

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 **1DT0/1C**

Design & Technology
Component 1: Polymers

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 must **show 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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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.

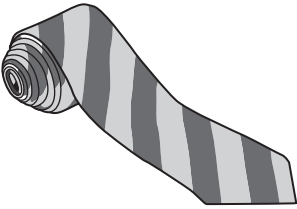
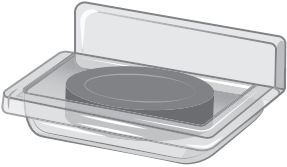

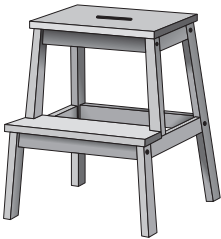
| Picture of product | Material and product | Property |
|---|--|--------------------|
|  | Polyester school tie | Crease resistant |
|  | Brass garden tap | (1) (i) |
|  | Acrylic soap tray | (1) (ii) |
|  | Folding box board breakfast cereal box | (1) (iii) |
|  | Beech kitchen steps | (1) (iv) |

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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(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.

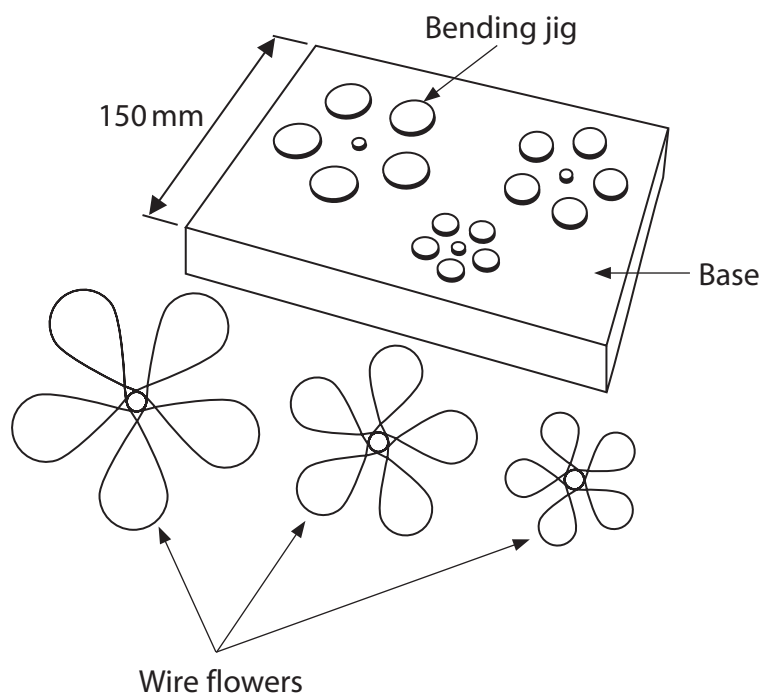


Figure 2

- (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.

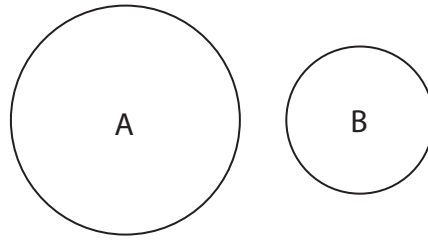


Figure 3

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 cm^2 .

(2)

Use $\pi = 3.142$

Area of circle A cm^2



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

(2)

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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)



(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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(Total for Question 4 = 12 marks)

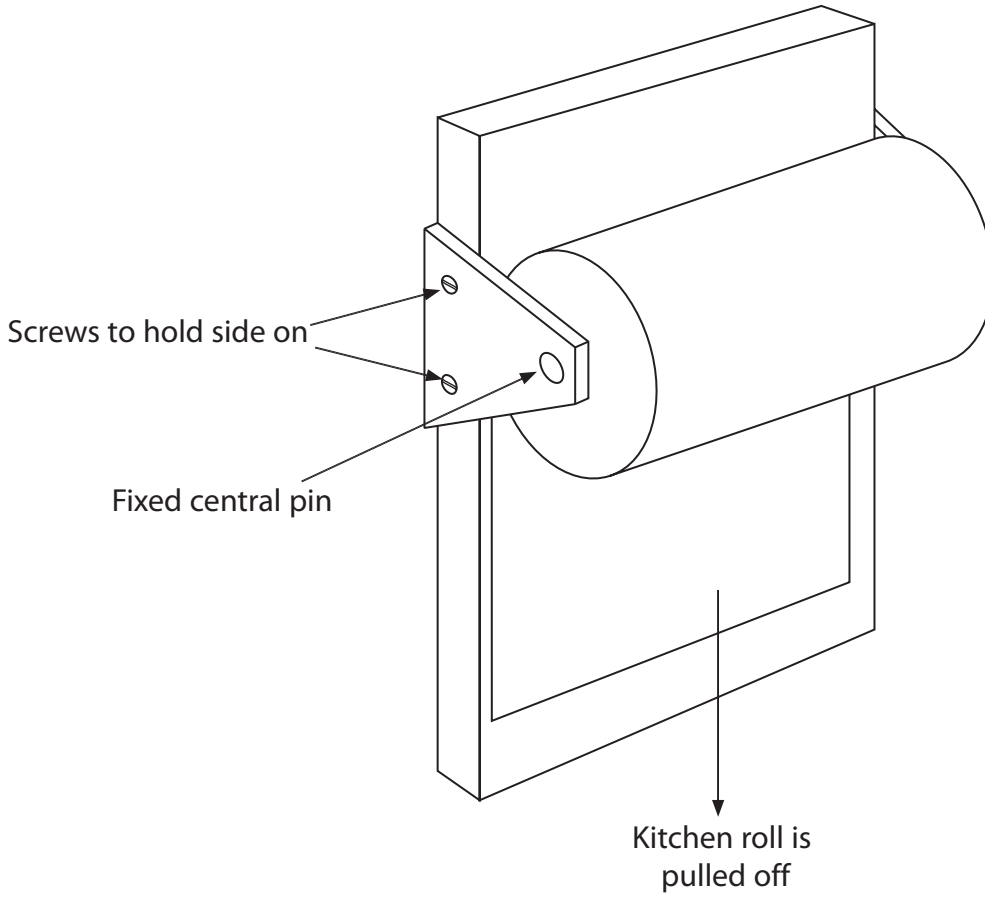
TOTAL FOR SECTION A = 40 MARKS



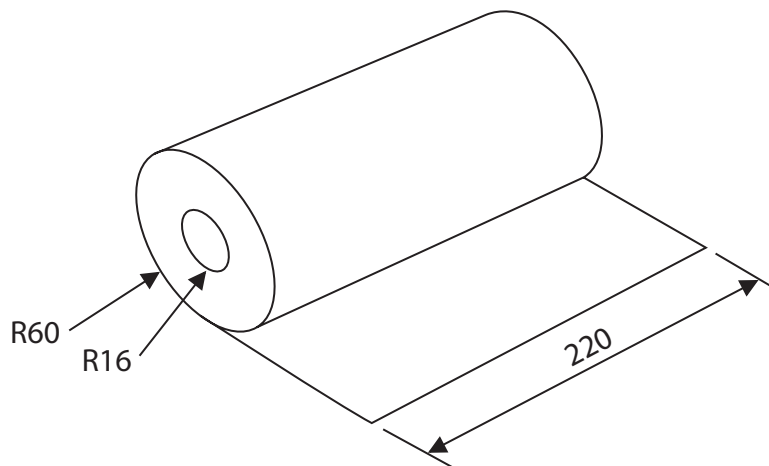
SECTION B – POLYMERS

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

- 5 Figure 7 shows a design solution for a kitchen roll holder together with some additional information.



Additional information



All dimensions in mm

Figure 7

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- (a) The kitchen roll holder needs to be improved to include the following specification points.

The kitchen roll holder must:

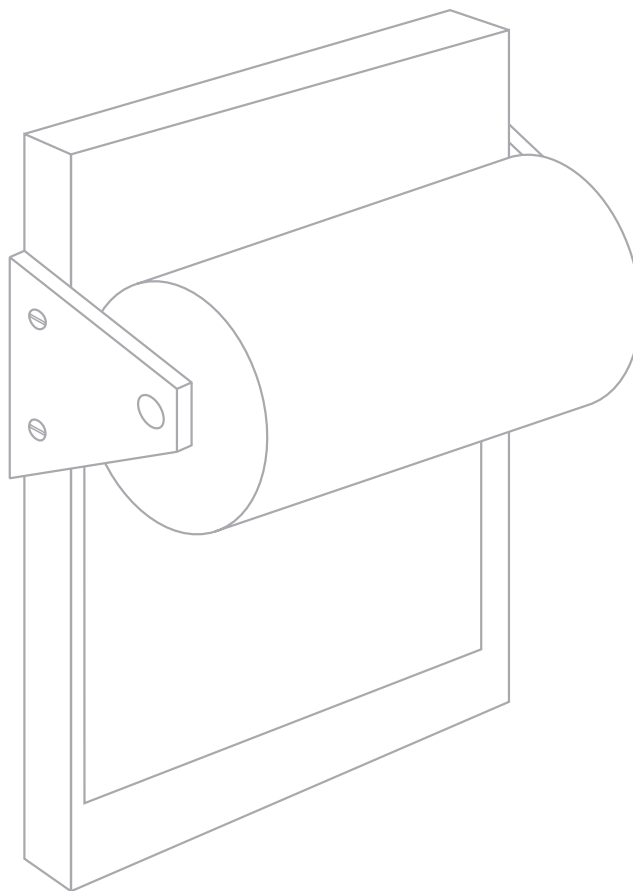
- allow an empty kitchen roll to be removed easily and replaced securely
- be held vertically on a wall and not move when the kitchen roll is pulled off
- provide easily accessible storage space for a spare kitchen roll.

Use notes and sketches to show how the kitchen roll holder 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 some examples of laser cut vegetable markers that are used by gardeners to show where they have planted specific vegetables in the garden.

They are manufactured from 3 mm thick acrylic and are 150 mm long.

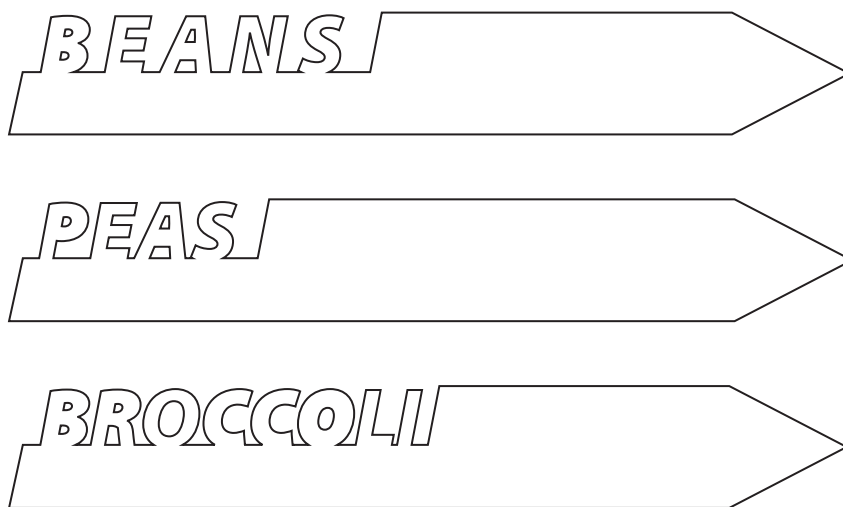


Figure 8

Explain **two** ways that the vegetable markers meet or fail to meet the criteria of providing a method to show where specific vegetables are planted in the garden.

(4)

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(Total for Question 5 = 10 marks)



6 Figure 9 shows an electric light switch made from urea formaldehyde.

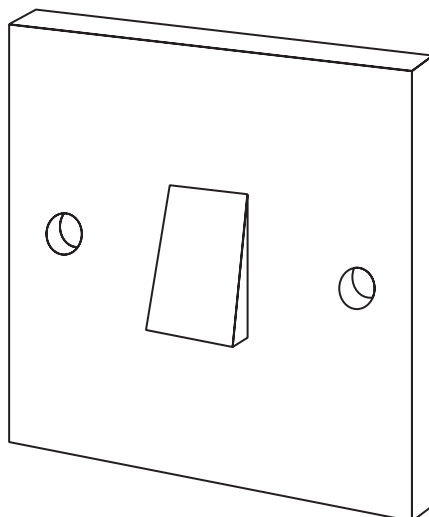


Figure 9

(a) Explain **two** availability factors that could result in urea formaldehyde becoming a difficult polymer to source.

(4)

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Figure 10 shows how the electric light switch has been decorated with vinyl stickers.

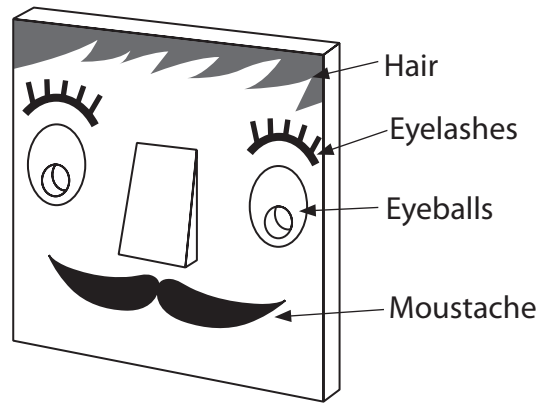


Figure 10

- (b) Use notes and sketches to show how the stickers are produced using a CNC vinyl cutting machine.

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

(4)



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(c) Vinyl for the stickers is supplied in different-sized sheets.

Explain **one** reason why the manufacturer of the stickers would only buy sheets that are the same size.

(2)

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(d) Give **two** different properties of urea formaldehyde that make it an appropriate choice of material for the electric light switch.

For each property, explain **one** advantage of using urea formaldehyde for the electric light switch.

(6)

Property 1

Explanation

Property 2

Explanation

(Total for Question 6 = 16 marks)



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QUESTION 7 BEGINS ON THE NEXT PAGE



7 Figure 11 shows a noticeboard.

The acrylic letters are attached using an adhesive.

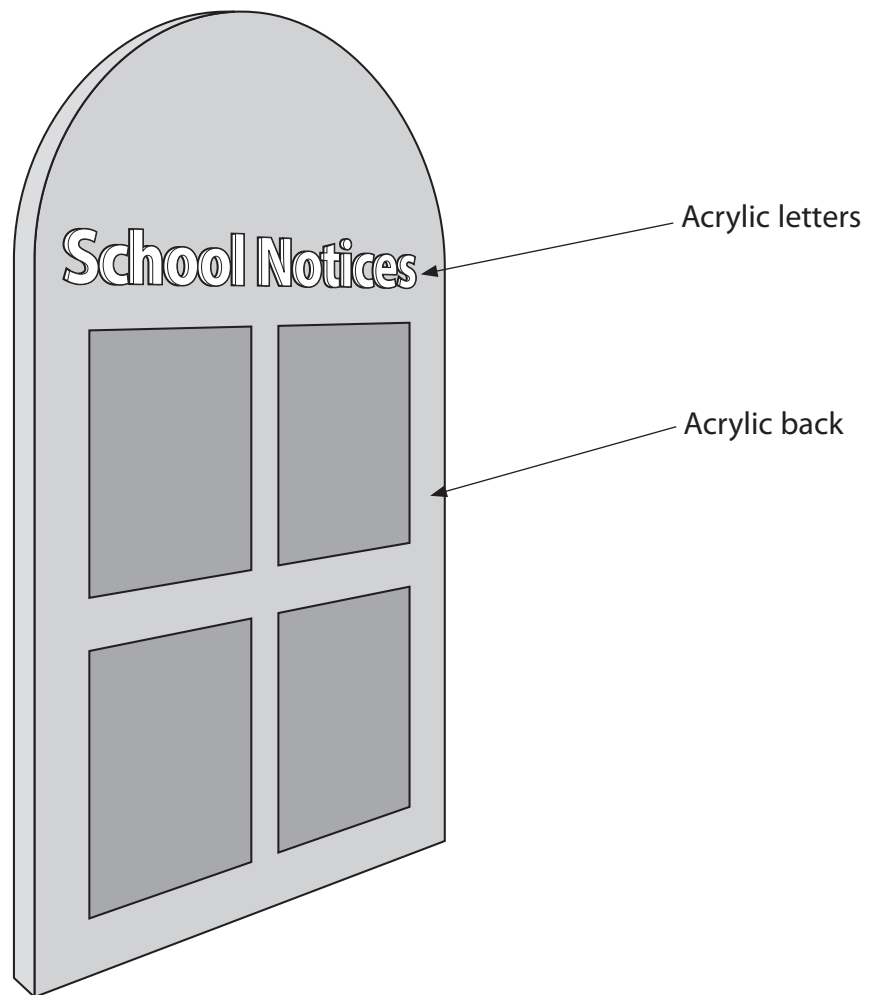


Figure 11

(a) Name the specific type of adhesive that is used to join acrylic to acrylic in a school workshop.

(1)

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Figure 12 shows a template that is used when marking out the back of the noticeboard.

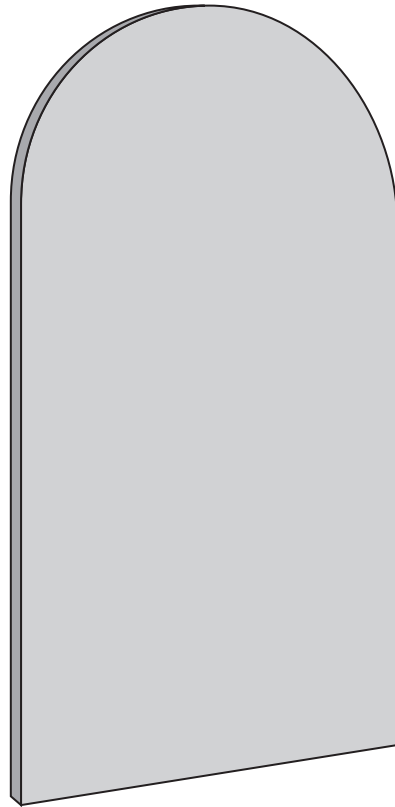


Figure 12

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

(4)

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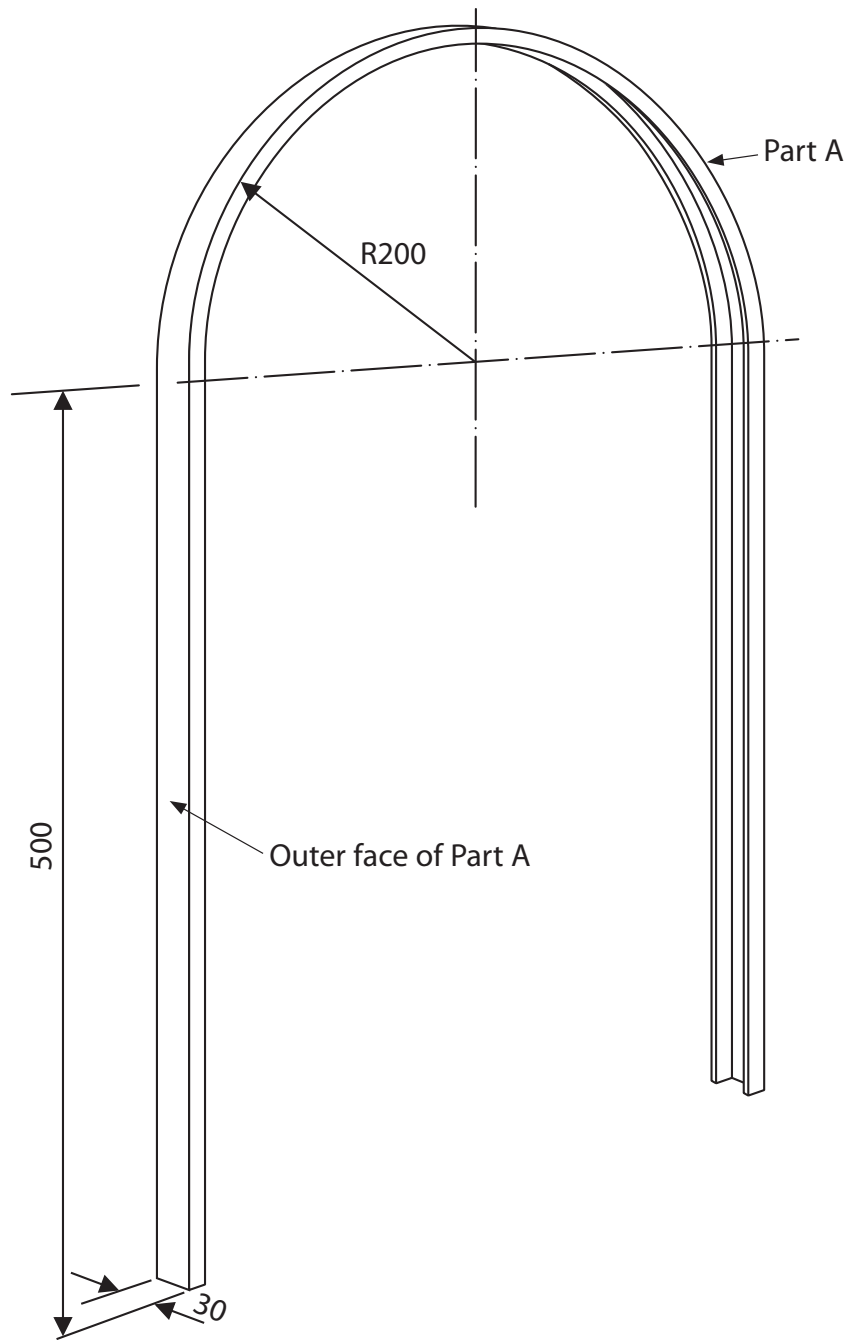
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Figure 13 shows the dimensions for a flexible extruded profile, Part A, that will go around the edge of the noticeboard.



All dimensions in mm

Figure 13

Use $\pi = 3.142$

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



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(c) Calculate the whole surface area of the outer face of Part A, the flexible extruded profile, that goes around the edge of the noticeboard.

Give your answer to the nearest whole cm^2 .

(5)

Answer cm^2



Figure 14 shows the section shape of the flexible extruded profile, Part A.

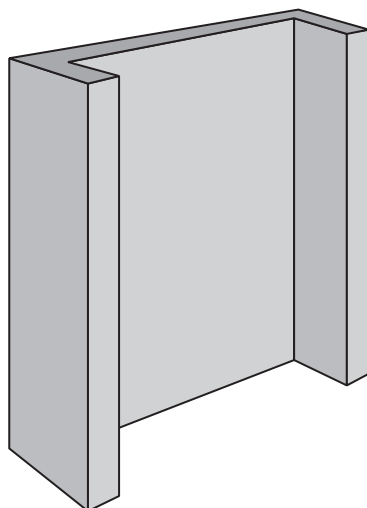


Figure 14

(d) Explain **two** reasons for using the process of extrusion to form the profile.

(6)

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(Total for Question 7 = 16 marks)

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8 Figure 15 shows a small tub for ice cream and a polymer spoon that fits underneath the lid.

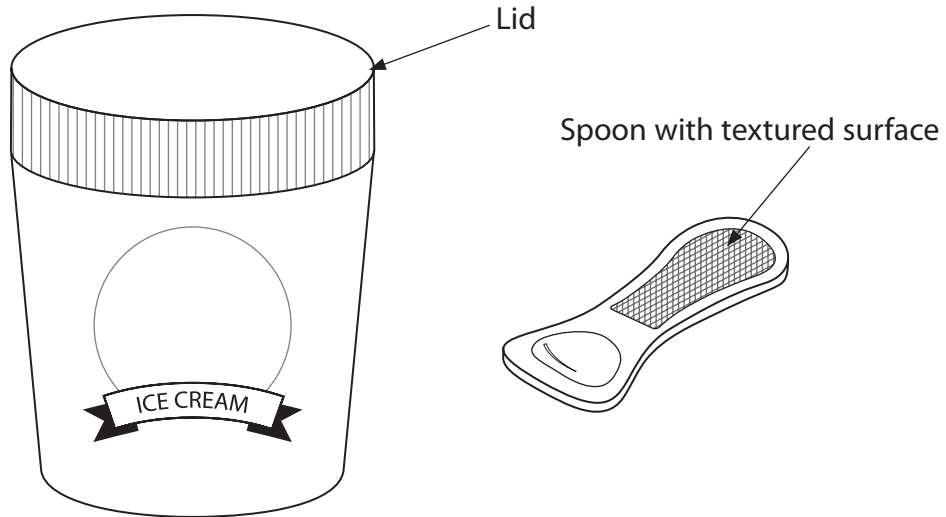


Figure 15

(a) Explain **one** reason for having a textured surface finish at one end of the spoon.

(2)

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(b) The spoon has been manufactured by injection moulding.

Explain **one** reason for using polymer granules when injection moulding the spoon.

(3)

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(c) Explain **two** reasons why a biodegradable polymer should be used to make the spoon. (4)

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(d) The spoons are manufactured in Europe and transported all around the world.

Figure 16 shows information about the spoons.

| | |
|----------------------------|---|
| Scale of production | Mass |
| Potential market | World wide |
| Life span | 1 year |
| Intended market | Cinemas, theatres, festivals, small cafes |
| Surface finish | Textured surface |

Figure 16

Analyse the information in Figure 16.

Evaluate the spoons 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**

