

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel**  
**Level 1/Level 2 GCSE (9–1)**

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**Friday 22 May 2020**

Afternoon (Time: 1 hour 45 minutes)

Paper Reference **1DT0/1D**

**Design and Technology**  
**Component 1: Systems**

**You must have:**

Calculator, ruler, HB pencil, protractor, compass

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You should **show all your working out** with **your answer clearly identified** at the **end of your solution**.

### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

**SECTION A – CORE**

**Answer ALL questions. Write your answers in the spaces provided.**

- 1 (a) The materials that products are made from are chosen because of their properties.

Figure 1 shows a table of products.

For each of the products shown, give a property of the material it is made from that makes the material suitable for the product.

The first one has been done for you.

Picture of product	Material and product	Property
	Polyester school tie	Crease resistant
	Brass garden tap	(1) (i) .....
	Acrylic soap tray	(1) (ii) .....
	Folding box board breakfast cereal box	(1) (iii) .....
	Beech kitchen steps	(1) (iv) .....

**Figure 1**

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(b) The school tie is made from a piece of fabric measuring 135 cm long by 9 cm wide.  
The fabric is supplied in a roll that is 90 mm wide and costs £3.55 per metre.  
The fabric can be bought to the nearest cm.

Calculate the cost of fabric required to make one tie giving your answer in pounds (£) to 2 decimal places (dp). (2)

Cost £.....

(c) An advantage of using polyester for the school tie is that it is crease resistant.  
Explain **one** other advantage of using polyester for the school tie. (2)

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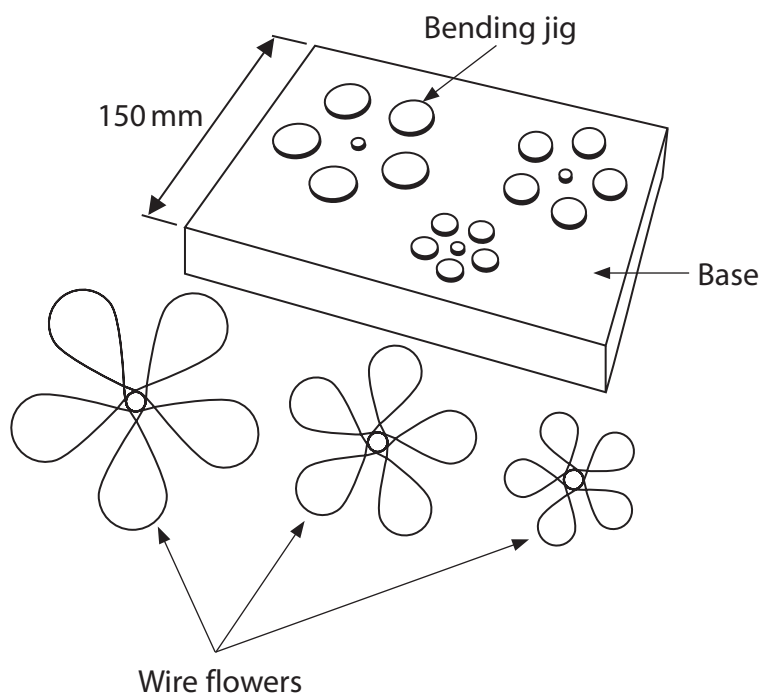
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**(Total for Question 1 = 8 marks)**



- 2 Figure 2 shows a bending jig that is used to make three separate, different-sized wire flowers for some jewellery.

The flowers are formed by wrapping copper wire around the different-sized circles.



**Figure 2**

- (a) Name **one** manufactured timber that could be used to make the base of the bending jig.

(1)

- (b) Prototype wire flowers were made using shape memory alloys (SMAs) to test the design before producing the final product from copper wire.

Explain **one** reason for using SMAs to make the prototype wire flowers.

(2)

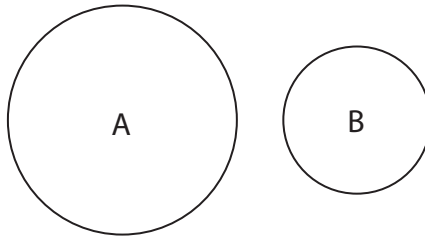


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Figure 3 shows two of the circles used on the bending jig.



**Figure 3**

Diagram not to scale

The two circles have different diameters in the ratio of 5:3.

(c) (i) Calculate the radius of circle B if circle A has a radius of 35 mm.

(2)

Radius of circle B ..... mm

(ii) Calculate the area of circle A giving your answer to the nearest  $\text{cm}^2$ .

(2)

Use  $\pi = 3.142$

Area of circle A .....  $\text{cm}^2$



(d) Explain **one** reason why copper wire was used to make the flowers.

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**(Total for Question 2 = 9 marks)**

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3 Figure 4 shows a games controller.

The case is made from high impact polystyrene (HIPS).



Figure 4

(a) Other than impact resistance, give **one** property of HIPS that makes it an appropriate material from which to make the case.

(1)

(b) The games controller is only sold online and is sent through the post in a corrugated board package.

Explain **one** reason for using corrugated board to make the package.

(2)



(c) The manufacturer is developing a new games controller that uses robotic materials.

Explain **one** way that robotic materials can be used in the new games controller.

(2)

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(d) The original games controller cost £12.50 and the new games controller costs £19.00.

Calculate the percentage increase in the cost of the new games controller.

(2)

Percentage increase ..... %

(e) Explain **two** environmental issues related to the development and release of the new games controller.

(4)

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**(Total for Question 3 = 11 marks)**





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4 Figure 5 shows a picture of a firefighter.



(Source: © John Kasawa/Shutterstock)

**Figure 5**

The firefighter's uniform has electronic sensors built into it to detect heat.

(a) Name an electronic sensor that is used to sense heat. (1)

(b) The firefighter's uniform is made from protective textiles.

Explain **one** disadvantage for the firefighter of wearing a uniform made from protective textiles. (2)

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(c) The firefighter's uniform contains an electronic system which is powered by a small 9V battery.

(i) Draw the circuit symbol for a battery in the space below.

(1)

Figure 6 shows some information about the battery and the consumption rate for the electronic system used in the firefighter's uniform.

Analyse the information.

Battery capacity (mAh)	1000
Load current (mA)	350
Consumption rate	0.7

**Figure 6**

(ii) Calculate the battery life for the electronic system used by the firefighter's uniform.

Use the formula below to calculate the answer.

Give your answer in minutes.

(2)

$$\text{Load current (mA)} = \frac{\text{Battery capacity (mAh)} \times \text{Consumption rate}}{\text{Battery life (hours)}}$$

Battery life ..... minutes



(d) Discuss the use of video conference meetings by companies around the world to develop new technologies for firefighters.

(6)

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Dotted lines for writing.

(Total for Question 4 = 12 marks)

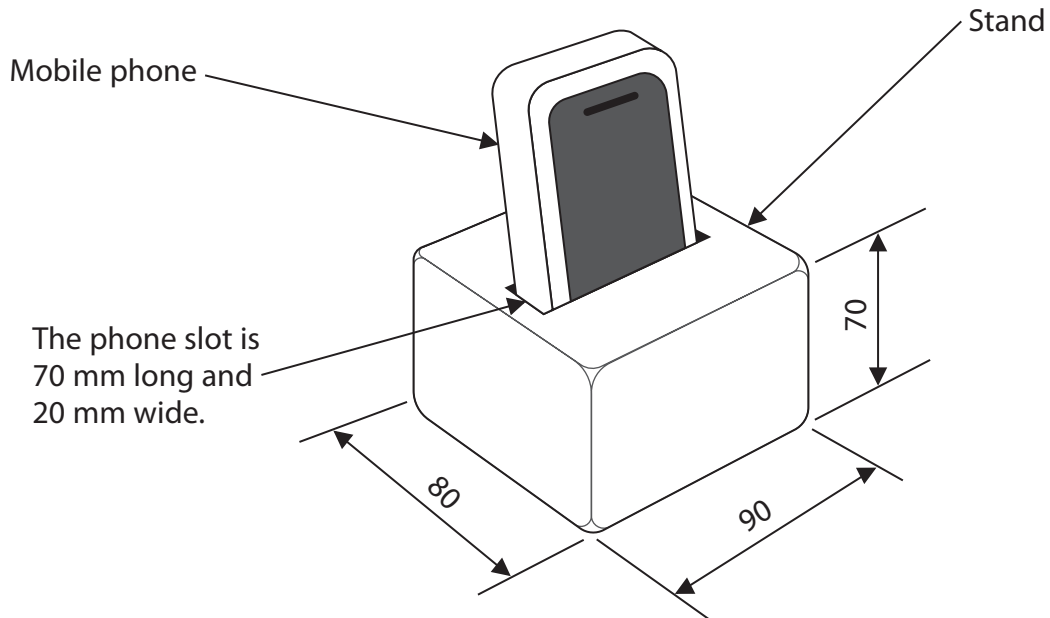
**TOTAL FOR SECTION A = 40 MARKS**



## SECTION B – SYSTEMS

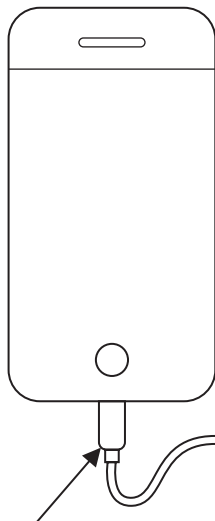
Answer ALL questions. Write your answers in the spaces provided.

- 5 Figure 7 shows a design solution for a stand that holds a mobile phone together with some additional information.



Additional information

Portrait position



Landscape position



Charging cable



When trying to store the phone in the stand to charge it, the cable gets in the way.

All dimensions in mm

Figure 7

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(a) The stand needs to be improved to include the following specification points.

The stand must:

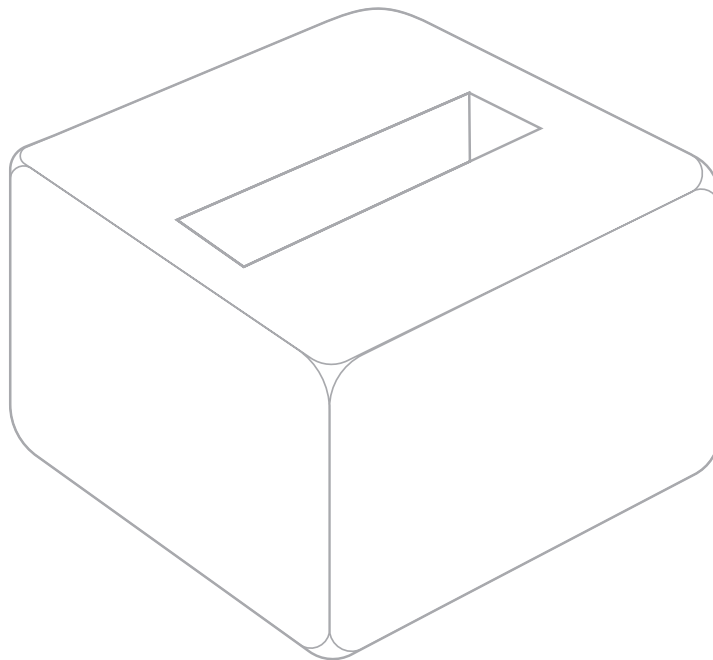
- provide a means of holding the phone in both the portrait and landscape positions when on charge so that the cable does not get in the way
- provide an easily accessible storage space for the cable when it is not in use
- provide a means of alerting the user with an audible output when the mobile phone is removed from the stand.

Use notes and sketches to show how the stand could be modified to include these three specification points.

You will be marked on how you apply your understanding of design and technology, not your graphical skills.

Use the outline of the original design solution to show your modifications.

(6)



(b) Figure 8 shows a garden soil moisture sensor.

It displays the moisture level in the garden soil using a seven-segment LED display.

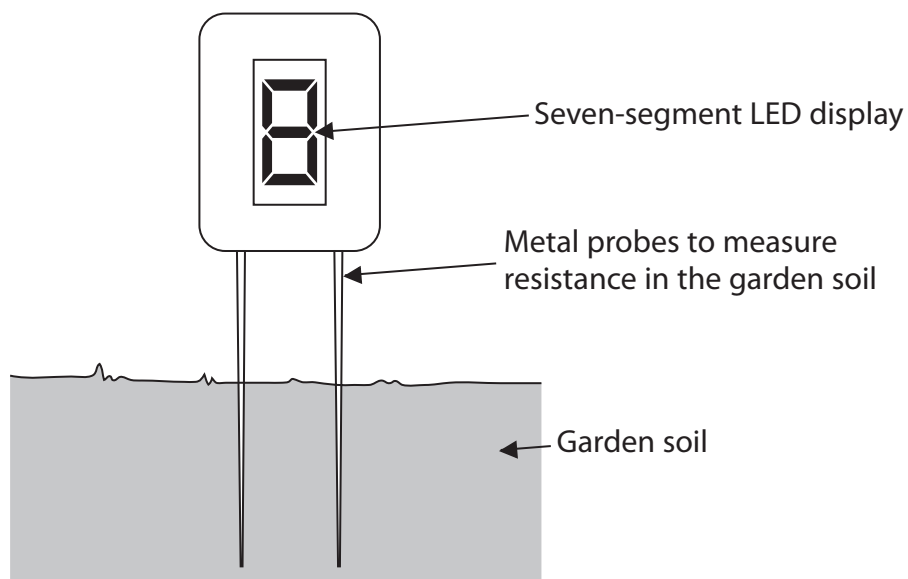


Figure 8

Explain **two** ways that the seven-segment LED display meets or fails to meet the criteria of providing a method to show the moisture level in the garden soil.

(4)

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(Total for Question 5 = 10 marks)



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6 Figure 9 shows a prototype solar powered garden light.

Some solar cells contain scarce elements.

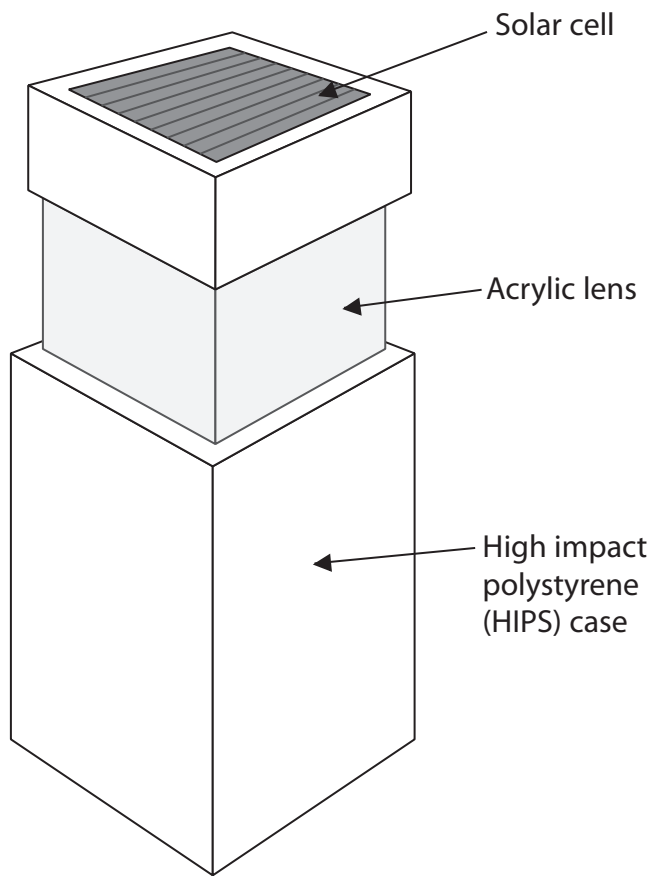


Figure 9

(a) Explain **two** availability factors that could result in scarce elements becoming even more difficult to source.

(4)

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(b) The prototype case is made from HIPS that has been painted.

Use notes and sketches to show how the surface of the HIPS case should be prepared and painted.

You will be marked on how you apply your understanding of design and technology, not your graphical skills.

(4)





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Figure 10 shows part of the circuit diagram for the electronic circuit for the solar powered garden light.

The LED requires 3V @ 20mA to light up.

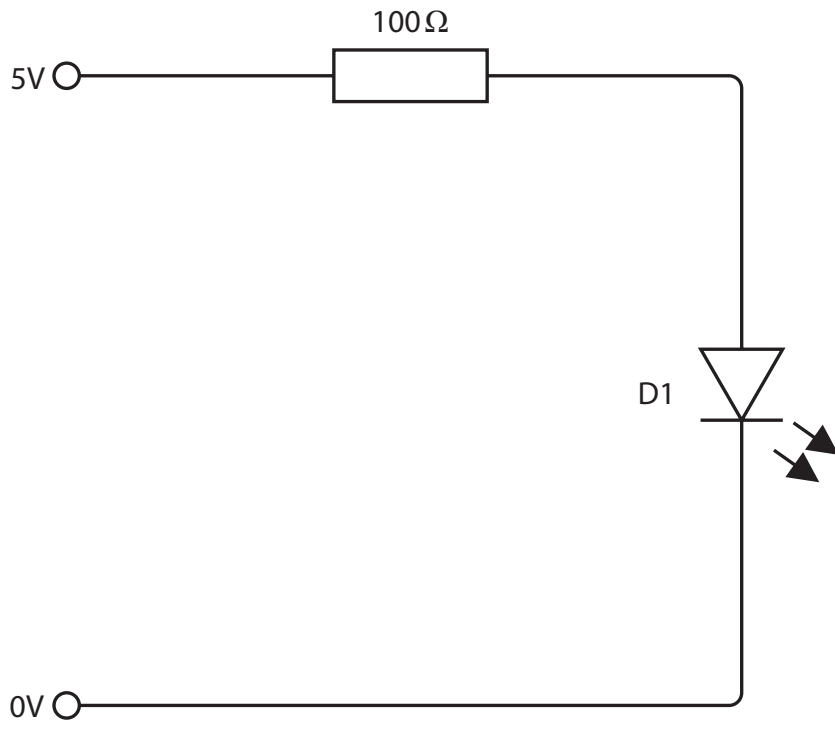


Figure 10

(c) Explain why a resistor with a value of 100Ω is used in this part of the circuit.

(2)

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(d) The lens of the solar powered garden light is made from acrylic.

Give **two** different properties of acrylic that make it an appropriate choice of material for the lens.

For each property, explain **one** advantage of using acrylic for the lens.

(6)

Property 1

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Explanation

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Property 2

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Explanation

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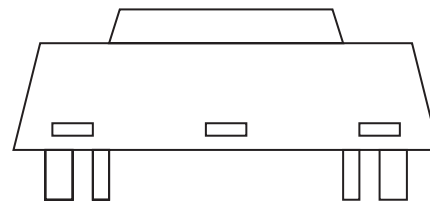
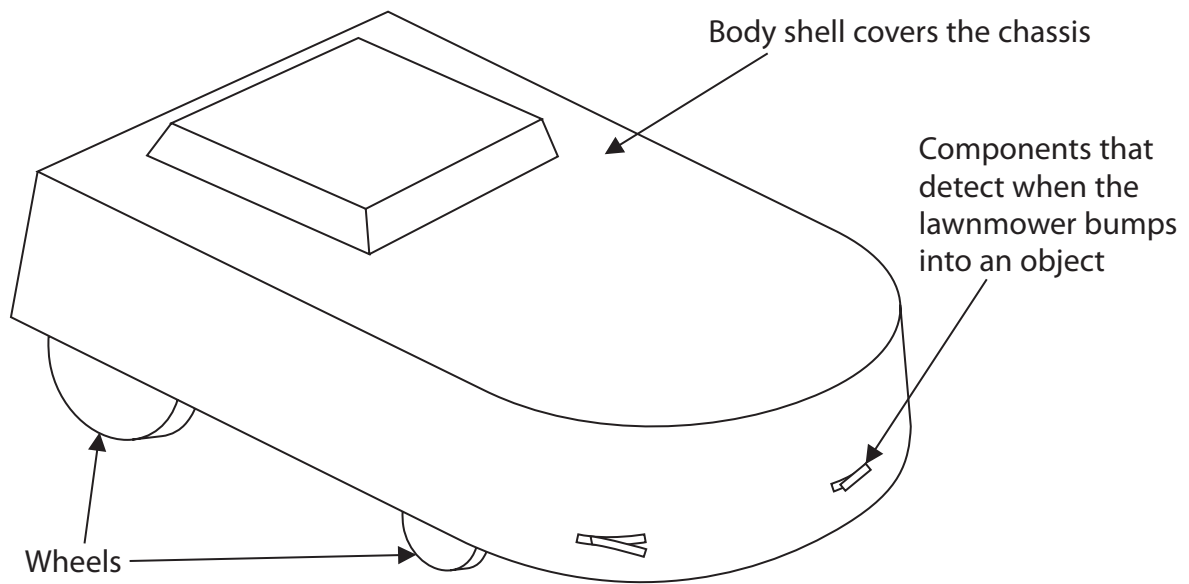
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**(Total for Question 6 = 16 marks)**

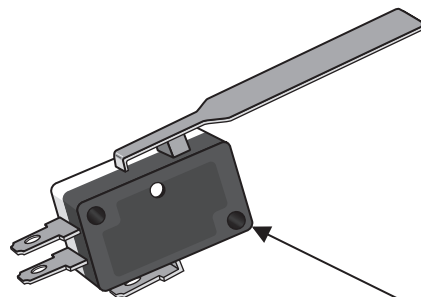


7 Figure 11 shows a robotic lawnmower.

The robotic lawnmower moves around the garden cutting the grass.



FRONT VIEW



One of the components that detect when the lawnmower bumps into an object

**Figure 11**

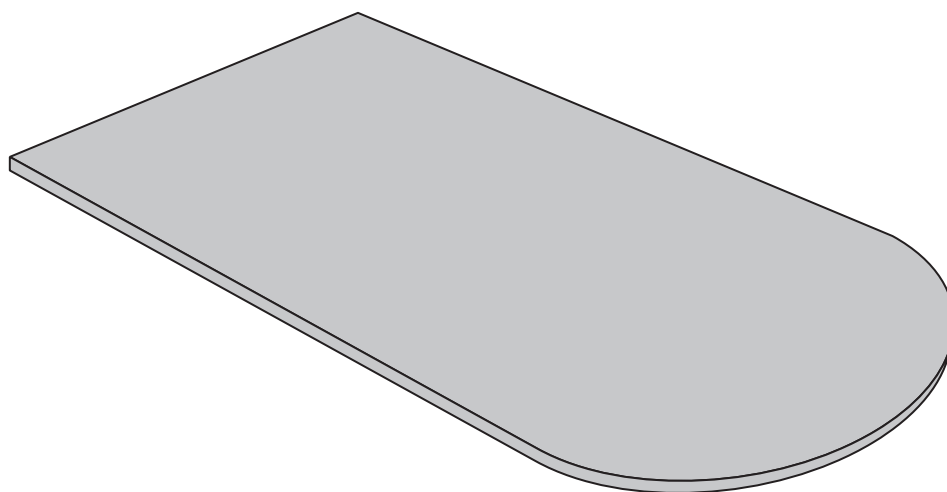
(a) Name the specific component shown in Figure 11.

(1)



The body shell is attached to the chassis and will form the bottom of the robotic lawnmower.

Figure 12 shows a template used to mark out the chassis of the robotic lawnmower.



**Figure 12**

(b) Explain **two** advantages of using a template to mark out the chassis when manufacturing in large quantities.

(4)

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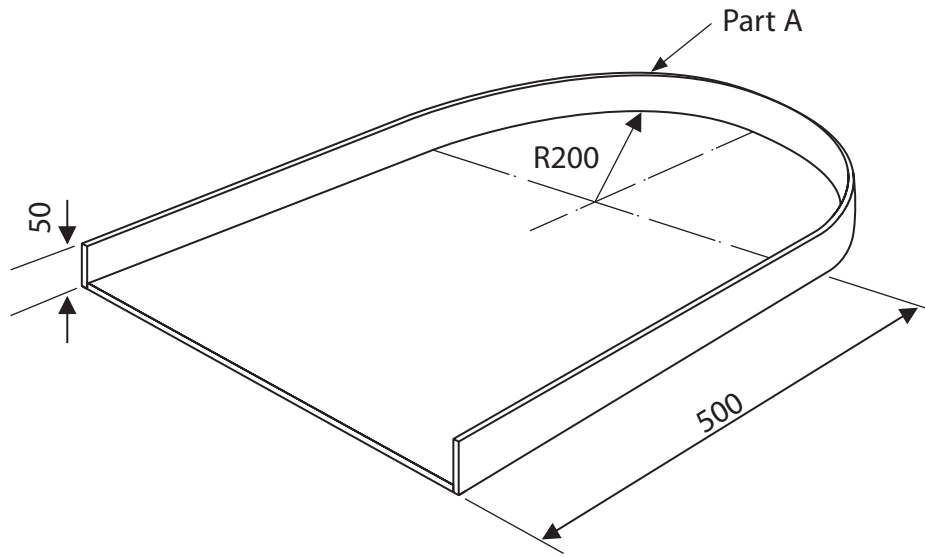
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Figure 13 shows the dimensions for the chassis.

An edge strip, Part A, has been added so the body shell can be attached to the chassis.



All dimensions in mm

**Figure 13**

Use  $\pi = 3.142$

Curved surface area of an open cylinder =  $2\pi rh$

- (c) Calculate the whole internal surface area of Part A, the edge strip, that goes around the chassis as shown.

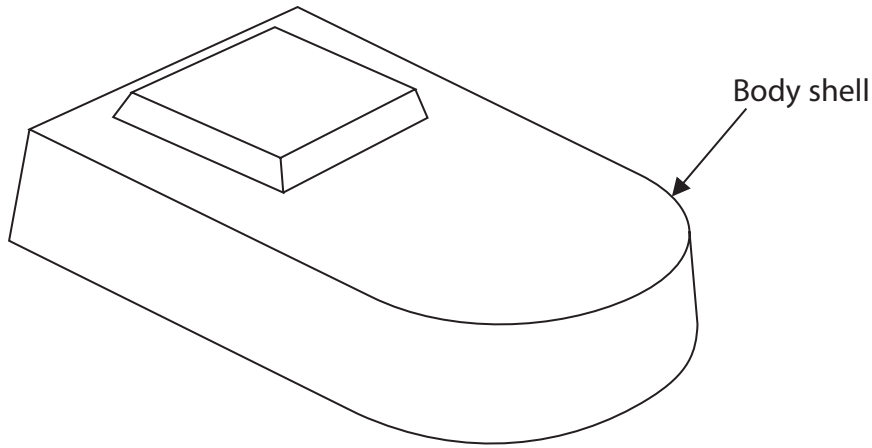
Give your answer to the nearest whole  $\text{cm}^2$ .

(5)

Answer .....  $\text{cm}^2$



The body shell shown in Figure 14 has been manufactured using the vacuum forming process.



**Figure 14**

(d) Explain **two** reasons for using the vacuum forming process to manufacture the body shell.

(6)

1 .....

2 .....

**(Total for Question 7 = 16 marks)**



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8 Figure 15 shows the body of a remote-controlled drone. Some of the components are made from aluminium.

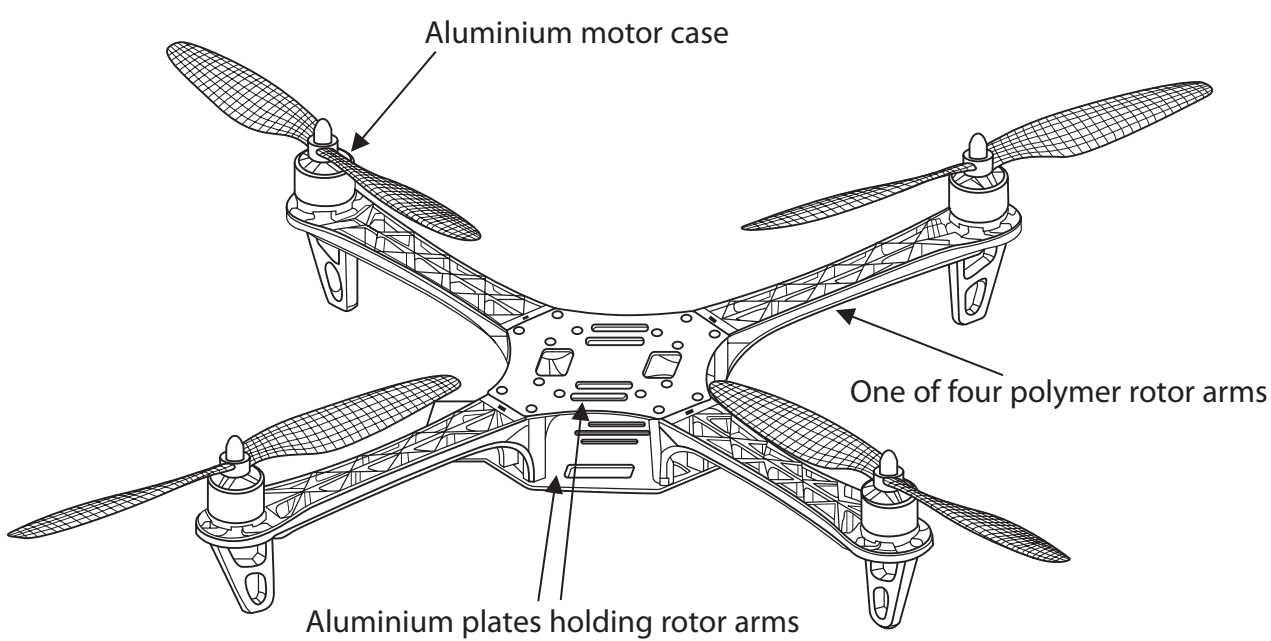


Figure 15

(a) Explain **one** reason for anodising the aluminium components.

(2)

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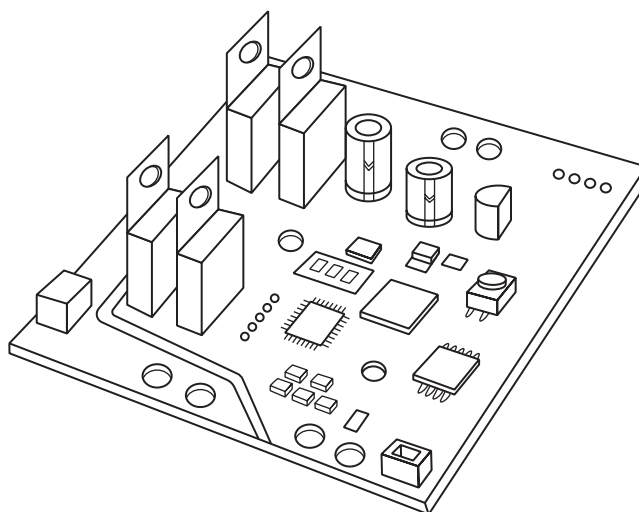
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Figure 16 shows an electronic circuit.

The electronic circuit will be attached to the middle of the drone.



**Figure 16**

- (b) The electronic circuit uses a mixture of surface-mount technology (SMT) components and through-hole components.

Explain **one** reason for using through-hole components in the drone circuit.

(3)

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(c) Explain **two** ways that the requirements of the Restriction of Hazardous Substances (RoHS) directive must be applied when choosing materials for the drone.

(4)

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(d) The drone is manufactured in China and transported all around the world.

Figure 17 shows information about the drone.

<b>Scale of production</b>	Mass
<b>Potential market</b>	Children aged 8+, world wide
<b>Life span</b>	2 years
<b>Power</b>	Rechargeable battery
<b>Surface finish</b>	Anodised aluminium, untreated polymers

**Figure 17**

Analyse the information in Figure 17.

Evaluate the drone with reference to cultural and ethical factors including:

- suitability for intended market
- the consumer society
- built-in product obsolescence.

(9)



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**(Total for Question 8 = 18 marks)**

**TOTAL FOR SECTION B = 60 MARKS**

**TOTAL FOR PAPER = 100 MARKS**



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