Paper Reference(s) 1DT0/1C
Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Total Marks

Design and Technology
COMPONENT 1: Polymers

Tuesday 18 June 2024 – Morning

Time: 1 hour 45 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

Y74049RA

Pearson

YOU MUST HAVE

Calculator, ruler, writing and drawing equipment, protractor, pair of compasses

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

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 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.

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.

Look at Figure 1 for Question 1(a) in the Diagram Booklet. It 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.
(4 marks)

The first one has been done for you.

(continued on the next page)

1 continued.

(b) (i) The frying pan is made from cast iron. Cast iron is hard, therefore it does not scratch easily.

Explain ONE OTHER advantage of using cast iron for the frying pan.
(2 marks)

(continued on the next page)

1(b) continued.

(ii) Cast iron contains 2% carbon.

The cast iron frying pan weighs 3 kg.

Calculate how many grams of carbon are in the cast iron frying pan.
(2 marks)

Answer _____ grams

(Total for Question 1 = 8 marks)

2 Look at Figure 2 for Question 2 in the Diagram Booklet. It shows a wooden sheep that is being threaded with a yarn.

(a) Name ONE specific animal fibre that can be used to make the yarn being threaded in Figure 2.
(1 mark)

_____

_____

(continued on the next page)

2 continued.

The wood that is used to manufacture the sheep is delivered to the manufacturer using vehicles powered by biofuels.

(b) Explain ONE advantage of using biofuels to power the delivery vehicles. (2 marks)

(continued on the next page)

2 continued.

(c) Explain ONE advantage of using computer-aided design (CAD) when producing the design ideas for the wooden sheep.
(2 marks)

(continued on the next page)

2 continued.

A new animal shape needs to be designed.

The designer has collected some data about the popularity of specific animals amongst young children.

Look at Figure 3 for Question 2(d)(i) in the Diagram Booklet. It is a table of data showing the popularity of specific animals amongst young children.

(d) (i) Complete Figure 3 by calculating the TWO missing values.
(2 marks)

Answer space continues on the next page.

Space for working

2(d)(i) continued.

Number of votes for Rabbit _____

Number of votes for Mouse _____

(continued on the next page)

2(d) continued.

Look at Figure 4 for Question 2(d)(ii) in the Diagram Booklet. It is a partly completed bar chart that shows the percentage of votes received for the Cat and the Dog.

(ii) Complete the bar chart shown in Figure 4 to show the percentage of votes received for the Rabbit and the Mouse.
(2 marks)

(Total for Question 2 = 9 marks)

3 Look at Figure 5 for Question 3 in the Diagram Booklet. It shows a pulley and pulley belt, a motor, and the cross section of the pulley belt used in a model boat drive system.

(a) Name the type of pulley belt shown in the cross section in Figure 5. (1 mark)

(continued on the next page)

3 continued.

(b) Explain ONE reason for manufacturing the pulley from aluminium rather than mild steel. (2 marks)

(continued on the next page)

3 continued.

Look at Figure 6 for Question 3(c) in the Diagram Booklet. It shows the pulley system for the model boat drive system.

(c) The pulley system has a velocity ratio of 5:1.

The input speed is 2000 revolutions per minute (rpm).

Calculate the output speed of the pulley system.

Use the formula below to calculate the answer.

$$\text{Velocity ratio} = \frac{\text{input speed}}{\text{output speed}}$$

Give your answer in rpm.
(2 marks)

Answer space continues on the next page.

3(c) continued.

Answer _____ rpm

(continued on the next page)

3 continued.

Look at Figure 7 for Question 3(d) in the Diagram Booklet. It shows the solar cell that powers the motor for the model boat.

The solar cell is 5 cm by 5 cm.

(d) Explain ONE disadvantage of using the solar cell to power the motor for the model boat.
(2 marks)

(continued on the next page)

3 continued.

Look at Figure 8 for Question 3(e) in the Diagram Booklet. It shows the frame for the model boat.

The model boat has been manufactured from balsa wood.

(e) Explain TWO benefits of using balsa wood for the frame of the model boat.
(4 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

_____

3(e) continued.

2

(Total for Question 3 = 11 marks)

4 (a) Explain TWO ways that conductive inks can be used in products. (4 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

_____

_____

2 _____

_____

_____

_____

4(a) continued.

(b) A small batch of conductive ink weighs 9 grams.

The ink contains 40% of hazardous material by weight.

Calculate the weight of hazardous material present in the ink in grams. (2 marks)

Answer space continues on the next page.

4(b) continued.

Answer _____ grams

(continued on the next page)

4 continued.

(c) Discuss how designers can minimise the environmental impact of materials when developing new and emerging technologies.
(6 marks)

Answer space continues on the next 4 pages.

4(c) continued.

4(c) continued.

4(c) continued.

4(c) continued.

(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 Look at Figure 9 for Question 5 in the Diagram Booklet. It shows a design solution for a file rack to hold three files, together with some additional information.

(a) The file rack holds three files and needs to be improved to include the following specification points.

The file rack must:

- **be able to hold an additional three files and stop the handles of the files from moving as the rack is carried around a workshop**

(continued on the next page)

5(a) continued.

- protect the user from potential scratches when carrying the rack and have a surface finish that is easy to clean
- be more stable when placed on a bench and be capable of being hung up on a wall.

Use notes and sketches to show how the file rack 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.

Look at the outline of the original design solution for Question 5(a) in the Diagram Booklet. Use the outline of the original design solution to show your modifications.
(6 marks)

(continued on the next page)

5 continued.

(b) Look at Figure 10 for Question 5(b) in the Diagram Booklet. It shows a food play set manufactured from polymers.

Explain TWO ways that the polymer food play set meets, or fails to meet, the criterion of providing a method to educate young children about healthy eating.
(4 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

_____

5(b) continued.

2

(Total for Question 5 = 10 marks)

6 **Look at Figure 11 for Question 6 in the Diagram Booklet. It shows a battery-powered candle and a polymer house.**

The candle sits inside the hole in the polymer house.

The polymer house has been manufactured from acrylic.

(a) Explain TWO reasons for manufacturing the house from acrylic.
(4 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

6(a) continued.

2 _____

(b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. It shows a dimensioned drawing of a marked-out piece of acrylic ready to be cut to the correct length of 60 mm to start making the polymer house.

(continued on the next page)

6(b) continued.

The acrylic has a cross section that measures **50 mm × 35 mm**.

Use notes and sketches, in the space on the next page, to show how the acrylic would be cut to the correct length using hand tools.

You will be marked on how you apply your understanding of design and technology, not your graphical skills. (4 marks)

Answer space continues on the next page.

(continued on the next page)

6(b) continued.

(continued on the next page)

6 continued.

(c) Explain ONE surface finish or treatment that could be used to personalise the house with a name or number.
(2 marks)

(continued on the next page)

6 continued.

Look at Figure 13 for Question 6(d) in the Diagram Booklet. It shows a dimensioned side view of the polymer house.

(d) Give TWO different manufacturing methods that could be used to remove the waste material to form the roof shape as shown in Figure 13.

Explain ONE reason for using each manufacturing method.
(6 marks)

Answer space continues on the next 2 pages.

Method 1

6(d) continued.

Explanation

Method 2

Explanation

6(d) continued.

(Total for Question 6 = 16 marks)

7 Look at Figure 14 for Question 7 in the Diagram Booklet. It shows a magazine rack.

(a) Name a reinforcement technique that could be used to stiffen the frame of the magazine rack shown in Figure 14.
(1 mark)

The curved tray has been formed from a sheet of high impact polystyrene (HIPS).

(b) Explain TWO working properties of HIPS that make it an ideal material for the curved tray.
(4 marks)

Answer space continues on the next page.

1

7(b) continued.

2

(continued on the next page)

7 continued.

Look at Figure 15 for Question 7(c) in the Diagram Booklet. It shows a dimensioned drawing of the curved tray.

Circumference of a circle = πD

Use $\pi = 3{\cdot}142$

(c) Calculate how many of the curved trays shown in Figure 15 can be cut from a large flat sheet of HIPS that measures 244 cm × 122 cm.

Ignore the width of any saw cuts.
(5 marks)

Answer space continues on the next page.

7(c) continued.

Answer _____

(continued on the next page)

7 continued.

(d) Look at Figure 16 for Question 7(d) in the Diagram Booklet. It is an exploded assembly view showing how the frame is joined to the curved tray.

Explain TWO benefits of using nut and bolt joints in the assembly of the magazine rack.
(6 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

_____

_____

_____

7(d) continued.

2

(Total for Question 7 = 16 marks)

8 Look at Figure 17 for Question 8 in the Diagram Booklet. It shows a swimming aid that has been manufactured from expanded polystyrene.

(a) Explain ONE advantage of manufacturing the swimming aid from expanded polystyrene. (2 marks)

(continued on the next page)

8 continued.

The swimming aids are manufactured from a standard thickness expanded polystyrene sheet.

(b) Explain ONE advantage of using a standard thickness expanded polystyrene sheet.
(3 marks)

(continued on the next page)

8 continued.

(c) Explain TWO ways that the expanded polystyrene has been cut during the manufacture of the swimming aid.
(4 marks)

Answer space continues on the next page.

1 _____

_____

_____

_____

_____

_____

2 _____

_____

_____

_____

8(c) continued.

(continued on the next page)

8 continued.

(d) The swimming aids are manufactured in the United Kingdom and sold around the world.

Look at Figure 18 for Question 8(d) in the Diagram Booklet. It shows some additional information about the swimming aids.

Analyse the information in Figure 18.

Evaluate the swimming aids with reference to cost factors including:

- quality of material
- manufacturing processes necessary
- treatments.

(9 marks)

Answer space continues on the next 4 pages.

8(d) continued.

8(d) continued.

8(d) continued.

8(d) continued.

(Total for Question 8 = 18 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 100 MARKS
END OF PAPER