

# Examiners' Report

## June 2018

### GCE Design And Technology - Product Design

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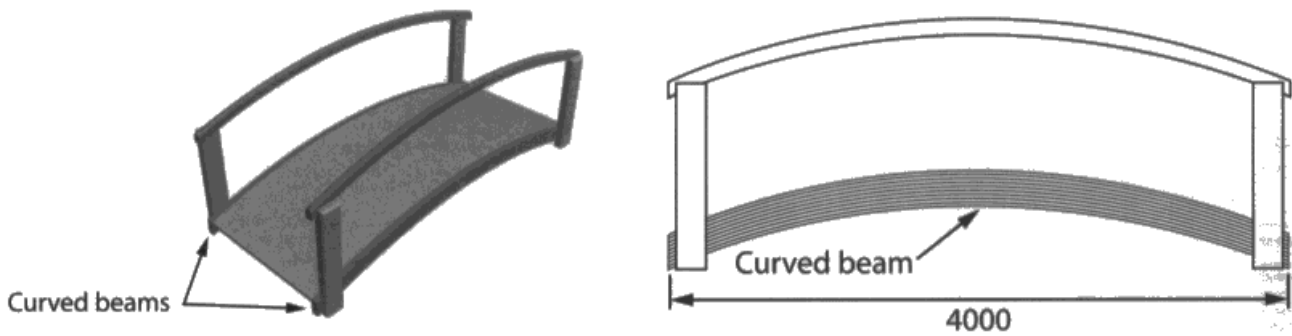
# Introduction

This is the first live paper for this specification. It has been designed with a number of new features to test both a wider spectrum of skills and a deeper level of understanding. There are only a small number of questions which candidates can answer using simple recall knowledge. Instead most responses will need candidates to apply their knowledge in a given situation in order to respond appropriately. On the whole candidates have risen to the new challenges well and have shown levels of understanding appropriate to this new level 3 qualification. However there are many lessons to be learned. There follows some good examples of responses from this year's cohort, and some examples to illustrate where lessons can be learned, and exam performance improved. Please read them carefully as they will help prepare candidates for future examinations.

## Question 1 (a)

This introductory question on laminating beams was largely straightforward for most candidates with common responses being based on increased strength, sections more easily bent and less wood needed. However many candidates confused laminating a beam with laminating (encapsulating) paper, leading to responses that focused on giving the beam a waterproof or shiny protective layer. These responses failed to score. A large number of responses also included 'cheaper' and 'smooth curve' which were also not accepted as a benefit over other methods of manufacturing the beam.

1 Figure 1 shows two views of a prototype of a bridge.



(All dimensions are in mm)

Figure 1

The curved beam has been produced by laminating.

(a) Give **two** benefits of using lamination to manufacture the curved beam.

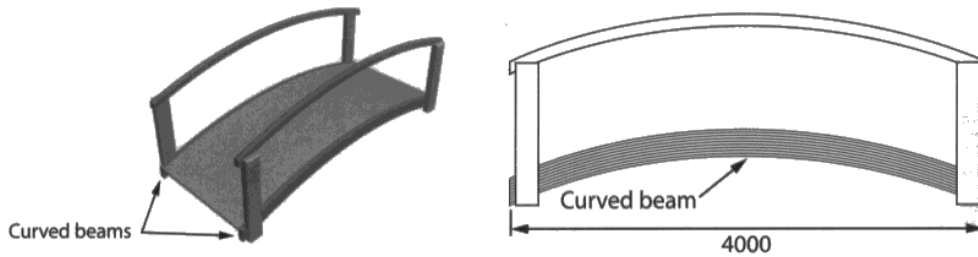
(2)

- 1 protects it to ensure there is no damage on the material below.
- 2 better aesthetics as it gives a shiny finish.



This form of answer was seen quite frequently but scored no marks. The candidate has confused laminating a beam with laminating paper or card.

1 Figure 1 shows two views of a prototype of a bridge.



(All dimensions are in mm)

**Figure 1**

The curved beam has been produced by lamination.

(a) Give **two** benefits of using lamination to manufacture the curved beam.

(2)

1. Strength will be built up because of the layering process.
2. It will maintain structural integrity because it will be very tightly compacted.



**Response 1** - This was awarded 1 mark for 'strength'.

**Response 2** - This is a repeat of the same issue using different words.



Ensure you are giving different points in each response rather than repeating the same issues using different terminology. Repeated issues will only be awarded once.

## Question 1 (b)

Many candidates scored highly on this question with frequent responses focusing on strength, speed of drying, water resistant versions, and cost issues. Less commonly seen were health issues and the ability to slide components into position once they are in contact. The simplistic phrase 'easy to apply' was not awarded as it is no easier than most other adhesives.

The curved beam was laminated using an adhesive.

(b) Explain **two** reasons why PVA (polyvinyl acetate) adhesive was used.

(4)

1 PVA gives a strong bond therefore the bridge gains stability and will not collapse.

2 After PVA hardened the initial white liquid changes to a colourless see-through material. This will improve the aesthetics because you cannot see rests of glue.



**ResultsPlus**  
Examiner Comments

This answer gained the full 4 marks for two explained points. 'Strength' is explained with 'will not collapse', and 'colourless' is explained with 'improved aesthetics'. Note that the point and its explanation can be stated in any order, as quite often either could be the point or the explanation.

The curved beam was laminated using an adhesive.

(b) Explain **two** reasons why PVA (polyvinyl acetate) adhesive was used.

(4)

1 PVA is a wood glue which holds both pieces together with a strong bond therefore it will be ~~very~~ durable

2 PVA can hold the laminate together securely and it will give allow the ~~big~~ bridge to be sustainable and be able to ~~use~~ withstand damage without falling apart



**ResultsPlus**  
Examiner Comments

The first response here was awarded 2 marks for 'strong' explained with 'it will be more durable'. The second response is another example of where a candidate has repeated the same issue using different terms. This is a common mistake and candidates need to be made aware of this.

## **Question 1 (c)**

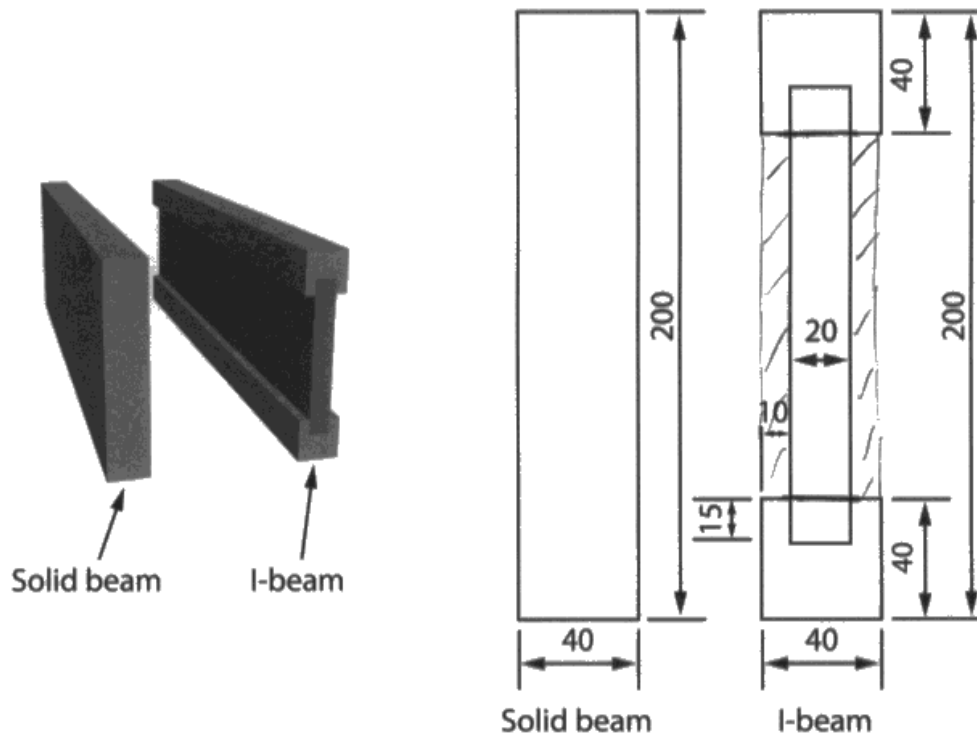
Candidates were required to name two appropriate wood composites in response to this question. The large majority gave MDF and Plywood gaining the 2 marks available. All the possible responses in the mark scheme were seen. The most frequent mistake was to just state two solid woods; beech and oak were frequently seen. This may have been due to either candidates not knowing what a wood composite was, or they did not read the question carefully enough.

## **Question 1 (d)**

Most candidates successfully solved this introductory calculation. Unfortunately the vast majority of them did the calculation using many more steps than were actually needed. The straightforward method is to calculate the volume of the two recesses either side of the central narrow section of the 'I' beam:  $2 \times 1 (20-8) \times 60 = 1440\text{cm}^3$ . Instead most calculated the volume of both beams, then subtracted the 'I' beam from the solid. Many errors were made in the unnecessary extra steps which lost candidates marks. Another common issue was incorrect conversions between  $\text{mm}^3$  and  $\text{cm}^3$  with many candidates moving the decimal point a single place as if it was a linear measurement.



(d) Figure 3 shows a solid wood beam and a manufactured 'I-beam'.



(All dimensions are in mm)

**Figure 3**

Both beams are 600mm long.

Calculate the difference in the volume of material in the two beams.

Show all of your workings.

Give your answer in  $\text{cm}^3$ .

(4)

$$\begin{aligned} \text{solid beam: } \text{area} &= 200 \times 40 \\ &= 8000 \text{ mm}^2 \\ \text{volume} &= 8000 \times 600 \\ &= 4800000 \text{ mm}^3 \\ &= 4800 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{I beam: } \text{area} &= 40 \times 200 - 2(10 \times (200 - 80)) \\ &= 8000 - 2400 \\ &= 5600 \text{ mm}^2 \\ \text{volume} &= 5600 \times 600 \\ &= 3360000 \text{ mm}^3 \\ &= 3360 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{difference: } &4800 \text{ cm}^3 - 3360 \text{ cm}^3 \\ &= 1440 \text{ cm}^3 \end{aligned}$$

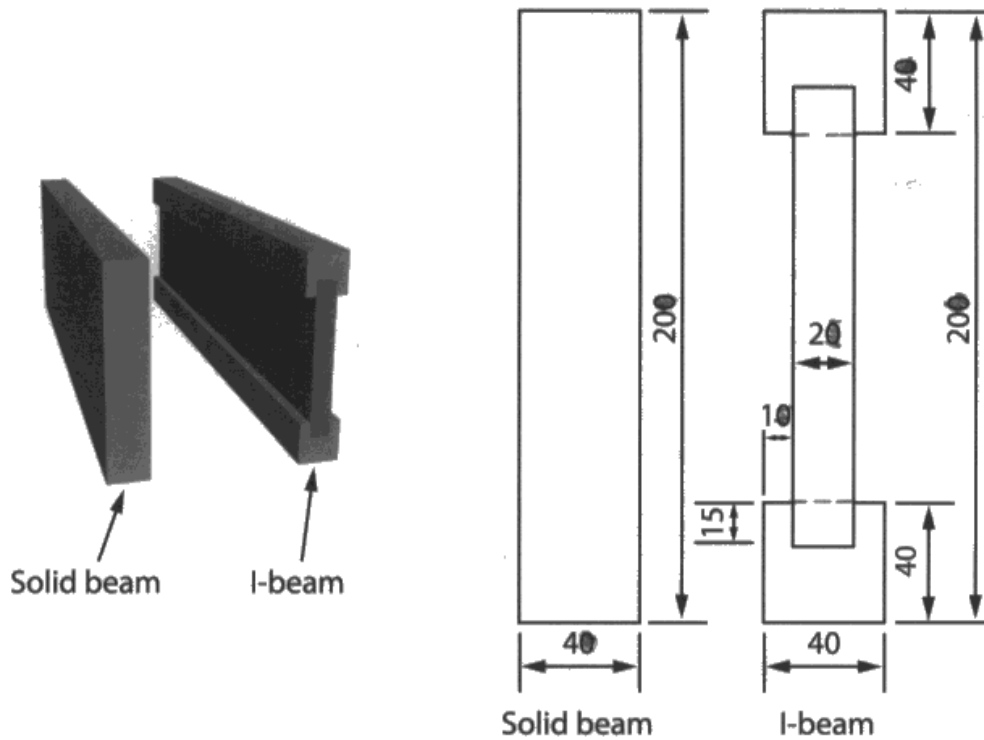
Answer ..... 1440 cm<sup>3</sup>

**(Total for Question 1 = 12 marks)**



A clearly laid out calculation with all steps correct.  
Full marks.

(d) Figure 3 shows a solid wood beam and a manufactured 'I-beam'.



(All dimensions are in mm)

Figure 3

Both beams are 600mm long.

Calculate the difference in the volume of material in the two beams.

Show all of your workings.

Give your answer in  $\text{cm}^3$ .

(4)

$V =$   
 $L \times B \times H$

SB  
 $4 \times 20 \times 60$   
 $= 4,800 \text{ cm}$   
 $= 4 \text{ cm} \times 20 \text{ cm}$   
 $= 80 \text{ cm}$

I-b  
 $2 \times 12 \times 60$   
 $= 1,440 \text{ cm}$   
 $= 2 \text{ cm} \times 12 \text{ cm}$   
 $= 24 \text{ cm}$

$4 \times 4 \times 60$   
 $= 960 \text{ cm}$   
 $= 4 \times 4 \text{ cm}$   
 $= 16 \text{ cm} \times 2$   
 $= 32 \text{ cm}$

$4,800 - (1,440 + 960 \text{ cm})$

$= 4,800 - 2,400$   
 $= 2,400 \text{ cm}^3$

Answer 2400  $\text{cm}^3$

(Total for Question 1 = 12 marks)



The candidate has correctly converted mm to cm (1) and has correctly calculated the volume of the solid beam (1). In calculating the volume of the 'I' beam they have only added one of the upper or lower sections to the middle (0). A method mark has been awarded for subtracting the incorrect 'I' beam volume from the solid beam volume (1). Total 3 marks.



Calculations should be thought through and then all working should be presented in a logical sequence. If a mistake is made marks will be awarded for correct stages completed with an error carried forward. These 'method' marks cannot be awarded if working out is not shown or is unclear.

## Question 2 (a)

Many strong answers were seen in response to setting up the CNC router, although few reached the full 6 marks available. It was often very clear whether candidates had practical experience of using a CNC machine or not, as responses in general tended to be quite polarised. A small minority of responses described the use of a laser rather than a router. Where this happened credit was awarded for correct parallel stages although marks were capped at 3.

- 2 Figure 4 shows a game that has been manufactured using a CNC router to form the base from a single piece of oak.

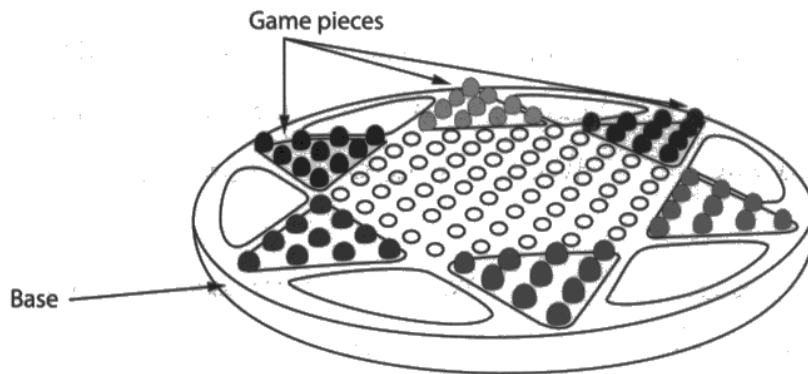


Figure 4

The computer-aided design drawing has already been produced.

- (a) Outline the process of setting up and cutting the base using a CNC router.

(6)

An appropriate router bit would be selected for drilling the holes for the game pieces and for routing wood. Then an appropriate spindle rpm and feed rate would be defined. The user would then need to define the cutting paths (one to route the lowered cutouts and another to drill the holes) and the depth of the cuts. The piece of oak will then need to be secured to the bed of the cnc. The router will be lined up and the user will start the cut.



This response, although not the strongest, achieved the full 6 marks for identifying six points in the mark scheme. The candidate understands many of the issues associated with setting up the CNC router, such as inputting feed rates, defining cutting paths (taken as creating a machine file) and the need for alignment, as well as the more physical aspects of fitting a cutter and securing the material. A sound understanding (although terminology is often inaccurate).

- 2 Figure 4 shows a game that has been manufactured using a CNC router to form the base from a single piece of oak.

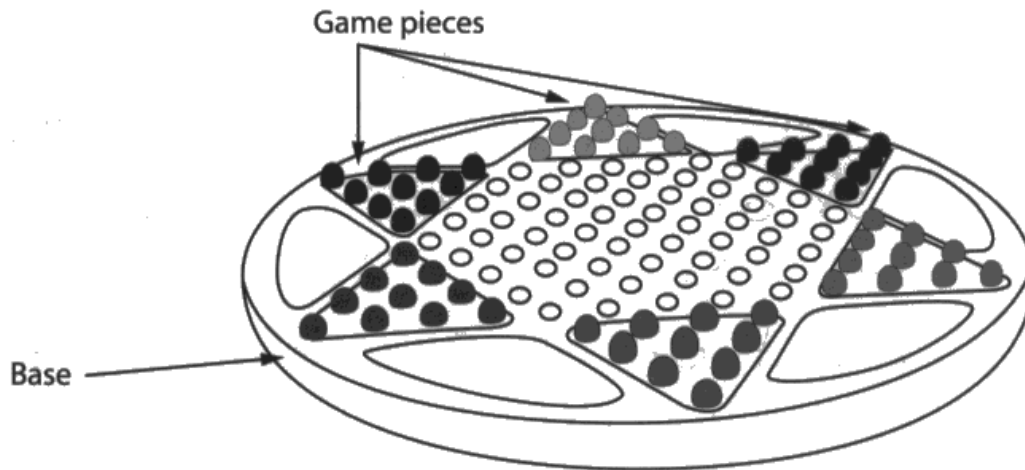


Figure 4

The computer-aided design drawing has already been produced.

- (a) Outline the process of setting up and cutting the base using a CNC router.

(6)  
A software programme would be used to set up the design for this. The oak would then be placed in the CNC router. The settings would need to be changed so it's set up to the correct speed, power and psi. The router would then be turned on and it would create the design from the programme.



**ResultsPlus**  
Examiner Comments

This weaker response was much more superficial and gained 3 marks for placing in the oak, setting the correct speed, and then being turned on.

## Question 2 (b)

Candidates were asked to explain three performance characteristics (properties) of oak that make it suitable for the game board. Specific performance characteristics and explanations were being looked for. Many candidates could easily identify three, but correctly explaining them caused much confusion. Strength was incorrectly linked with impact resistance and scratch resistance with toughness. Candidates need to have a solid understanding of material properties. Common incorrect responses seen were lightweight, cheap (not a performance characteristic), easy to cut, good aesthetics (also not a performance characteristic).

(b) Explain **three** performance characteristics that make oak a suitable timber from which to manufacture the base of the game.

(6)

- 1 It is a very strong and rigid wood with very good tensile strength that can be shaped & cut easily into any shape.
- 2 It can be laminated easily & be water-resistant therefore used for outdoor purposes. Has a very smooth ~~and~~ and even purpose.
- 3 It cannot snap or break easily as well as it being lightweight therefore suitable for this purpose.



**Response 1** This was correctly identified as 'strength' (1) which was then repeated twice, before the explanation diverged into an unrelated incorrect characteristic.

**Response 2** Incorrect.

**Response 3** The candidate made the correct stand-alone point of 'cannot snap...' (1). This is also a correct explanation of strength from response 1, although the candidate has not linked them.



(b) Explain **three** performance characteristics that make oak a suitable timber from which to manufacture the base of the game.

(6)

1 It is tough - it is able to withstand heavy impacts, it will not break easily.

2 Does not scratch easily - since it's ~~is~~ for a game, when children are playing with it, scratching will not be visibly shown easily.

3 It lasts long - it is a durable wood therefore it can last years without rotting.



**ResultsPlus**  
Examiner Comments

**Response 1** - Correctly identifies and explains toughness. (2)

**Response 2** - Correctly explains the need to be scratch resistant, but does not identify the performance characteristic. (1)

**Response 3** - Correctly links durable with lasting a long time. (2)

Total score = 5 marks.



**ResultsPlus**  
Examiner Tip

A clear understanding of the performance characteristics of the relevant materials is fundamental knowledge for candidates under this specification.

## **Question 2 (c)**

Naming two polymers that are suitable for rotational moulding was difficult for most candidates. A noticeable number of candidates identified one polymer; however, candidates displayed a tendency to list multiple polymers as opposed to directly addressing the question, this could be suggestive of guess-work. Centres need to be aware that if a question asks for two answers, then only the first two stated will be marked. Common incorrect answers focused on acrylic, polystyrene and ABS.

Examiner Tip.

Candidates should consider their answers carefully, as where questions ask for a limited number of answers, e.g. 'give two', then only the first two responses given will be marked.

## Question 2 (d)

This question asked candidates to compare their knowledge of both rotational moulding and injection moulding, then explain two benefits of using rotational for moulding the game base. A good number of candidates were able to give appropriate justified benefits showing a clear understanding of the two processes. The most frequent correct answers seen explained the benefits of producing a hollow moulding, the lower cost of the moulds (dies) and that less polymer is needed.

Other candidates found this question very challenging. Common mistakes included comparing rotational moulding with characteristics from other moulding processes such as vacuum forming, or comparing the two processes in general rather than focusing on moulding the game base. Common incorrect responses seen included: more even wall thickness, more environmentally friendly, and no visible seams.

(d) Explain **two** benefits of using rotational moulding in preference to injection moulding when producing the base of the game.

(4)

1 Rotational moulding allows for larger objects to be made as moulds can be made larger e.g. Oil tanks and bins.

2 Rotational moulding provides an even distribution of plastic throughout the whole product as it evenly rotates during melting and forming of product.



**ResultsPlus**  
Examiner Comments

**Response 1** Is incorrect, as although rotational moulding is able to produce larger mouldings, the question is focused on the game board which is a suitable size for either process.

**Response 2** Is also incorrect, as although rotational moulding can give a more even wall thickness compared to vacuum forming, it is not a correct comparison with injection moulding.

(d) Explain **two** benefits of using rotational moulding in preference to injection moulding when producing the base of the game.

(4)

1 rotational moulding will make the inside hollow so reducing it's weight before making it good for travel.

2 rotational moulding would also use less plastic making it's overall production cost less.



**ResultsPlus**  
Examiner Comments

This response gained the full 4 marks for two correct benefits both of which are appropriately explained.

### Question 3 (a)

A well answered question with the large majority of candidates achieving at least 2 marks, with many scoring higher. Candidates were able to grasp the direction of the question and respond appropriately, seeing the consequences of not having to join two separate parts. Some marks were lost as candidates failed to explain the advantage stated or did not attempt to explain it.

- 3 Figure 5 shows an aluminium component that has been machined as part of a small batch of 50 using a milling machine.

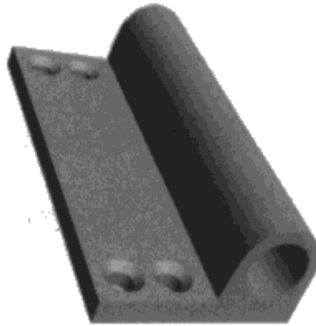


Figure 5

- (a) Explain **two** advantages of milling the aluminium component shown in Figure 5 from a solid piece of material rather than making it from two separate pieces.

(4)

1 It saves time because if it was made out of two separate pieces you would need a second process to join them together.

2 It has an aesthetic advantage producing it from a single piece than seeing a joint between two separate ones.



The full 4 marks were awarded for this response which gives two advantages and explains them both.

- 3 Figure 5 shows an aluminium component that has been machined as part of a small batch of 50 using a milling machine.

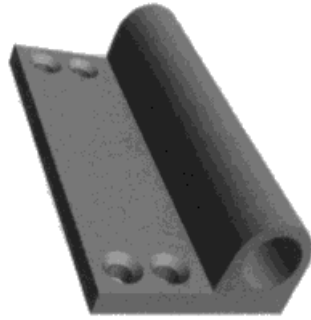


Figure 5

- (a) Explain **two** advantages of milling the aluminium component shown in Figure 5 from a solid piece of material rather than making it from two separate pieces.

(4)

1 It is less likely to break apart and the process would be completed easily.

2 No form of soldering would have to be used.



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Examiner Comments

**Response 1** This answer is correct, but it is followed by an incorrect explanation as it is unrelated to the advantage given. 1 mark.

**Response 2** This is also correct but no attempt has been made to say why this is an advantage. 1 mark.

Total score - 2 marks

### Question 3 (b)

Most candidates were able to score 1 or the full 2 marks on this question with the most common correct answer being less waste is produced.

(b) Figure 6 shows two parts that could be joined to make the component shown in Figure 5.

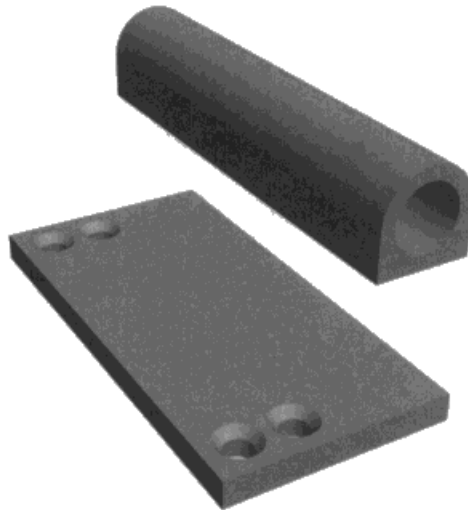


Figure 6

Give **two** advantages of making the component by joining two pieces together rather than machining it from one solid piece.

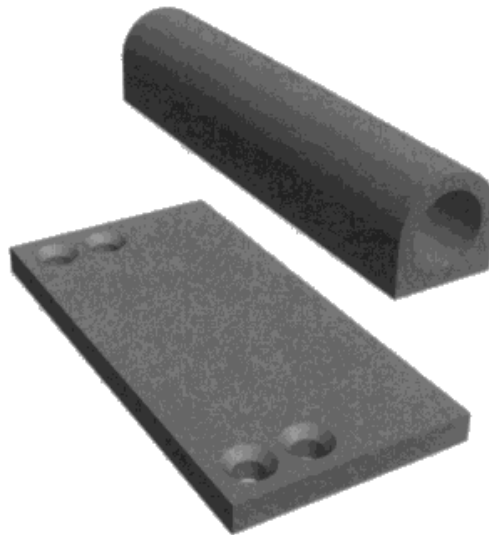
(2)

1. much less waste is created because less metal has to be cut away.
2. could be more easily ~~made~~ and cheaply made from stock materials such as a slab/sheet and a rod.



This answer scored the full 2 marks for two clear points.

(b) Figure 6 shows two parts that could be joined to make the component shown in Figure 5.



**Figure 6**

Give **two** advantages of making the component by joining two pieces together rather than machining it from one solid piece.

(2)

1. It would be more accurate as both pieces were measured individually.
2. It would be easier to apply a surface finish if they were separated.



**ResultsPlus**  
Examiner Comments

This response scored zero as neither answer has been thought through sufficiently well for the candidate to realise that they are incorrect.



### Question 3 (c)

Anodising proved a challenging topic for most candidates as few scored more than 2 of the 4 marks available. The most popular correct response was durability. In general candidates did not understand how the process of anodising is done which lead to many superficial or incorrect responses. Common ones e.g. were faster, cheaper, and less waste. Many responses also focused on better aesthetics. This point was not accepted as good aesthetics is more a matter of opinion in terms of preferred colour, texture, level of shine, e.g., as opposed to an advantage.

(c) The finish specified for the component shown in Figure 5 is anodising.

Explain **two** advantages of anodising in preference to painting for the component shown in Figure 5.

(4)

- 1 Anodising ensures an even coating rather than painting may be different thicknesses and different parts and may affect the functional ability.
- 2 Anodising leaves a smoother surface finish as painting may leave streaks and make component paint chip.



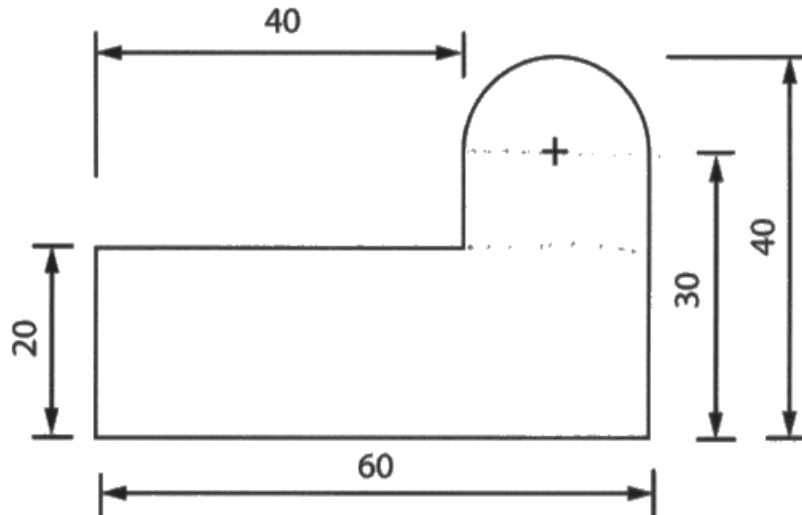
This candidate shows some knowledge by identifying that it provides an even coating (1), with a correct explanation that an uneven painted surface may affect functionality (1). The second response starts with a repeat of the same issue but ends in identifying that paint may chip (1).

Total score = 3 marks.

### **Question 3 (d)**

A large proportion of the candidates were able to successfully solve this calculation and gain the full 6 marks. Of those who did not, most were able to pick up several marks for correct steps, or correct stages with an error carried forward. As with the previous calculation the less complex method of calculating the waste area only was largely overlooked, and candidates went through a number of extra stages to calculate the volume of the block, then subtract it from the original. Both methods lead to the correct answer but the more stages candidates went through, the greater their risk of either getting lost or making an error. If there is a choice, choose the simple method.

(d) Figure 7 shows the end view of a similar component to that shown in Figure 5 before any of the holes have been machined.



(All dimensions are in mm)

Figure 7

The component is 100mm in length.

Calculate the amount of waste material that is removed (excluding any holes) when the component is machined from a single piece of material that is 100 x 60 x 40mm.

Show all of your workings.

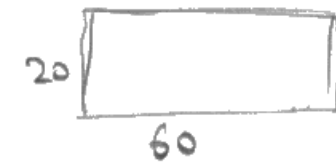
Give your answer in mm<sup>3</sup>.

$$\begin{array}{r}
 100 \\
 \times 60 \\
 \hline
 6000 \\
 \times 40 \\
 \hline
 240000
 \end{array}$$

$$240000 \text{ mm}^3$$

$$\begin{array}{r}
 240000 \\
 \phantom{0}3999 \\
 \phantom{00}3999 \\
 \phantom{000}3999 \\
 \phantom{0000}3999 \\
 \hline
 240000 \\
 - 171416 \\
 \hline
 68584
 \end{array}$$

$$68584$$



$$\begin{array}{r}
 60 \\
 \times 20 \\
 \hline
 1200 \\
 \times 100 \\
 \hline
 120000
 \end{array}$$

$$\begin{array}{r}
 120000 \\
 20000 \\
 \hline
 31416 \\
 \hline
 171416
 \end{array}$$



$$\begin{array}{r}
 200 \\
 \times 100 \\
 \hline
 20000
 \end{array}$$



$$\begin{array}{r}
 20 \\
 \pi r^2 \\
 \pi 10^2 \\
 \pi 100
 \end{array}$$

$$\begin{array}{r}
 \pi 100 \\
 \times 100 \\
 \hline
 31415.92654 \\
 31416
 \end{array}$$

Answer 68584 mm<sup>3</sup>



This candidate has shown all their working and laid it out clearly so it can be followed. All stages shown are correct except that they have not halved the volume of the cylinder. With the error carried forward this single mistake means that they were still awarded 5 of the possible 6 marks.



Think through calculations carefully before you begin, as there may be a simpler route to the final answer which may reduce the risk of mistakes and save you time.

## Question 4 (a)

This question requires candidates to give two relevant characteristics of ABS which make it suitable for the toy building blocks, and then justify each reason twice. This double justification is a new style of question for this specification and aims to test a deeper level of understanding in the higher level candidates. The question can be answered for full marks in two ways: first, characteristics can be justified with two different reasons; second, characteristics can be justified, and this justification can then itself be justified. On the whole it worked well with a minority of the stronger candidates gaining the full 6 marks available. Responses were drawn from across the whole mark scheme with many being correct, although many characteristics were only justified once. Where there was a second justification it was often either incorrect, or was not linked to the characteristic or the justification given, even though it may in itself have been a factually correct statement.

- 4 Figure 8 shows two toy building blocks made from acrylonitrile butadiene styrene (ABS).

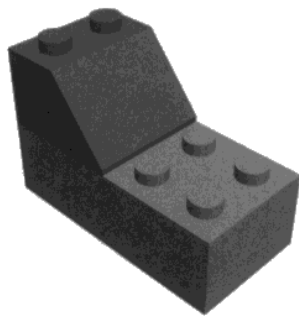


Figure 8

- (a) Explain **two** characteristics of ABS that make it a suitable material for the toy building blocks.

(6)

1. It can come in a wide variety of colours. This ~~helps~~ gives the block a range of bright colours that appeal to kids. The plastic is also smooth and so the child won't be able to cut themselves on any sharp edges of the block.

2. The block is tough. ABS is a tough material meaning it can withstand being indented. This allows it to be dropped or ~~withstand impacts~~ <sup>take</sup> ~~impacts~~ <sup>without</sup> it breaking or being unable to use. ABS can also be moulded into shape making it perfect for the blocks as they could be moulded.



**Response 1** This was awarded 2 marks for recognizing that ABS is available in a range of colours (1), which is justified with increased appeal to children (1). The second justification states that the plastic is smooth which is justified with children not hurting themselves. No marks were awarded for this second part as it is not linked to either the original characteristic of the first justification. However this second characteristic is correct and could have been awarded marks if no second response had been given. In this case a second response is present.

**Response 2** This was also awarded 2 marks for recognizing that ABS is tough (1) so can be dropped without breaking (1). A further correct point concerning it being able to be moulded is also given, but receives no mark as it is unlinked.

Total for the question = 4 marks.

- 4 Figure 8 shows two toy building blocks made from acrylonitrile butadiene styrene (ABS).

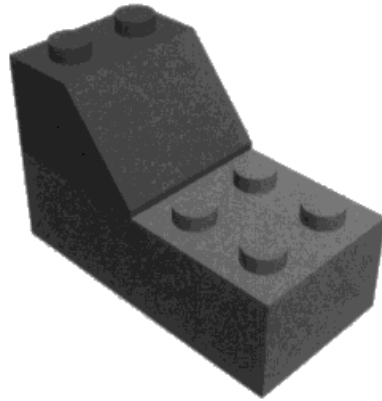


Figure 8

- (a) Explain **two** characteristics of ABS that make it a suitable material for the toy building blocks.

(6)

1 ABS is hard. This means it will be resistant to scratching and scraping which is good as children are prone to damage toys in this way. This also means the pins will not wear away so there will still be tight fittings between blocks

2 ABS comes in a wide range of colours. This means structures that a child will build will have character as they are not just a single colour. Children are very fond of creating colourful objects ~~more~~ as opposed to monochrome designs



**Response 1** – The characteristic given is ‘ABS is hard’ (1) justified with ‘it will be resistant to scratching and scraping’ (1) and a further justification of ‘the pins will not wear away so the blocks remain tight fitting’ (1).

**Response 2** – The characteristic is ‘ABS comes in a wide range of colours’ (1), justified with ‘so structures .... will have character’ (1) and further justified with ‘children are very fond (of this)’ (1).

Total score = 6 marks



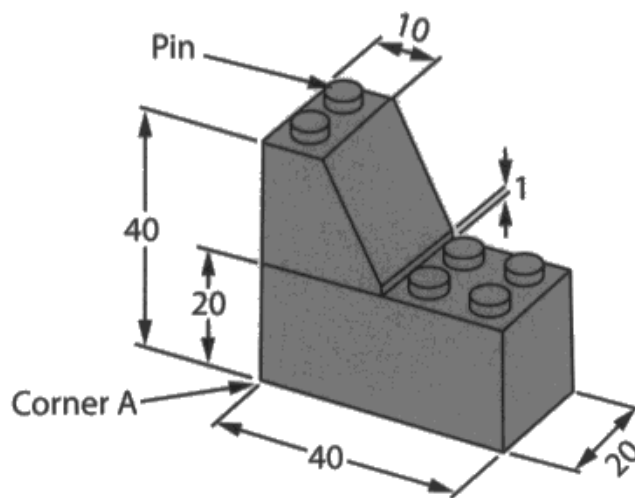
Candidates should take note of the number of marks available for these ‘Explain’ questions. If they are 3 marks per point you must give two justifications for each point made.



## Question 4 (b)

Under this new specification there will be an important focus upon graphical questions, in order to test a wider base of skills among candidates. On the whole most candidates answered this well showing a reasonable understanding of orthographic principles and being able to draw with sufficient accuracy to gain 4+ marks out of the 8 available. Weaker candidates did not understand the importance of view alignment and positioned different views randomly. To gain high marks candidates needed to align the four views appropriately; the views had to be correct with accurate details, and a consistent line style should have been used throughout. A pleasing number of candidates reached the full 8 marks. A small minority attempted to draw oblique or isometric images on the grid.

(b) Figure 9 shows an isometric view of the two blocks.



(All dimensions are in mm)

**Figure 9**

The dimensions of the pins are 6mm in diameter and 2mm in height. The centres of the pins are 5mm from the edges and they are equally spaced.

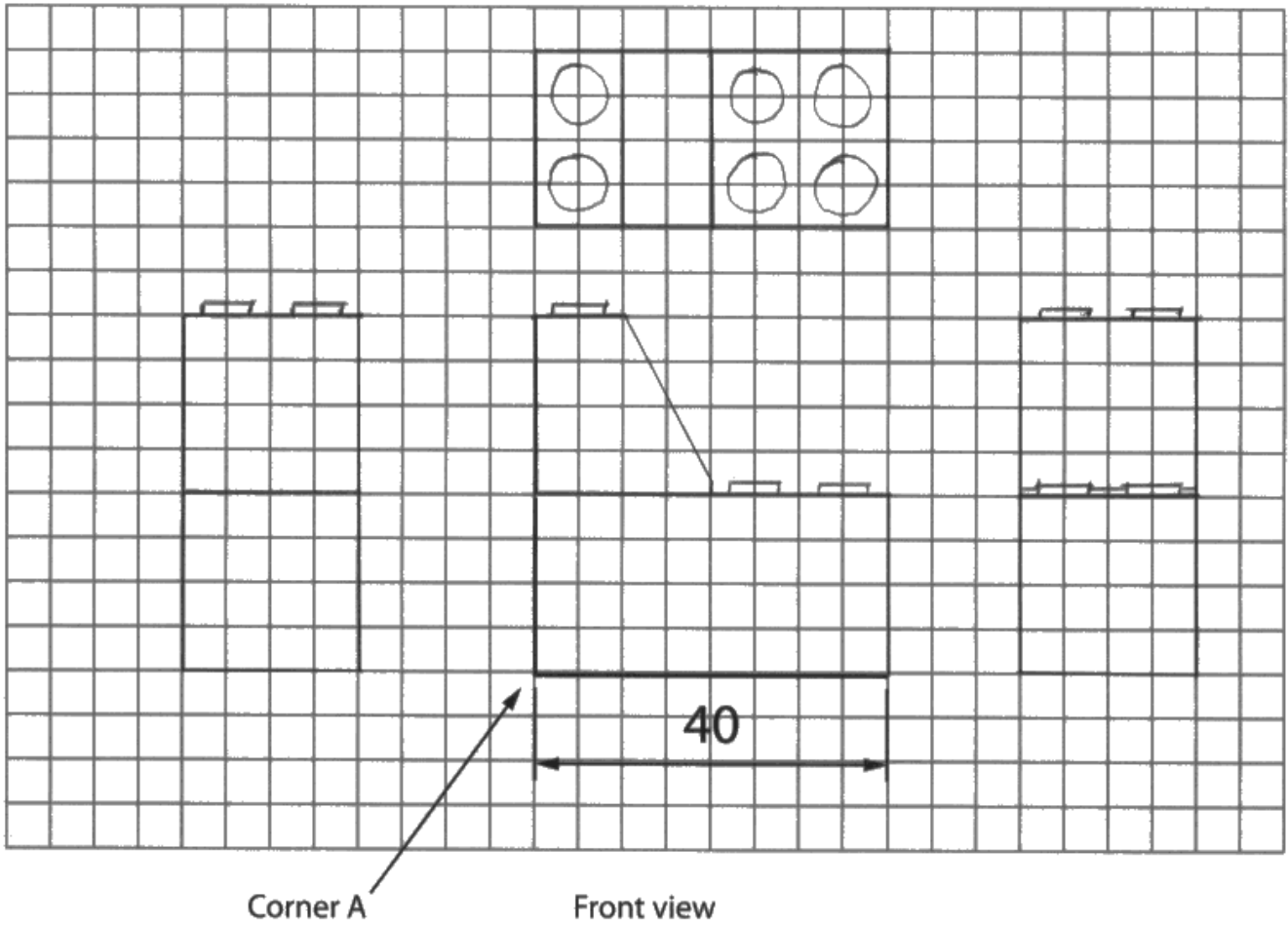
Draw a full size 3rd angle orthographic projection of the two joined blocks on the grid opposite. Each grid square is equivalent to 5mm.

Include both side views and a plan view. Corner A of the front view has been provided for you.

Dimensioning of the drawing is not required.

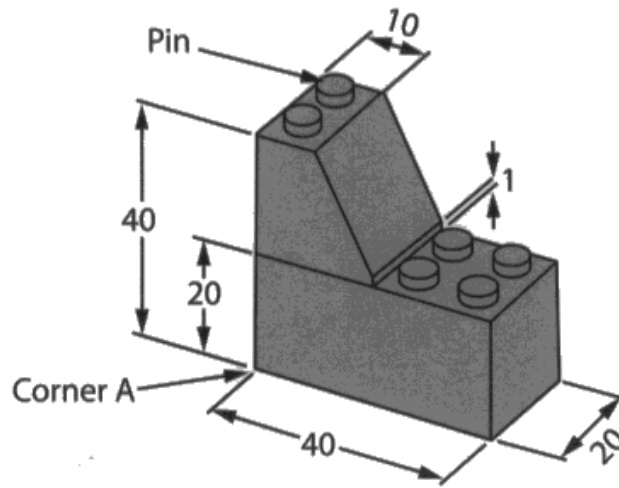
Do **not** show hidden detail.

(8)



This drawing shows all 4 views correctly aligned and accurately drawn with all details shown, although an inconsistent line style has been used as parts of the drawing are barely visible. It was awarded 7 marks.

(b) Figure 9 shows an isometric view of the two blocks.



(All dimensions are in mm)

**Figure 9**

The dimensions of the pins are 6mm in diameter and 2mm in height. The centres of the pins are 5mm from the edges and they are equally spaced.

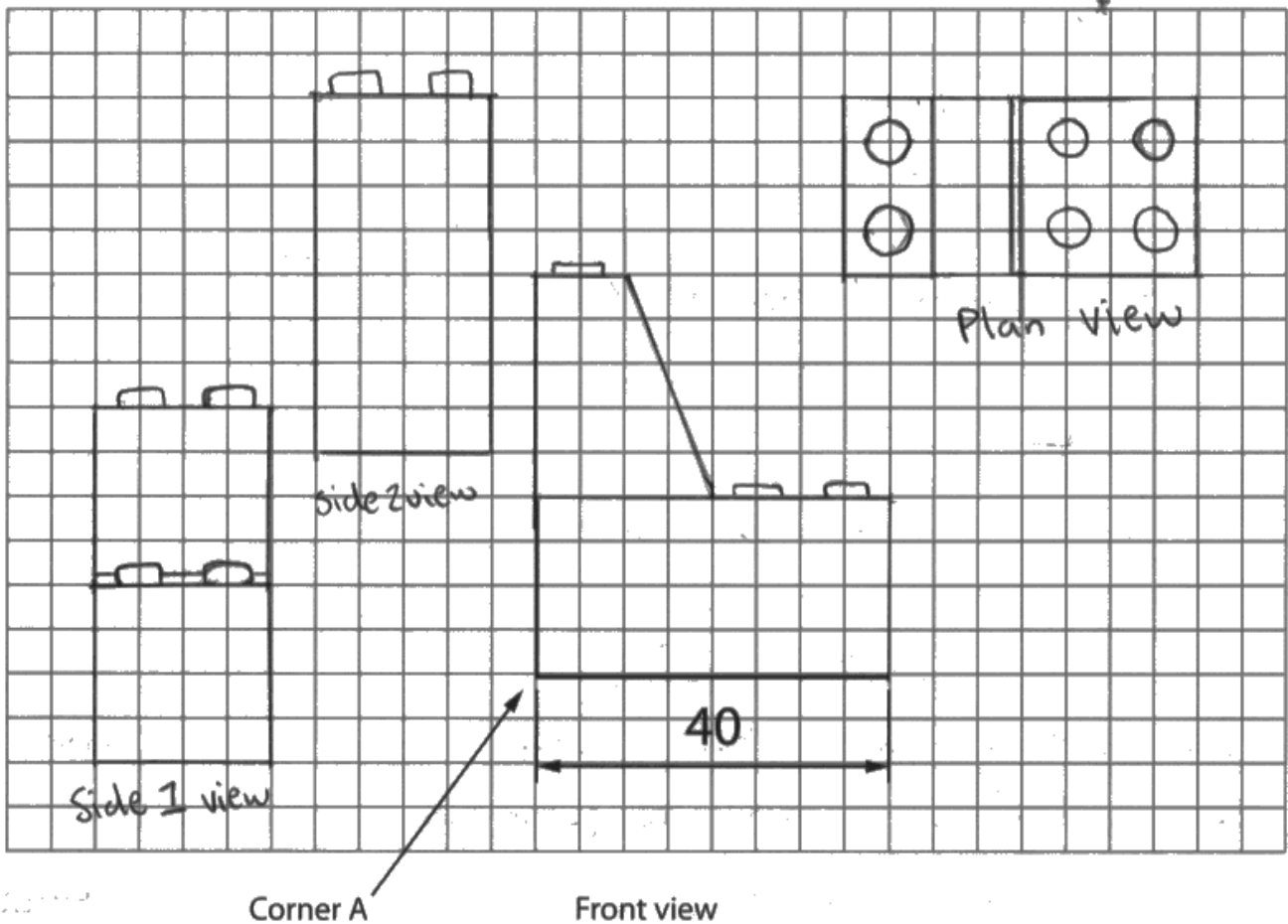
Draw a full size 3rd angle orthographic projection of the two joined blocks on the grid opposite. Each grid square is equivalent to 5mm.

Include both side views and a plan view. Corner A of the front view has been provided for you.

Dimensioning of the drawing is not required.

Do **not** show hidden detail.

(8)



**ResultsPlus**  
Examiner Comments

This response has all 4 views shown which shows an understanding of what orthographic views are. Unfortunately the views are incorrectly aligned, the plan has an extra line and the central view is 5mm (1 square) too tall. This response was awarded 4 marks.



**ResultsPlus**  
Examiner Tip

Practice converting images between isometric, orthographic, perspective and net formats. Take note of the importance of being accurate and using a consistent line style when drawing, as all these features will help you achieve higher marks.

## Question 4 (c)

This question requires candidates to justify the decision to use die casting to manufacture the blocks. Two reasons and an explanation of those reasons are being looked for. Most candidates were able to access the marks scoring 2+ marks for answers that focused on increased speed due to the re-usable nature of the die, or cheap production as no further processing is needed. These were the most common form of answers seen, although all points in the mark scheme were seen reasonably frequently. This indicates that candidates had a good knowledge of the process. A lesser number of candidates struggled to justify the decision giving incorrect answers such as increases weight, reduced weight, and can be made in colours.

Figure 10 shows a solid version of a building block that is part of a key ring. A batch of 5000 blocks is to be made from aluminium using a die casting process.

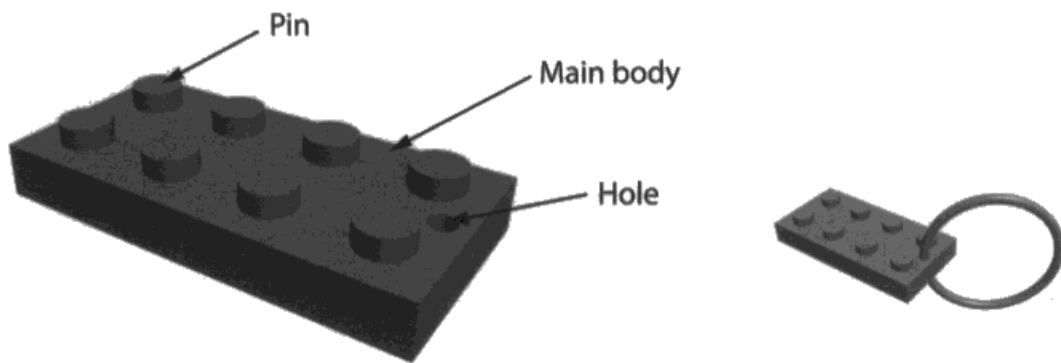


Figure 10

(c) Explain **two** reasons why die casting is the method chosen to make the batch of aluminium building blocks.

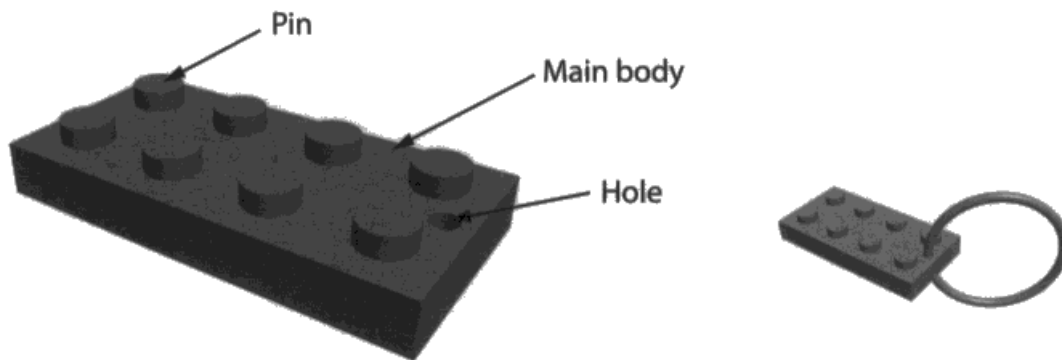
- (4)
1. As die casting is a fast method of production it is selected to create a batch of 5000 blocks as the die can be reused and they can be cooled quickly.
  2. Die casting gives a highly accurate machined surface to the products so it is better aesthetically than sand casting or investment casting.

**Response 1** States 'fast method of production' (1) explained with 'as the die can be re-used' (1).

**Response 2** 'Highly accurate...surface' is taken as the candidate knows that die casting produces a high quality surface finish (1), which is explained with 'so it is better aesthetically' (1)

Total = 4 marks.

Figure 10 shows a solid version of a building block that is part of a key ring. A batch of 5000 blocks is to be made from aluminium using a die casting process.



**Figure 10**

(c) Explain **two** reasons why die casting is the method chosen to make the batch of aluminium building blocks.

(4)

- 1 Die casting has been used as it can support the molten aluminium temperatures as it has a very high melting point compared to other methods of casting.
- 2 As it is a batch of 5000, die casting ~~is~~ is ideal because ~~the~~ once a mould is made, the same mould can be used various amount of times before it needs changed or replaced.



**Response 1** - This is incorrect.

**Response 2** - This scored 1 mark for repeatable use of the mould / die, although why this is a benefit has not been explained.



Candidates should proof-read their own work specifically looking to see if they have justified responses in these types of questions.

### Question 4 (d)

Candidates who attempted this calculation generally showed a logical progression through it and showed their working clearly, which was encouraging. Having said this there were relatively few candidates that reached the end without making an arithmetical error, or who didn't get lost in the steps. This meant that most candidates picked up some marks although few reached the full 6 for the correct answer. Common errors included either forgetting to multiply the pin volume by 8 for the eight pins, or miscounting the pins and multiplying them by 6. The volume of the hole was also a source of error to candidates as many just calculated its area, or incorrectly used 2mm as its depth. There was also a significant minority of candidates that left this question blank.

(d) The table below shows the dimensions in millimetres (mm) of the aluminium building block that is to be die cast and used for the key ring.

	Length	Width	Thickness
Main body	40	20	4
Pins	6 diameter		2
Hole	3 diameter		

Calculate the amount of material necessary to make 5000 building blocks.

(6)

Show all of your workings.

Give your answer in mm<sup>3</sup>.

$$1 = 3,200 + (6 \times 2 \times 6)$$

$$1 = 3,272 \text{ mm}^3$$

$$5,000 = 3,272 \times 5,000$$

$$= 16,360,000 \text{ mm}^3$$

Answer 16,360,000 mm<sup>3</sup>





No working is shown for the volume of the rectangular block, but its correct value of  $3200\text{mm}^3$  is present (1). The volume of the pins has been calculated incorrectly and the volume of the hole has been overlooked. The candidate has multiplied their volume by the number of bricks (5000) which is a correct method with error carried forward (1). Total = 2 marks.



Never leave a question blank, as even doing the simple first steps of a calculation correctly will gain marks.

(d) The table below shows the dimensions in millimetres (mm) of the aluminium building block that is to be die cast and used for the key ring.

	Length	Width	Thickness
Main body	40	20	4
Pins	6 diameter →		2
Hole	3 diameter →		4

mm.

Calculate the amount of material necessary to make 5000 building blocks.

(6)

Show all of your workings.

Give your answer in mm<sup>3</sup>.

1 block.

$$\begin{aligned} \text{Main body } V &= l \times b \times h \\ V &= 40 \times 20 \times 4 \\ V &= 3200 \end{aligned}$$

$$\begin{aligned} \text{Hole} &= \pi r^2 \times \text{thickness} \\ &= \pi 1.5^2 \times 4 \\ &= \cancel{28.27433388} \cdot 9\pi. \end{aligned}$$

$$\begin{aligned} \text{Pin} \times 8 &= \pi r^2 \times \text{thickness} \\ &= \pi 3^2 \times 2 \\ &= 18\pi \\ \times 8 &= 144\pi. \end{aligned}$$

$$144\pi - 9\pi = 135\pi.$$

$$3200 + 135\pi = 1 \text{ block.}$$

$$= 3624.115008.$$

↓

$$\times 5000 \text{ blocks}$$

$$= 181120575.04.$$

mm.

Answer ..... 181120575 mm<sup>3</sup> .....



This response shows a well laid out calculation which has clearly helped the candidate structure their steps and avoid mistakes. It achieved the full 6 marks.



Laying out the steps of a calculation in an ordered sequence will help you maintain a correct thought train and reduce the risk of unnecessary errors occurring.

## Question 5 (a)

This question generated a wide range of responses, including some that allowed a demonstration of a detailed knowledge of the Arts and Crafts Movement. Higher scoring response showed good connections between the stated points, which demonstrated a comprehensive understanding of the concepts, whilst lower quality responses lacked detail and provided limited relevant factors. The most common issues discussed included handcrafted production and 'form follows function', with the more knowledgeable candidates moving into discussions about drawing inspiration from nature, basic / humble styling and the use of natural materials. The stronger candidates were also able to produce prose that linked these issues together in a coherent manner rather than just using basic unrelated statements.

**5 William Morris was an influential designer during the Arts and Crafts period. One of his views was that craftsmanship was an important part of the design and manufacture of products.**

**(a) Discuss how designers of the period were influenced by the principles of the Arts and Crafts movement.**

**(8)**

~~The Arts and Crafts movement~~ Products which follows the Arts and Crafts movement is designed to be more functional, which makes them a function over form product. Simple forms and patterns were inspired by the nature and beauty of natural materials. Products that were designed were simple and proportional and they were heavily influenced by plants, birds and animals. As the products were made by hand, this meant that not everybody could afford as the price of the products were high, due to the products being made by hand, as it takes very long to have one product made.



Although this response is relatively short it raises the issues of 'form follows function', the use of basic form and pattern, the inspiration of nature, the beauty of natural materials, proportion, handcrafted, production time and cost implications. These issues are woven together in a piece of prose that shows a clear understanding of many of the influences of the Arts and Crafts movement. This fairly comprehensive but short response makes good connections between issues, and is an example of a level 3 answer. It was awarded 7 marks. Some candidates were able to give further details still, and were awarded the full 8 marks.



As well as knowledge of the topic, the quality of language used and effective linkage between the points made, are significant contributing factors in the score achieved on these longer 'discuss' questions. Candidates should take the opportunities available to them to develop their extended writing skills in order to maximize their marks.

5 William Morris was an influential designer during the Arts and Crafts period. One of his views was that craftsmanship was an important part of the design and manufacture of products.

(a) Discuss how designers of the period were influenced by the principles of the Arts and Crafts movement.

(8)

Designers of the arts and crafts movement were outlined by a few principles that governed how they designed:

One of these principles was that products should be passed down through generations, and so they must be made to last and be durable. Because of this, many arts and crafts products were made of solid wood and other single piece materials.

Another principle was that the form of a product should be second to its function (form follows function). This means that a product should be designed for its functionality, and that its aesthetics are not as important.



**ResultsPlus**  
Examiner Comments

This response raises the influences of longevity and form follows function. It shows a basic knowledge of the movement although there is some linkage and explanations of the points made. This is an example of a level 1 response and was awarded 2 marks.

## Question 5 (b)

Most candidates were able to access this question and score well. Candidates were required to analyse the William Morris chair and explain features where the influence of 'form follows function' could be seen. The most common answers related to the cushions adding comfort and the wheels adding manoeuvrability. Unfortunately, a significant minority interpreted the question incorrectly and gave opposing points, highlighting where unnecessary added decoration had been used to improve aesthetics. This exemplifies how candidates can lose marks if a question is not directly engaged with, through sufficiently close reading.

William Morris believed that form should follow function.

Figure 11 shows a chair designed by William Morris.



Figure 11

(b) Explain **two** ways in which the chair in Figure 11 exhibits the philosophy that form should follow function.

(4)

1 The wheels on the end of the legs, allow the user to easily move the chair and its position in the room.

2 The slanted and curved legs and arms provide a unique design but makes the chair more comfortable for the user as they can relax and lean back in the chair.



**Response 1** Correct identification of the wheels (1) with correctly linked explanation concerning being able to easily move the chair (1).

**Response 2** Correct identification of the slanted / reclined structure (1) which provides increased comfort (1).

Total score = 4 marks.



William Morris believed that form should follow function.

Figure 11 shows a chair designed by William Morris.



Figure 11

(b) Explain **two** ways in which the chair in Figure 11 exhibits the philosophy that form should follow function.

(4)

1. Since, it is a chair the main function would be so a person can sit comfortably ~~and~~ and ~~the~~ the ~~design~~ ~~for~~ form of this design follows function as the cushion and arm rest allow that.
2. Another function of the chair would be to lean backwards so there is a back rest. This design has a back rest along with cushion so it is also comfortable and therefore the form follows the function.



**Response 1** – The feature of the cushions and arm rests (1) increasing comfort (1).

**Response 2** – The feature of the back rest leaning backwards (1) justified with 'comfort'

Which is a repeat of the justification used in response 1.

Total score = 3 marks.



Candidates should be aware of repeating themselves. Points will only be awarded once, so different justifications need to be used.

## Question 6

A large number of candidates failed to score marks on this question. This could be suggestive of an incomplete understanding of the principle of obsolescence among the cohort collectively. Some candidates just described the principle of obsolescence, some confused it with the repair-ability of products, and a significant number of candidates gave no response at all. Successful responses focused mainly on the benefit of keeping consumers up to date with modern technology, and having a wider choice of products when upgrading / replacing. In order to score well candidates needed to identify two benefits and justify each benefit twice in order to achieve the full 6 marks. A small number of candidates achieved this.

### 6 Built-in obsolescence has had a number of varied effects on society.

Explain **two** positive effects built-in obsolescence has had for the consumer.

(6)

- 1 Due to built-in obsolescence the companies make sure their product is <sup>of</sup> a high quality so the customers are loyal to the company and purchase a new product everytime it is released. This allows the customer to get products of high quality everytime a new one is released.
- 2 Built-in obsolescence increases the ~~compet~~ competition as all the companies want to attract customers and want them to stay loyal. Due to this the companies reduce the price of their product so customers have a wider range of options ~~at~~ for a better price.

**Response 1** The candidate has focused on consumer loyalty rather than obsolescence, although 'every time it is released' shows sufficient understanding that companies frequently release new products (1).

**Response 2** The candidate has identified that increased competition (1) leads to reduced prices (1) which also can lead to them having a wider range of options (1). This illustrates a correct point and two correct justifications of that point.

Total score = 4 marks.

**6** Built-in obsolescence has had a number of varied effects on society.

Explain **two** positive effects built-in obsolescence has had for the consumer.

(6)

1 <sup>built-in</sup> ~~product~~ obsolescence pushes the creating companies to push for a newer and better version, this means the customer each year will get better and better products, this increases the customer satisfaction.

2 built-in obsolescence also stops the user from using the product dangerously as if it can break softly and possibly in one way it prevents it from breaking catastrophically in another way which might lead to injury or even death.



**Response 1** – The candidate has correctly stated that the 'creating company will push for a new and better version' (1). This has been justified with 'the customer will get a better and better product' (1), which is further justified with increased customer satisfaction (1).

**Response 2** – The candidate has described a situation where a product breaks 'safely' in order to stop it breaking 'dangerously' which would protect the consumer. This could have gone in an appropriate direction, but it is too vague at this point to be awarded marks.

Total score = 3 marks.

## **Question 7**

This final question is synoptic in its nature, and as such should draw on a wide range of understanding from across the specification, rather than examining a focused area of knowledge. Candidates are encouraged to analyse the two tin openers on a range of levels which should include function, aesthetics, ergonomics, anthropometrics, safety, maintenance, and economics. From this analysis they should be able to present balanced arguments for and against each product which are backed up by facts rather than subjective opinions. The greater range of issues perceived and discussed, with insightful connections being made which are backed up by evidence and lead to sound conclusions, the higher marks will be achieved.

A full range of responses were seen: from well argued, detailed evaluations; to limited, poorly constructed, responses. Some of the common issues encountered were that candidates did not give a wide enough range of factors, or dwelled too long on the same point, often repeating it over and over again. Product evaluations need to be practised and should come naturally to candidates studying this specification.

7 Figure 12 shows two tin openers and two specification points for each.

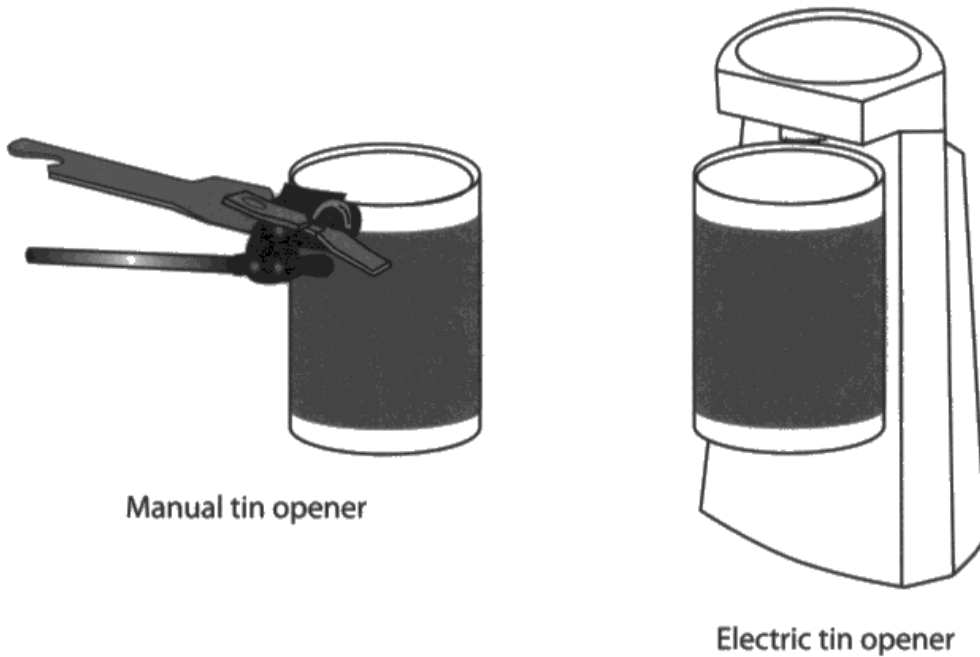


Figure 12

	Manual tin opener	Electric tin opener
Power	Hand	Battery
Weight	200 grams	1 kg

Evaluate the user requirements of the two tin openers with reference to everyday use in a family home.

(12)

The manual tin opener is a quick and convenient, lightweight tool that allows the user to open the lid on a tin can. The user must stick the opener in the lid using the pivoted handle to squeeze the opener in then using force, ~~if~~ turn the screw type handle to allow the opener to brushly cut the lid open. The downside to this tool is that it may not always be effective.

Due to human error this tool may fail to open the can. On the otherhand the tool itself can become (~~is~~ ~~not~~) difficult to cut the lid as over time it may wear away or become blunt, ~~and~~ leaving it only indent the lid instead of cutting it. The ~~a~~ user must be capable (~~of~~) ~~of~~ opening the lid with force and some people may struggle with using this type of tool.

Compared to the manual tin opener, the electric tin opener is far more reliable than the manual as all the user has to do is insert the tin and turn the machine on. The electric tin opener reduces human error making it more consistant than the manual one.

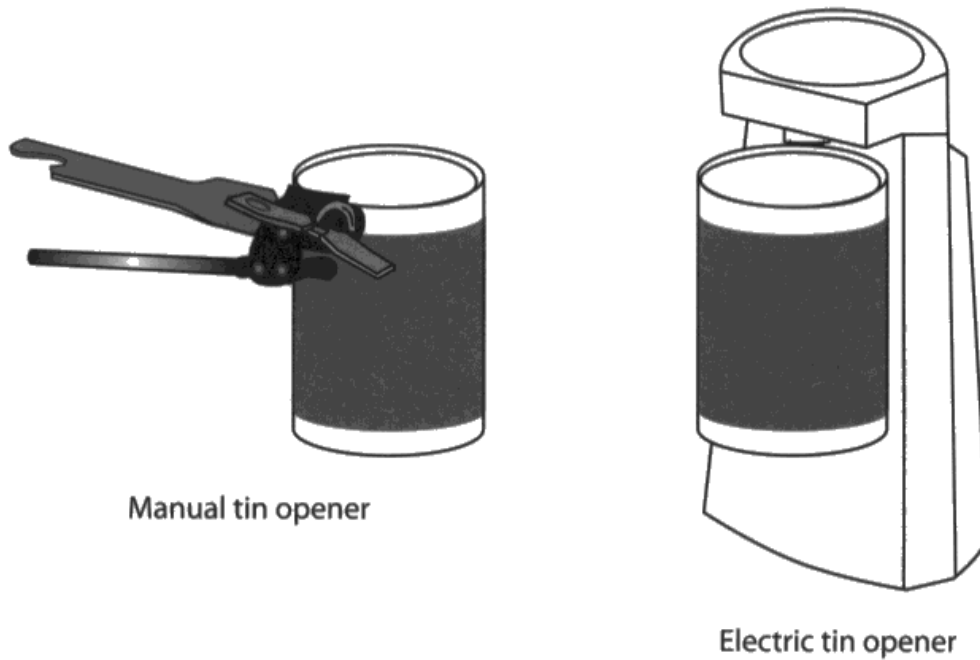
Since the electric one is battery powered the user will not have to use any ~~a~~ force to open the lid, making the electric tin opener superior at ~~some~~ user convenience. However due to it's weight it is less portable than the manual tin opener, ~~making~~ making moving it less convenient ~~of~~ for the user. Overall the electric tin opener is more efficient than the manual tin opener ~~of~~ for the user as it is more consistant and convenient for the user.





In this response the issues evaluated are weight, force required / battery powered, reliability, working life, and portability. These issues have been discussed relating where appropriate to both tin openers with a number of positive and negative points being made. The structure of the evaluation flows reasonably well with largely clear connectivity. There is factual information presented although some is subjective opinion, such as the points concerning reliability. This response fits into level 2 although it is quite strong so was awarded 6 marks.

7 Figure 12 shows two tin openers and two specification points for each.



**Figure 12**

	Manual tin opener	Electric tin opener
Power	Hand	Battery
Weight	200 grams	1 kg

Evaluate the user requirements of the two tin openers with reference to everyday use in a family home.

(12)

The first reason that the manual tin opener is more suitable for a family home is the cost. The electric tin opener requires more materials as well as electronic components which will make it a more expensive, unnecessary luxury for a typical family. Another reason that the manual tin opener is more suitable is because of its size. A family home often has minimal worktop space so they require a smaller item which doesn't clutter the kitchen. The manual opener is also more environmentally

friendly because it uses metal which is more widely recycled than plastic. The issue of sustainability is becoming more important to modern families as our resources begin to run out. A family ~~to~~ will require the tin opener to be lightweight making it simple easy to handle and use. The battery powered opener works ~~for~~ 5 times more than the manual opener so a family ~~a~~ (especially with young children) are more likely to use a lighter device. The manual tin opener is more cost effective because it is cheaper to replace than the battery powered opener which is more likely to break ~~and cost more~~ <sup>due to it's more complicated</sup> parts. However, in a family home, the design of a product is very important. Therefore they may prefer the simple lines and curves <sup>of</sup> the electric can opener rather than the manual opener which is considerably less aesthetically pleasing. ~~Finally~~, the manual opener is much easier to store and clean than the electrical opener as it could be hard to remove food or liquids from the electric opener which may also require disassembly. Overall, I believe that the manual opener meets the requirements of a family home because it is simple to use and <sup>cheaper</sup>.



This response discusses a wider range of issues which include economics, size, storage, environmental impact, weight, range / ability of users, reliability, aesthetics and ease of cleaning. Each of these issues is supported by reasoning, much of which is factual. The candidate has shown insight into issues such as how families may store the tin openers, and issues that may occur when cleaning them. Balanced arguments have been presented that address wide ranging issues using insightful connections. This response fits level 4 and was awarded the full 12 marks.



- Candidates should learn the headings used when writing a specification, and use as many of these as are relevant to evaluate the products presented.
- Use factual evidence where available to justify their points rather than just opinions.
- Arguments should be presented clearly and succinctly with clear linkage in the prose.
- Candidates should avoid repeating a small number of issues over and over again.

## Paper Summary

Generally candidates responded well to this year's paper. Few blank responses were seen indicating good coverage of the specification, and most candidates gained some, if not high, marks on the extended writing questions. Many answer plans were also seen for these longer questions with strong, well-structured responses following. The calculations are one of the new features of these papers. Although on the whole they were attempted reasonably well, candidates need to follow the advice given earlier in order to ensure their marks fully reflect their ability.

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

- Some candidates will benefit from reading questions more carefully and underlining important words.
- Candidates should have a clear understanding of the different command words so that they can focus their responses appropriately.
- Candidates should lay out solutions to calculations in a logical manner and show all their working.
- Accuracy and use of a consistent line style is important in drawing questions.
- Candidates should ensure that all their answers are justified when the command word 'Explain' is used. Also note that some questions now require two justifications.
- When questions require multiple responses, candidates must ensure that each point made is different knowledge, not the same or similar knowledge in different words, which will be treated as a repeat.
- With the extended writing questions candidates are further encouraged to use the top few lines of the answer space to generate a small plan of the points they intend to make.

## 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>



