly laid out their calculations identifying the different faces of the timber piece.

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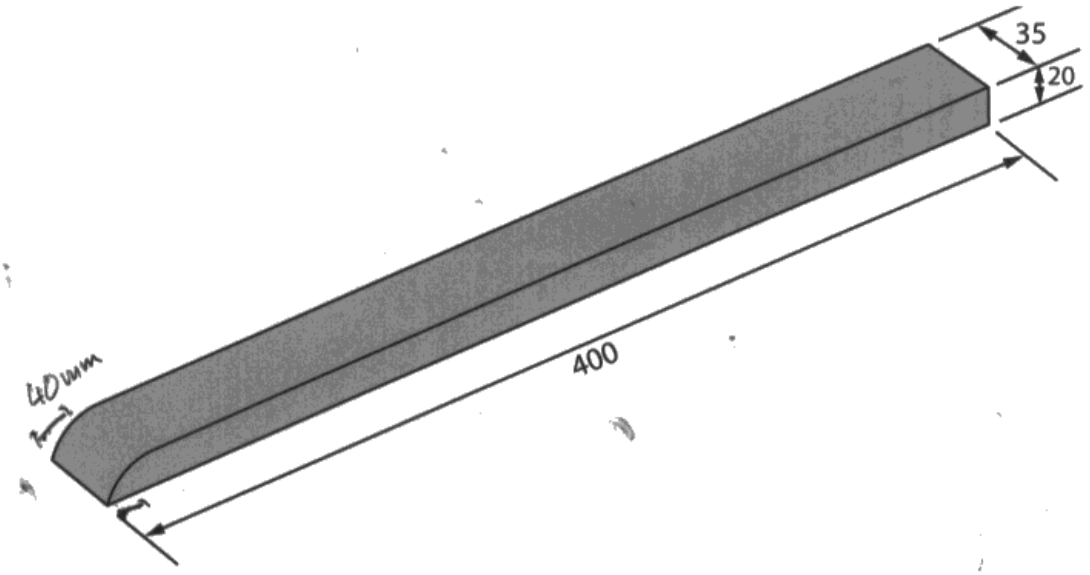
The cutting list shows the total number of pieces required for a batch of chairs.



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- Circumference of a circle = $2\pi r$
- Use $\pi = 3.142$

Show all of your workings.

(8)

~~400 - 20 = 380mm~~

400mm x 35mm = 14000mm

= 14m²

~~14 x 2400 = 33600m²~~

~~33600 ÷ 11 = 3054.54 tubes~~

35mm x 20mm = 700mm

= 0.7m²

~~1680 ÷ 11 = 152.7 tubes~~

Circumference = 2 x 3.142 x 20

= 125.68mm

Area = 3.142 x 20²

= 1256.8mm²

= 1.26m²

14m² + 14m² + 0.7m² + 0.7m² + 8m² + 8m²

Total area - rounded end

= 45.4m²

Answer .....

ResultsPlus
Examiner Comments

This response was awarded two marks. The first mark for calculating the area of the base at 14,000mm^2 and the second mark using error carried forward for the correct addition of the total area at 45.4m^2

ResultsPlus
Examiner Tip

Remember: showing your working will help you pick up marks even when the final answer is incorrect.

Question 4 (d)

The question relates to how a copyright will protect the company's images in the context of photographs used on their website. The focus on copyright posed a challenge for a number of candidates who were unable to differentiate between copyrights and patents resulting in them considering the physical chair rather than the images used on the website.

Candidates who were able to differentiate between copyrights and patents generally provided good responses and were subsequently awarded two marks.

The company that manufactures the chair has produced images of it for use on their website.

Copyright protection will prevent others from illegally copying the images.

(d) Give **two** other ways a copyright will protect the company's images.

(2)

1 It stops others from selling the companies images for money.

2 It stops others from claiming they made the images.

ResultsPlus
Examiner Comments

This response was awarded the full two marks for: preventing the selling of images by others and preventing others from claiming ownership of the images.

The company that manufactures the chair has produced images of it for use on their website.

Copyright protection will prevent others from illegally copying the images.

(d) Give **two** other ways a copyright will protect the company's images.

(2)

1 No one else can use the design of the chair and resell it

2 Can use the image as their brand image

ResultsPlus
Examiner Comments

This response was awarded zero marks.

The first part of the response relates to the design of the product rather than the copyright of the image or photograph.

The second part of the response could imply ownership of the copyright, but there is insufficient evidence to confirm this.

ResultsPlus
Examiner Tip

Study the question carefully. Remember there could be subtle differences between different part of the specification. This question required knowledge of copyrights rather than patents.

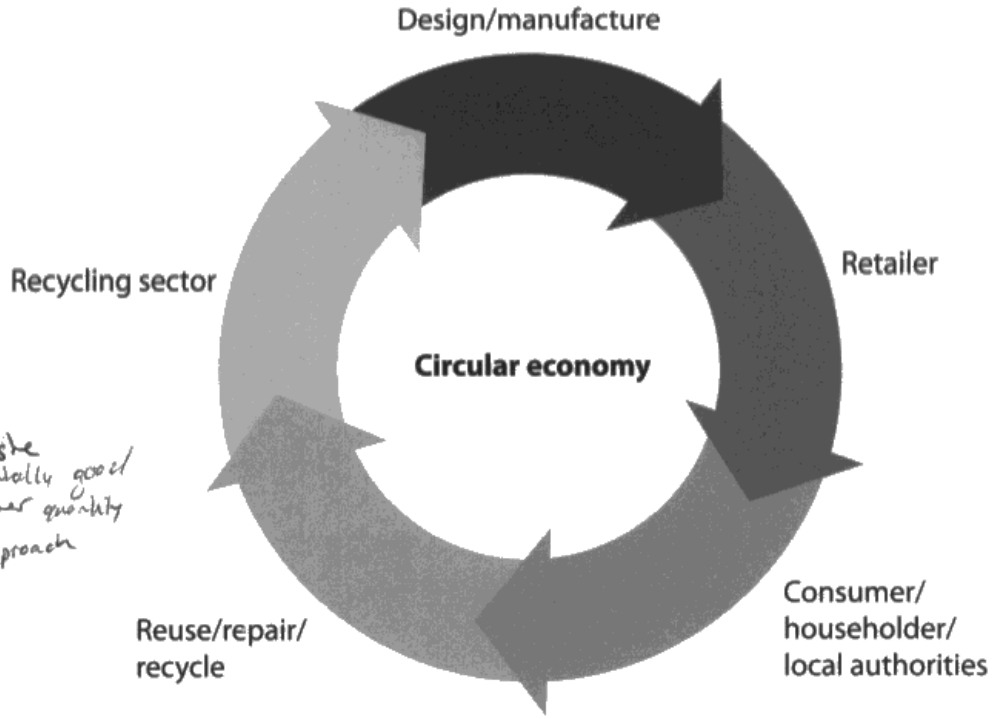
Question 4 (e)

This question required candidates to evaluate the use of the circular economy with reference to suppliers and consumers. The graphic provided in the question provided a clear prompt for many responses.

Weaker candidates focused on a description of the graphic and more able candidates were able to import knowledge of the circular economy focusing on issues such as consumer engagement and the repair rather than replace mind-set.

Some of the better answers considered sustainability and the circular economy at the design stage. Overall, the question performed well with a good distribution of marks appropriate to the grade and positioning within the paper.

(e) Figure 6 shows a graphical representation of the circular economy.



- less waste
- environmentally good
- quality over quantity
- holistic approach

Figure 6

The company is keen to embrace the concept of the circular economy.

Evaluate the use of the circular economy with reference to suppliers and consumers.

(9)

Circular economy looks at a products life cycle holistically rather than atomically, this leads to the break down of Poor and dismissal of 'throw away' culture.

One of the huge benefits of circular economy is the own reduction of environmental impact due to less wastage. products are designed and manufactured to be able to be repaired and replace, parts are usually standardised by designers and manufacturers as well as being easily accessed on the products via panels and modules. Materials chosen by the designers and manufacturers can usually be in some way reused or recycled; in being more environmentally friendly the company reduces its carbon footprint. The benefits for the consumer are the high quality products sourced from selected and closed groups of suppliers provides a high quality product with a good life-span that at the end of its cycle can be easily repaired, recycled and overall reduce the chance of working parts ending up in a landfill. Parts that are recycled can be repaired in the recycling sector and reused again in the design and manufacture sector as a cheaper and greener way to source materials, an example of this are cans, it is 20% more efficient to recycle and reuse cans than it is to work with raw material. In conclusion, a circular economy approach by a company has many benefits, on the enviroment, the cost of materials, the consumers use and the companies overall reputation.

ResultsPlus
Examiner Comments

This is a good response, awarded marks in level 3, in which the candidate demonstrates a developed understanding of the circular economy concept, linking back to the design stage and considerations within the products life cycle.

ResultsPlus
Examiner Tip

Remember when asked to evaluate, you need to produce a well written response in continous prose with conclusive comments.

Mere bullet points or simple identification of advantages and disadvantages will gain limited credit.

(e) Figure 6 shows a graphical representation of the circular economy.

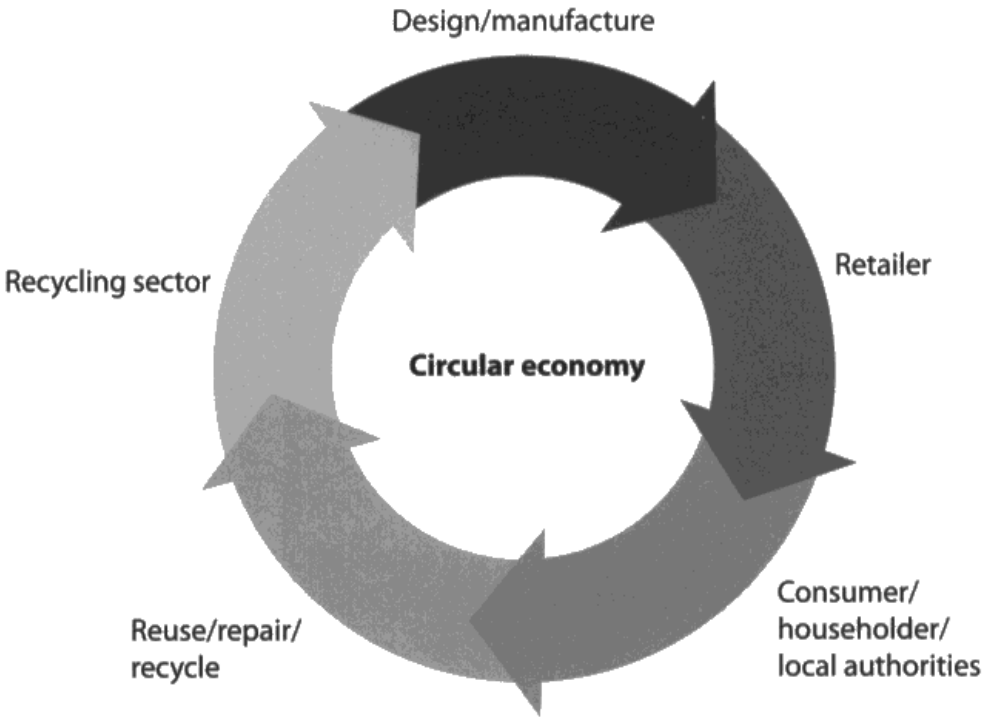


Figure 6

The company is keen to embrace the concept of the circular economy.

Evaluate the use of the circular economy with reference to suppliers and consumers.

(9)

The circular economy is ~~how~~ how products are handled throughout its life span and what happens to them after. For suppliers this means that in

the design and manufacturing process this has to be kept in mind, so often designers will plan to use recyclable materials or materials that have already been recycled. This however often increases ~~cost~~ costs for suppliers as there are usually cheaper material alternatives and those that use less power to manufacture, meaning that suppliers often end up with higher costs.

For consumers this process quite often improves their quality of life as the environment is affected ~~less~~ fewer due to ~~less~~ products going to landfill sites. However the process of recycling, reusing and repairing can be time consuming and confusing, so many consumers tend to just throw away products as this is easier and less time consuming than recycling and repairing, then go onto buy a new product.

Overall the circular economy is beneficial to everyone in the long run due to the environmental ~~bee~~ benefits gained.

ResultsPlus
Examiner Comments

This response was awarded marks in level 2. The candidate has produced work that demonstrates good understanding of the circular economy concept providing a reasonable balance between the impact on consumers and suppliers.

(e) Figure 6 shows a graphical representation of the circular economy.

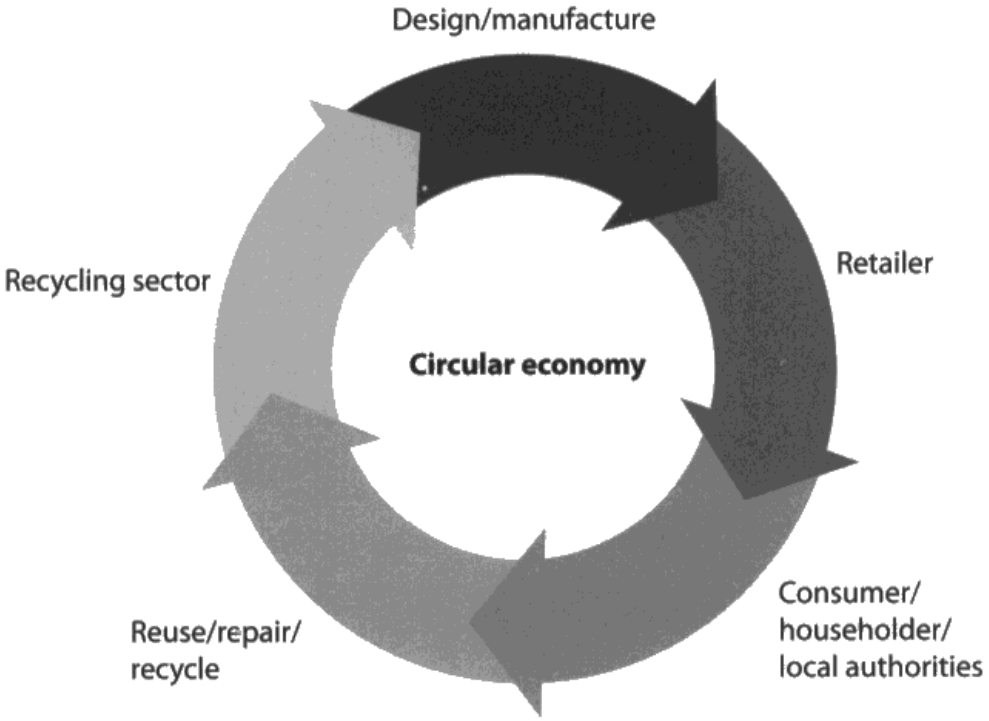


Figure 6

The company is keen to embrace the concept of the circular economy.

Evaluate the use of the circular economy with reference to suppliers and consumers.

(9)

A circular economy benefits all participants. This encourages growth of wealth amongst all members of this circular economy. Money that transfers from one element to the other will benefit all, including the one who inputted the money.

ResultsPlus
Examiner Comments

This response was awarded zero marks as the candidate has not been able to demonstrate knowledge of the circular economy, but has merely picked up on the word 'economy' and has concentrated on the flow of money.

Question 5 (a)

This question required candidates to name two official sources of anthropometric data.

The most common correct responses were BSI and ISO.

Most incorrect responses related to unofficial sources of anthropometric measurements.

In reality only the official sources provide appropriate data due to the massive scale of the research required to cover a large population and all aspects of human body measurement covering all aspects of the human body detailing the 5th, 50th and 95th percentile.

5 Figure 7 shows a games controller.

Anthropometric data has been used in designing the games controller.

Figure 7

(a) Name **two** official sources of comprehensive anthropometric data.

(2)

1 BSI - British standards

2 International standards

ResultsPlus
Examiner Comments

This response was awarded two marks for correctly identifying BSI and ISO.

(a) Name **two** official sources of comprehensive anthropometric data.

(2)

1 handspan

2 length of fingers

ResultsPlus
Examiner Comments

This response was awarded zero marks because it relates to elements of anthropometric measurements rather than official sources of anthropometric data.

(a) Name **two** official sources of comprehensive anthropometric data.

(2)

1 Direct observations / interviews

2 Internet

ResultsPlus
Examiner Comments

This response was awarded zero marks because both parts of the response are too generic and do not relate to official sources of data.

Question 5 (b)

This question required candidates to explain two performance characteristics of ABS that make it a suitable material for the main body of the games controller.

The manufacturer has decided to use acrylonitrile butadiene styrene (ABS) for the main body of the games controller.

(b) Explain **two** performance characteristics of ABS that make it a suitable material for the main body of the games controller.

(6)

1 ABS is a tough material, this is beneficial for controller as it would be handled nearly everyday and would need to withstand sudden impacts ~~when~~ if it is dropped onto the floor and not break into pieces. Using ABS prolongs the controllers lifespan.

2 ABS is also a hard material, this means it can withstand ~~scratch~~ scratching, this would be an aesthetically pleasing characteristic for the consumer as other plastic's prone to scratching would look aesthetically unpleasing.

ResultsPlus
Examiner Comments

This response was awarded six marks for correct double linked explanations of 'tough' and 'hard'.

ResultsPlus
Examiner Tip

Remember: when an 'explain' question is shown as three marks per explanation i.e. six marks for two explanations, you need an identification e.g. 'tough' in this instance plus two reasons why the material is tough or two benefits of it being tough.

The manufacturer has decided to use acrylonitrile butadiene styrene (ABS) for the main body of the games controller.

(b) Explain **two** performance characteristics of ABS that make it a suitable material for the main body of the games controller.

(6)

1 ABS is chemical resistant, so won't be damaged by sweat, ~~etc~~ from the user hands. This means that it can easily be cleaned, and will therefore maintain its look and shape

2 ABS has a high impact strength, which means that if it is dropped, it won't dent or brake. This durability allows it to last a lot longer without being broken, even after constant use.

ResultsPlus
Examiner Comments

This response was awarded the full six marks for 'chemical resistance' and 'impact strength', both with two appropriate links that gain credit under the mark scheme.

The manufacturer has decided to use acrylonitrile butadiene styrene (ABS) for the main body of the games controller.

(b) Explain **two** performance characteristics of ABS that make it a suitable material for the main body of the games controller.

(6)

1 It's a material which is lightweight and that can help the person using the controller as they will not want to hold a controller that is heavy for a long time as it will become uncomfortable.

2 ABS can be ~~easily~~ easily cut and drilled, and that will allow the machines to produce them at a faster rate. As well as that, they can be hollowed shape which allows all cable and wires to be secure inside of the controller.

ResultsPlus
Examiner Comments

This response was awarded zero marks. ABS at 1.03 tonnes per cubic metre is not a lightweight material or a lightweight polymer, although the controller can in itself be lightweight because of the thin wall construction of the product. The second part of the response relates to cutting and drilling which are not processes relevant to the production of the games controller.

The manufacturer has decided to use acrylonitrile butadiene styrene (ABS) for the main body of the games controller.

(b) Explain **two** performance characteristics of ABS that make it a suitable material for the main body of the games controller.

(6)

1 ABS is a strong material which is used on ~~one~~ most hand held product e.g. remotes game controllers, umbrella handles etc. Making This making it easier for users to grip onto the product and hold.

2 ABS is cheap to purchase ~~00~~ and can easily be bent into its shape as shown in image 7 of the game controller.

ResultsPlus
Examiner Comments

This response was awarded zero marks: neither response is correct, so they are not covered by the mark scheme.

Question 5 (c)

This question was about the conflicting needs of form and function and asked candidates to discuss how the designer had balanced form and function in the design of the games controller.

Candidates tended to respond well to this question with many discussing a wide range of factors demonstrating either a competent or thorough understanding.

Candidates achieved higher credit when they were able to show understanding of the conflicting nature of form and function and also where they demonstrated a clear understanding of ergonomics and the use of anthropometric data.

(c) Designers have to prioritise form or function when designing products.

Discuss how the designer has balanced form and function in the design of the games controller.

(6)

It has balanced form and function by taking a sleek simplistic, yet attractive design that is aesthetically pleasing and made it suited to its function using ergonomics. The long controller handles cater for the consumers hands making it comfortable to use, preventing RSI, whilst adding a unique recognisable feature to the designers product that makes it stand out amongst other existing products as it's very eye catching. It also has all the needed feature of a controller accessible for the consumer so that the product actually works and can be used successfully. This creates lots of symmetry which is very attractive and stylish

ResultsPlus
Examiner Comments

This is a good response that demonstrated developed understanding of the conflicting needs of form and function. The response was awarded marks in level 3 of the mark scheme.

(c) Designers have to prioritise form or function when designing products.

Discuss how the designer has balanced form and function in the design of the games controller.

(6)

The designer has balanced form with function with this controller as they have designed a product that functions as intended with an ergonomic shape making it comfortable for the user hold and operate. They have done this by providing two ergonomically designed handles with all the buttons and moving parts in the same area, making it easy for the user to operate the controller with their two thumbs as they don't have to stretch anywhere out of reach. The form of the controller is also still of a high standard as it has a sleek modern appearance making it attractive to the younger generation, the designers target market.

ResultsPlus
Examiner Comments

This was a clear well written response where the candidate demonstrated sound and effective knowledge and understanding of ergonomics. The response relating to form is slightly weaker, but overall there was sufficient evidence to gain a level 3.

(c) Designers have to prioritise form or function when designing products.

Discuss how the designer has balanced form and function in the design of the games controller.

(6)

The designer wants the controller this to be practical and not to have weak points in the design. The design still wants the controller to look aesthetically pleasing for the user, so it looks apealing in store and standouts. But it still has to work well and be tough, durable and waterproof.

ResultsPlus
Examiner Comments

This is a very generic response that does not consider the specific features of the controller. The response was awarded a mark in level 1 as there is limited understanding demonstrated of the conflicting needs of form and function.

Question 5 (d)

This was a simple knowledge recall question where candidates had to name two types of automated materials handling system.

The two most common correct responses were AGV and ASRS.

(d) Automated materials handling systems are to be used in the factory producing the games controller.

Name **two** types of automated materials handling systems.

(2)

1 ASRS - Automated storage and retrieval system

2 AGV - Automatic guided vehicles.

ResultsPlus
Examiner Comments

This response was awarded two marks for two correct responses 'ASRS' and 'AGV'.

(d) Automated materials handling systems are to be used in the factory producing the games controller.

Name **two** types of automated materials handling systems.

(2)

1 Injection moulding

2 Vaccumee forming.

ResultsPlus
Examiner Comments

This response was awarded zero marks. The candidate has named two plastic forming processes rather than materials handling systems.

Question 5 (e)

This was a three mark calculation question requiring candidates to calculate the total cost of boards required to complete a packaging order.

Candidates performed very well on this question with a high proportion achieving full marks.

Candidates who clearly showed their working were able to gain credit via follow through/error carried forward even when the final answer was incorrect.

(e) The games controllers need to be packaged for sale.

The board used for packaging the games controllers costs £36.88 per pack.

Each pack contains 50 A2 sheets (420mm x 594mm).

A total of 310m² of board will need to be ordered for the packaging of the games controllers.

The board can only be ordered in whole packs.

Calculate the total cost of the order.

Show all of your workings.

(3)

59.4

m

100cm

10m

1cm

~~310m ÷ 420~~

~~4.2cm x 5.94cm~~

~~0.042 m x 0.0594m~~

50 x 42cm x 59.4 cm

50 x 0.42~~mm~~m x 0.594 m

= 12.474m² per pack

~~310 ÷ 50~~

310 ÷ 12.474 = 24.851 packs

25 pack needed

36.88 x 25 = 922

Answer £922

ResultsPlus
Examiner Comments

This response was awarded full marks for the correct answer with the correct working shown. Note the response would receive full marks if the correct answer was shown without any working.

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A total of 310m² of board will need to be ordered for the packaging of the games controllers.

The board can only be ordered in whole packs.

Calculate the total cost of the order.

Show all of your workings.

(3)

£36.68

50 A2 Sheets.

$310\,m^2$ = total area.

1 Pack = 50 x (0.42m x 0.594m) = 1 Pack.

$12.474\,m^2$.

$\frac{310}{12.474} = 24.85$ Packs

24 Packs ordered x 36.88 = £885.12

Answer £885.12

ResultsPlus
Examiner Comments

This response was awarded two marks for getting the first two stages of the calculation correct. The candidate then incorrectly rounded down and multiplied by 24 instead of 25 to miss the final mark for the correct answer.

Note: if the candidate had not shown any working and had written £885.12 in the answer space, then zero marks would have been awarded.

ResultsPlus
Examiner Tip

Show your working out! You'll probably pick up some marks even if you get the final answer wrong.

(e) The games controllers need to be packaged for sale.

The board used for packaging the games controllers costs £36.88 per pack.

Each pack contains 50 A2 sheets (420mm x 594mm).

A total of 310m^2 of board will need to be ordered for the packaging of the games controllers.

The board can only be ordered in whole packs.

Calculate the total cost of the order.

Show all of your workings.

(3)

~~420 x 594 = 249,480 mm^2~~

~~= 24,948 cm^2~~

~~= 249.48 m^2 per~~

$0.42 \times 0.594 = 0.24948\ m^2$

$\times 50 = 12.474\ m^2$ per pack

$\frac{310}{12.474} = 24.85$

= 25 packs of boards

Answer 25

ResultsPlus
Examiner Comments

This response was awarded two marks for getting the first two stages of the calculation correct. The candidate has provided an answer relating to the number of packs required rather than the cost of these packs.

ResultsPlus
Examiner Tip

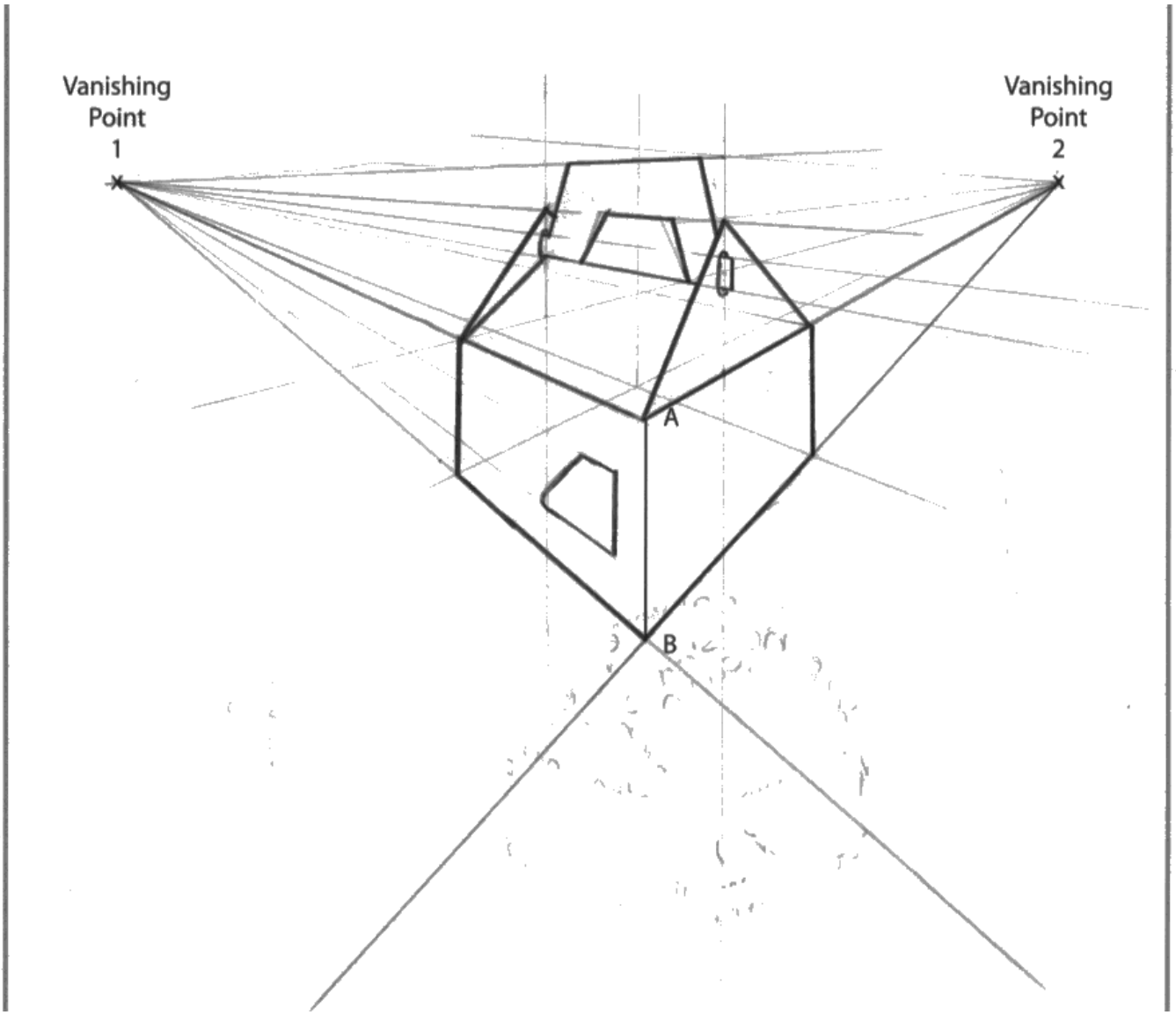
Check what the question is asking you to do! Here you need the total cost rather than the total number of packs.

Question 5 (f)

This question required candidates to produce a two point perspective drawing of some packaging using the net of the packaging as the source material.

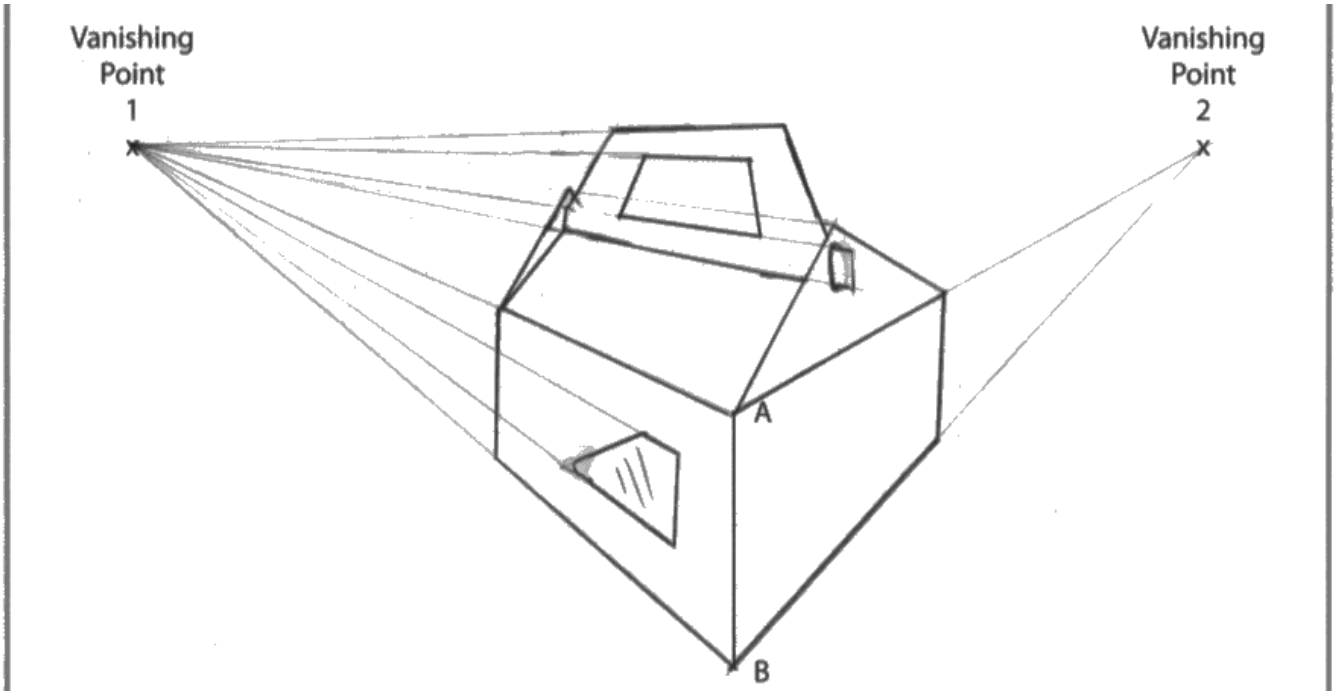
This was a question that allowed candidates to access marks across the mark range from one to six with very few candidates failing to score.

Many candidates were able to produce work that entered level 3 and achieved 5 or 6 marks. However, very few candidates realised that the top of the packaging curved towards the handle.



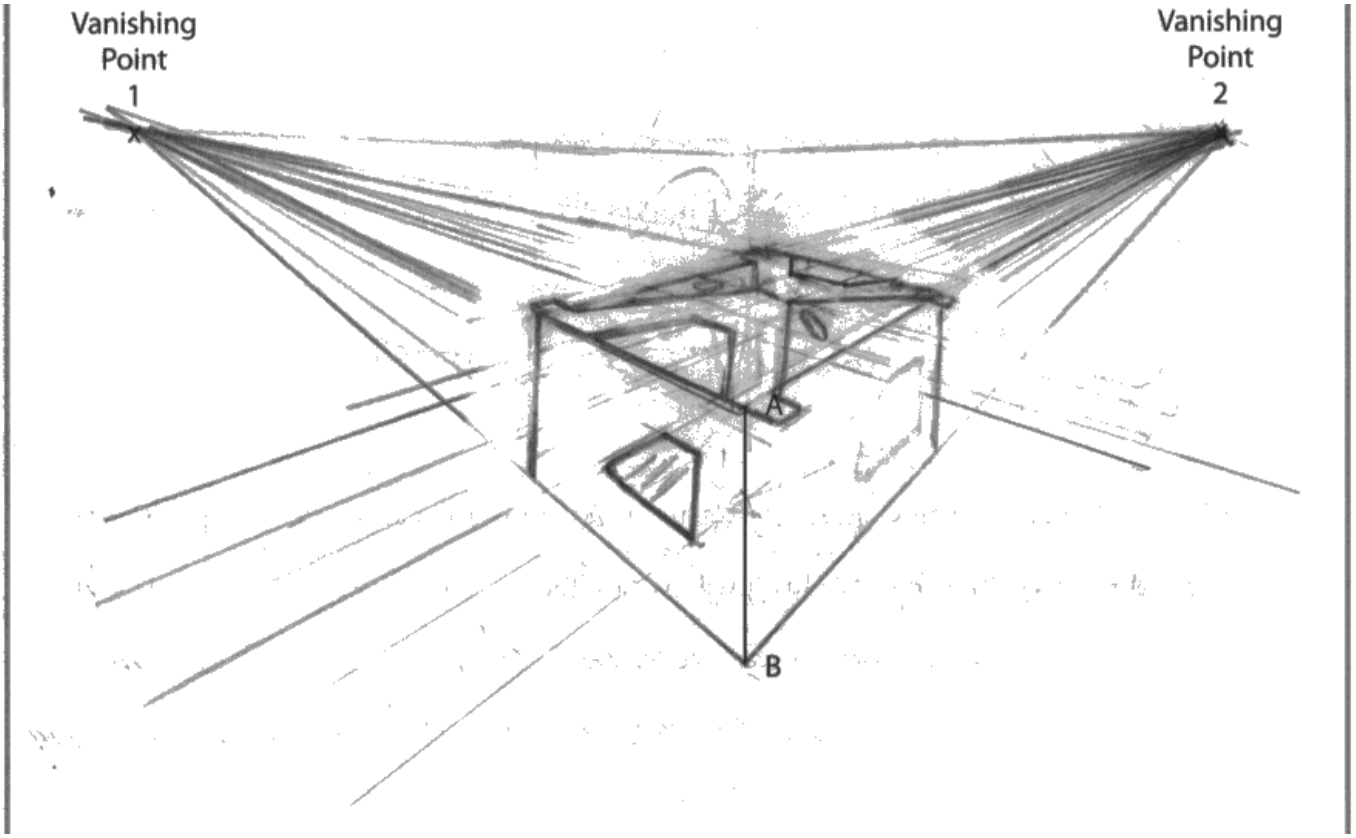
ResultsPlus
Examiner Comments

This is a good clear response that was awarded at the top of level 3 of the mark scheme.



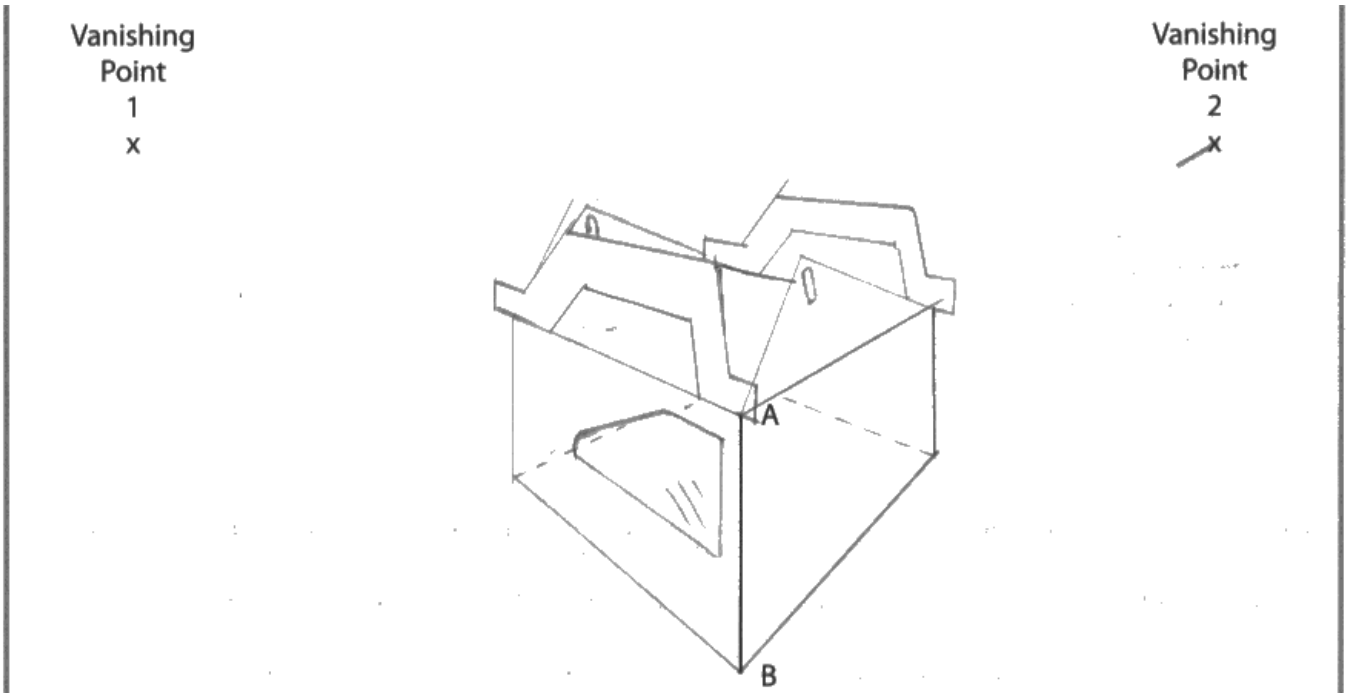
ResultsPlus
Examiner Comments

This is a good response that was awarded a mark in level 3 of the mark scheme.



ResultsPlus
Examiner Comments

This incomplete response was awarded a mark at the top of level 1.



ResultsPlus
Examiner Comments

This response was awarded at the bottom of level 2. The candidate has provided a two point perspective of the basic box and has started to address the detailing of the handles and top of the package.

Question 6

This question provided some photographic stimulus material of a Paris Metro station entrance designed during the Art Nouveau period.

Candidates were required to discuss how the design of the Metro station entrance was influenced by Art Nouveau philosophies.

Candidates across the ability range were able to access marks on this question.

More able candidates were able to bring an in-depth knowledge of Art Nouveau into their analysis of the Metro station entrance producing some high quality answers. Less able candidates relied more heavily on descriptive comments referencing the photograph provided in the question. Some candidates were confused by the philosophies of different design movements.

6 Figure 9 shows an entrance to a Paris Métro station designed and constructed during the Art Nouveau period.

~~- nature~~
~~- female form~~
~~- other cultures~~
~~- whiplash lines~~
~~- flowers~~
~~- ornamental~~
~~- range of materials~~

(Source: © atm2003/Shutterstock)

Figure 9

Discuss how the design of the Métro station entrance was influenced by Art Nouveau philosophies.

(9)

Art nouveau was a movement dedicated to bridging the gap between arts and crafts and modern design. It involved the use of highly skilled crafts such as glass and metal working, which can be seen in the picture. The use of nature was a prominent theme, using whiplashed lines and stylised flowers which can be seen in the iron railings, where there are intricately detailed flowers and curvy, sweeping shapes and lines. The use of other cultures was also important, taking inspiration from japanese art with its flowing, sinuous lines and flower detail. This is evident

in the image as it has flower influences and uses symmetry for decoration, which was used in a lot of ancient cultures. It had a very stylised focus and encouraged multi-disciplinary arts, which is shown in the glass and metal, adding flair to an otherwise dull object. It is very ornamental and pleasing to the eye. The use of an alternative font makes it interesting and has an architectural focus but takes aesthetics into consideration for most of it. It is opulent and lavish, but highly skilled, bringing in different skill sets and having a modern feel to it by using materials such as metals and glass. AA nouveau often draws on the female form and while this isn't obvious in the image, it uses lots of curves and sinuous shapes to add flair to the ~~st~~ structure.

ResultsPlus
Examiner Comments

This was a very good response awarded a mark at the top of level 3. The candidate demonstrated a developed understanding of Art Nouveau design and philosophy linking well to the scenario of the question.

6 Figure 9 shows an entrance to a Paris Métro station designed and constructed during the Art Nouveau period.

(Source: © atm2003/Shutterstock)

Figure 9

Discuss how the design of the Métro station entrance was influenced by Art Nouveau philosophies.

(9)

Art Nouveau is a ~~brave~~ desgin movement which became more popular within the 19th century. The Métro station entrance, has been influenced by Art Nouveau, ~~f~~for example the detail on the Metal barriers around the entrance, the Metal work on the barriers have many curved details and Symetrical patterns with no 90° degree angles. Further-more another feature of the entrance that has been influenced by Art Nouveau, is the Symetricalness of the desgin. each Side of the desgin is a mirrored image of the other, ~~this is uncommon in movements~~ for example look at the five circular details placed at ~~such as bannister~~ head height when walking down the

entrance, they are ~~at~~ all at the same height and distan
-ce apart.
Moreover another influence of Art Nouveau on the
entrance is the materials used within the desgin, the
material used is able to be moulded into the desired
Shape using force and heat.

ResultsPlus
Examiner Comments

This response is a short superficial discussion considering a narrow range of factors demonstrating a limited understanding of Art Nouveau design and philosophy. The response was awarded a mark in the middle of level 1.

Question 7 (a)

This question required candidates to discuss factors that need to be considered when deciding between locations for a manufacturing facility, within the UK and in a developing country.

Candidate performance on this question was very good and candidates of all abilities were able to find appropriate access to the mark scheme.

7 Figure 10 shows an electric car.

(Source: © Gyuszko-Photo/Shutterstock)

Figure 10

The manufacturer of the electric car is considering two options for the location of a new manufacturing facility:

- a manufacturing facility in the United Kingdom
- a manufacturing facility in a developing country.

The facility will contain the latest and most advanced manufacturing technologies.

(a) Discuss the factors that need to be considered when deciding between the two options for the location of the new manufacturing facility.

(9)

Through operating the manufacturing facility in a developing country the business could benefit from cheaper labour due to weaker employer legislation and a lower minimum wage. This would allow the car to be produced for less therefor widening the businesses profit margins. Also the developing country may have an abundance of materials needed for producing the vehicle therefor decreasing the amount of fuel needed to supply the manufacturing facility with raw materials. The developing country may also be closer to the target market of the company this too would reduce quantities and cost of fuel used to ship

the cars to the market. This may have less of an impact on the environment. and reduced ~~pollu~~ However developing countries often have weaker pollution laws so this would have a negative impact to the environment and may cause pollution contributing to global warming. Also the developing country is unlikely to have high demand for the car because incomes will be lower so the car would have to be shipped to market.

Or If manufacturing facility in the UK would be more expensive, however it is less likely to damage the businesses brand name because they won't be seen to be exploiting workers. Also they will have to abide to pollution and emission laws in the UK, because the UK are more likely to stick to the Paris agreement because of stricter governance. So manufacturing in the UK will have less of an impact to the environment.

Or Also the UK has a large middle class who are becoming increasingly ethically and sustainably conscious. therefor ~~the~~ operating in the UK would be wise because there would be a high demand for electric cars so distribution fuel would be decrease so less pollution and lower costs.

Overall I think that many factors need to be discussed such as productivity, schedule, cost, environment and proximity to market.

ResultsPlus
Examiner Comments

This is a very good response that was awarded a mark at the top of level 3. This response represents a comprehensive discussion that provides evidence of a developed understanding of factors that influence the location of a manufacturing facility within the context of the question scenario.

7 Figure 10 shows an electric car.

(Source: © Gyuszko-Photo/Shutterstock)

Figure 10

The manufacturer of the electric car is considering two options for the location of a new manufacturing facility:

- a manufacturing facility in the United Kingdom
- a manufacturing facility in a developing country.

The facility will contain the latest and most advanced manufacturing technologies.

(a) Discuss the factors that need to be considered when deciding between the two options for the location of the new manufacturing facility.

(9)

~~The factors that~~ One of the factors that needs to be considered when ~~it~~ choosing the location of the new manufacturing facility is the type of environment that the car will be manufactured in and the type of skills that are required by the people in that area as in a developing country the people that they may employ are likely to be less skilled than those in the United Kingdom. Moreover, the developing country may not have the correct area for the new manufacturing facility.

ResultsPlus
Examiner Comments

This response was awarded a mark in the middle of level 1. The response is a superficial discussion of a narrow range of issues demonstrating limited understanding of the factors that influence the location of the manufacturing facility.

Question 7 (b)

This question worked well as a key discriminator at the higher grades, as only more able candidates could respond to the focus of the question.

The key focus of this question is on the computer system controlling the robotics.

Many candidates provided extensive answers regurgitating all they know about robotics with no reference to the computer system that controls the robotics. This resulted in many candidates failing to access the available marks.

~~1 become more precise (finer detail) 2 no human error 3 more accurate.~~
~~uniform components. laser guidance + gps.~~

(b) The new manufacturing facility will make extensive use of computers to control robotic systems during the manufacture of the electric car.

Explain **three** ways that computers have enabled robotic systems to become more effective in the manufacture of the electric car and other consumer products.

(9)

1 The advancement of computer systems has allowed for robots to become more precise and has meant things can be done in finer detail, this has made components more uniform + has lead to a decrease in human error showing how the robots have become more effective.

2 Secondly, the technology within computer systems has become much quicker which has meant robots have been able to work faster than humans and this has enabled products with high demand to be made in larger volumes.

3 Finally, computers are now able to use laser guidance + gps systems so that robots can be used for stocking purposes in warehouses without the need for humans as they can be linked to a single cloud system showing how they are more effective.

ResultsPlus
Examiner Comments

This is a good response where the candidate has appropriately explained three ways in which computers have enabled robotic systems to become more effective within the manufacturing scenario. The response was awarded nine marks.

(b) The new manufacturing facility will make extensive use of computers to control robotic systems during the manufacture of the electric car.

Explain **three** ways that computers have enabled robotic systems to become more effective in the manufacture of the electric car and other consumer products.

(9)

1 Accuracy, robots will have a CAD higher accuracy when creating the product. As long as the user has told the robot the correct sizes etc the robot will be precisely remade but with no mistakes.

2 Speed, the robots will be able to create the electric cars because of many reasons, one is that robots will just create them at a higher speed, two is that there will be no human errors. Three there will be no holidays and they make 24 hours a day.

3 Cost, many reasons to why it is cheaper in the long run. Labour costs will be lower because there is less people to employ. Also can turn the lights off, no heating needed ever the factory can be to provide as much food.

ResultsPlus
Examiner Comments

This response was awarded zero marks. The candidate's primary focus is on robotics rather than computer systems.

ResultsPlus
Examiner Tip

Remember to check the focus of the question. This question is about computer systems and not about robotics i.e. all three explanations need to have a primary focus on computers rather than robotics.

Question 8

This final question on the paper has the highest mark tariff with a total of 12 marks being allocated to the question.

This essay style question with the command verb 'evaluate' allows candidates to draw upon knowledge from across the unit specification.

The question focuses on design with reference to ergonomics, aesthetics and user needs. The candidate is asked to evaluate the interior of an electric car with reference to these key design elements.

The open nature of the question and provision of an appropriate visual stimulus allowed candidates of all abilities to access marks at the appropriate point commensurate with their ability.

More able candidates were able to draw upon a broad range of points from the mark scheme providing insightful connections between the various concepts, providing a balanced evaluation that demonstrated relevant understanding resulting in well developed conclusions and evaluative discussion throughout. Less able candidates were able to access marks in levels one and two of the mark scheme demonstrating some knowledge of ergonomics linked to observed features of the interior of the vehicle. At this level the work was more descriptive than evaluative.

8 Figure 11 shows the interior of the electric car.

(Source: © Sergey Kohl/Shutterstock)

Figure 11

The interior has been designed with ergonomics as a key priority.

Evaluate the ergonomics of the interior with reference to aesthetics and user needs.

(12)

The curved shape of the seat with the reclined backrest and cushioning & clearly ~~designed~~ shows that the seat has been designed to be as comfortable ~~and~~ as possible for the user. There is also padded armrests either side of the seat, ensuring optimum comfort. This seat design minimises the risk of injury to the user through being sat in an uncomfortable position for a prolonged period of time. The shape of the gearstick and screen control dial is designed to be comfortable and easy to user based on anthropometric data of the human hand*. The positioning of controls, such as the window buttons being at the end

*(The designer would have used data for the 5th to 95th percentile to ensure comfort).

of the armrest, has been considered to ensure that the user doesn't have to strain to reach them, increasing easy of use. This also ensures the safety of the driver ~~and~~ as they do not have to overreach or move significantly to reach the controls, which would distract them from the road. ~~The car has a~~ This is also shown by the fact that there are controls on the steering wheel, as the driver does not have to take their hands of the wheel to press certain buttons, making the buttons easier, safer and more comfortable to press. The shape and design of the steering wheel is designed for optimum comfort; it is fabric-covered to make it soft and comfortable to hold and the fabric along with the shape ensures the wheel is easy to grip, giving the driver maximum possible control of the car. The interior of the car has a wide range of settings, such as air-con temperature/direction, and dials for heated seat settings, meaning the user can adjust them all accordingly to ensure maximum comfort. There is however the risk of distraction from the screens and controls, ~~making~~ putting the driver at risk of hazards. This however has been minimised as much as possible by having the screens positioned so that the user does not have to take their eyes off the road too much and by having the controls positioned so the ~~user~~ driver does not have to over reach. One of the screens is placed through a gap in the steering wheel, designed specifically so the driver can easily flick ~~her~~ their eyes to the screen without having to turn their head.

(Total for Question 8 = 12 marks)

ResultsPlus
Examiner Comments

This is a very good response that was awarded a mark in level 4. The candidate has demonstrated a developed understanding of ergonomic design within the context of the question. This is a well written, in depth essay that provides insighful connections of concepts throughout the work and has embedded evaluative comments throughout. Although the candidate has not provided a separate conclusion, this is acceptable when concluding elements are embedded within the response.

8 Figure 11 shows the interior of the electric car.

(Source: © Sergey Kohl/Shutterstock)

Figure 11

The interior has been designed with ergonomics as a key priority.

Evaluate the ergonomics of the interior with reference to aesthetics and user needs.

(12)

One key feature that has been incorporated to ensure ease of use for the consumer is the adjustability of various aspects. The ability to adjust the seat and steering wheel enables the consumer to drive the car in a very comfortable and easy way for them. Along with this feature is the one of accessibility. The incorporation of a cup holder just next to the driver's seat enables easy access to a drink, without the driver having to lose much concentration whilst driving. Ease

of accessibility is also present through the positioning of all controls that the driver will need to have a comfortable journey. By having all controls in the centre of the car and at just the right height so that the consumer can comfortably reach them, the ease of accessibility is already largely increased. Another very clever aspect incorporated is the addition of buttons and controls on the steering wheel, which enables the person driving to take calls, change things on the radio and even change the volume without taking their hands off of the steering wheel. The positioning and addition of the small screen in the centre of the car enables the driver clear view of the road whilst also having the ability to easily look at the screen without any strain; the controls on the steering wheel also coincide with this to ensure ease of use. Furthermore, the large central piece situated between the two front seats inhabiting a cup holder and further controls ensures all travellers in the car are comfortable as they have enough space for both long and short journeys; this also adds to the aesthetics because it appears very simplistic and modern.

ResultsPlus
Examiner Comments

This is a clear well written response in which the candidate has demonstrated a reasonably good understanding of ergonomic design and has linked this knowledge to the design of the interior of the car shown in the question. The candidate has embedded evaluative comments throughout the response rather than provide a separate formal conclusion at the end. This response was awarded a mark in level 3.

ResultsPlus
Examiner Tip

Remember to look at the command verb. When you are asked to 'evaluate', you need to include concluding or evaluative comments. These can be embedded throughout the response or included in a final conclusion at the end of your response.

8 Figure 11 shows the interior of the electric car.

(Source: © Sergey Kohl/Shutterstock)

Figure 11

The interior has been designed with ergonomics as a key priority.

Evaluate the ergonomics of the interior with reference to aesthetics and user needs.

(12)

The ergonomics ~~of~~ of the interior has been designed to ensure ~~the~~ consumer satisfaction. This is evident as the ~~the~~ driver's seat appears to look quite soft and comfortable for the user, which satisfies user needs. In addition the ~~seat~~ colour scheme of the seat is ~~the~~ contrasting ~~to~~ the other areas of the interior which prove to be quite aesthetic.

As shown in the image above, the positioning of the wheel is ~~centred~~ located in the middle

of the driver's seat which fulfills the user's needs, as it is important to be able to reach the wheel in order to drive. Furthermore, as for the layout of the gears and buttons, there is a clear finish that has been applied to ensure that it looks aesthetically pleasing; additionally, it is also quite close to the driver's seat which ensures that the driver is able to reach, this evidents the fact that ergonomics has been carefully considered and was a key priority during the designing process.

ResultsPlus
Examiner Comments

This response was awarded marks in level 1. The response is rather brief and as such the candidate has only been able to demonstrate a limited understanding of ergonomic design linked to the context of the scenario. The response includes some very basic simplistic statements such as the wheel being in the middle of the seat.

Paper Summary

Based on their performance on the paper, candidates are offered the following advice:

- In this first year of the qualification candidates generally performed well on this paper. There is however some evidence that candidates still have a focus on either graphics or resistant materials as this was evident in the balance of responses seen.
- Candidates generally performed well on the mathematics questions.
- Candidates need to become more practised in the writing of 3 mark 'explain' type questions in order to become more accomplished in answering this type of question and pick up the third mark.
- Candidates did well on the longer essay type questions marked with a levels based mark scheme, but on these type of questions should be written in continuous prose rather than bullet pointed lists, which will limit access to the higher mark levels.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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