

**Time allowed: 1 hour 45 minutes**

- a scientific or graphical calculator
- an HB pencil

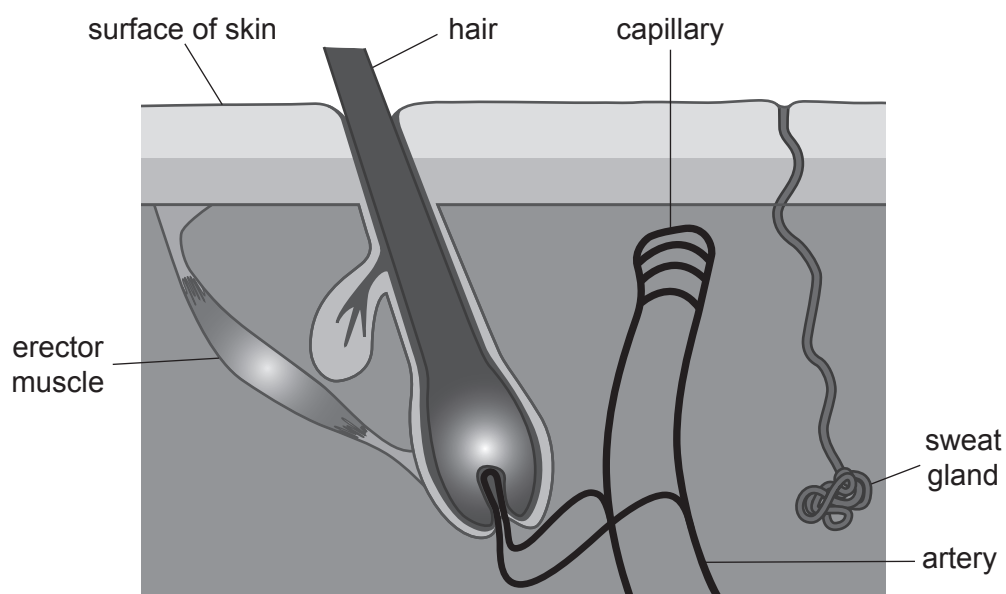


- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- Quality of extended responses will be assessed in questions marked with an asterisk (\*).
- This document consists of **24** pages.

Answer **all** the questions.

- 1 The skin helps the human body to control its temperature.

Look at the diagram of structures in the skin.



- (a) Complete the table to describe how structures **in the skin** help to cool you down when you are too hot.

| Structure | What the structure does  | Appearance of skin |
|-----------|--------------------------|--------------------|
|           |                          | Sweaty             |
|           | Relaxes                  | Hairs lying flat   |
|           | Gets wider (vasodilates) | Flushed red        |

[4]

(b) James is feeling cold.

(i) The hairs on his skin are standing on end.

Explain how this helps to warm him up.

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..... [2]

(ii) James starts to shiver.

Shivering happens because muscles are contracting rapidly.

Explain how this helps to warm him up.

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..... [2]

- 2 A teacher shows a plant to three students, Ben, Ling and Kai.



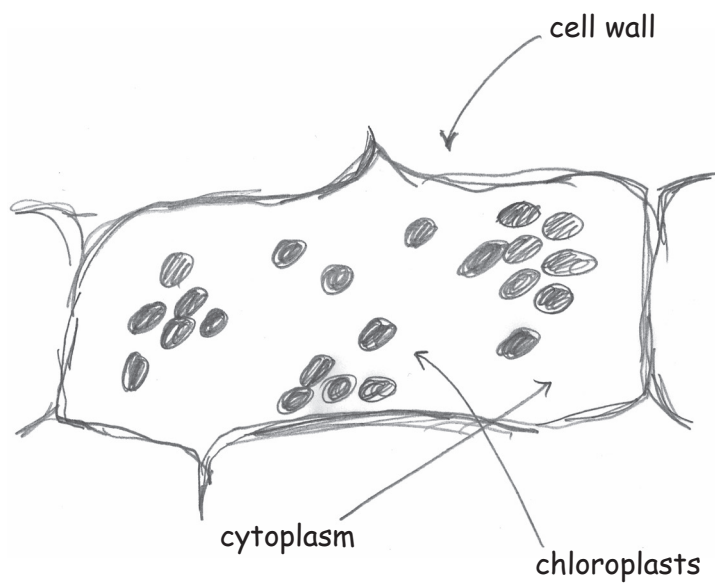
The teacher says it could be either a real living plant or a plastic plant.

She challenges the students to investigate whether the plant is real.

- (a) Ben takes a small piece of leaf from the plant. He places the piece of leaf on a microscope slide. He looks at the slide using a light microscope.

The piece of leaf appears to be made of cells.

Ben draws a scientific drawing of what he sees.



Ben could draw a better scientific drawing **without** changing the slide or the microscope.

Describe **four** ways Ben could improve his scientific drawing.

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2 .....

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3 .....

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4 .....

..... [4]

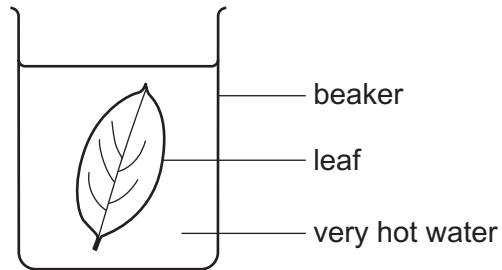
- (b) Ling knows that living plants store glucose as starch.

She tests a leaf from the plant for starch.

Here is her method.

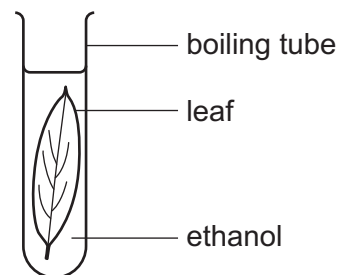
### Step 1

Place the leaf in very hot water until it goes soft.



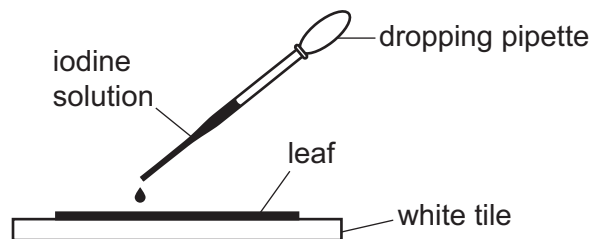
### Step 2

Place the leaf in ethanol (HIGHLY FLAMMABLE) and heat until all the green colour has been removed from the leaf.



### Step 3

Rinse the leaf with water, and then spread it out on a white tile and add a few drops of iodine solution.



- (i) Write down **two** hazards in Ling's method **and** suggest a way of reducing the risk from each hazard.

hazard .....

way of reducing risk .....

.....

hazard .....

way of reducing risk .....

..... [4]

- (ii) The colour change when iodine solution is added shows that the leaf contains starch.

Describe this colour change.

..... [1]

- (c) Kai decides to investigate how the plant responds to light.

He places the plant on a sunny windowsill and leaves it there until next week's lesson.

- (i) Write a testable prediction that describes what will happen if the plant is real.

.....  
..... [1]

- (ii) Kai finds that the plant has grown towards the window.

Use ideas about plant hormones to explain how this has happened.

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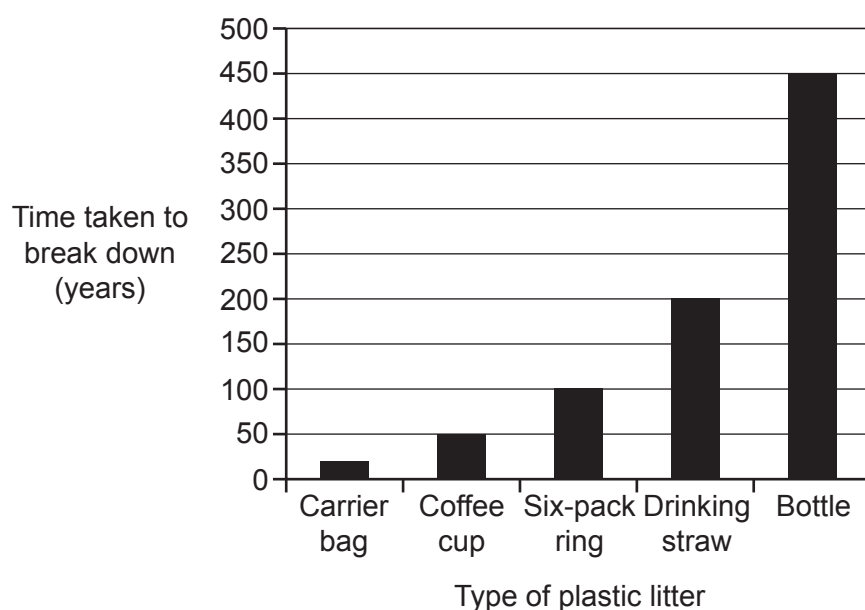
- (d) The students conclude that the plant is a real living plant.

Use evidence from the students' investigations to support this conclusion.

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..... [2]

### 3 Plastic pollution in the sea is a big problem.

- (a) The bar chart shows how long it takes for different types of plastic litter to break down in the sea.



- (i) Which type of plastic litter takes the longest time to break down, and how long does it take?

type of plastic litter .....

time taken to break down ..... years [2]

- (ii) A crisp packet takes 80 years to break down in the sea.

Which types of litter, shown on the bar chart, will break down faster than a crisp packet?

Tick (✓) **two** boxes.

Carrier bag

☐

Coffee cup

☐

Six-pack ring

☐

Drinking straw

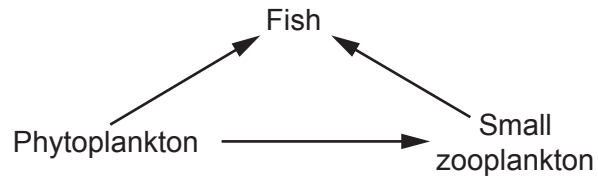
☐

Bottle

☐

[1]

(b) Look at the food web from the North Sea.



(i) Add the following information to the food web above:

- Phytoplankton are eaten by shellfish.
- Shellfish and fish are eaten by seagulls.

[2]

(ii) Draw straight lines to join each **part of an ecosystem** to the correct **example from the food web**.

| Part of an ecosystem | Example from the food web                         |
|----------------------|---------------------------------------------------|
| Community            | All the organisms and their North Sea environment |
| Ecosystem            | All the organisms in the food web                 |
| Individual organism  | All the fish                                      |
| Population           | A fish                                            |

[3]

- (iii) Phytoplankton are producers.

Zooplankton, fish, shellfish and seagulls are all consumers.

Describe the differences between a producer and a consumer.

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..... [3]

- (iv) Plastic litter in the sea breaks down into very small pieces of plastic.

Fish cannot tell the difference between very small pieces of plastic, phytoplankton and small zooplankton.

Phytoplankton and small zooplankton are digested by enzymes in a fish's gut.

Explain why very small pieces of plastic in the sea could cause fish to die.

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..... [4]

- (v) Humans eat fish caught from the North Sea.

Explain why very small pieces of plastic in the North Sea could be dangerous for humans.

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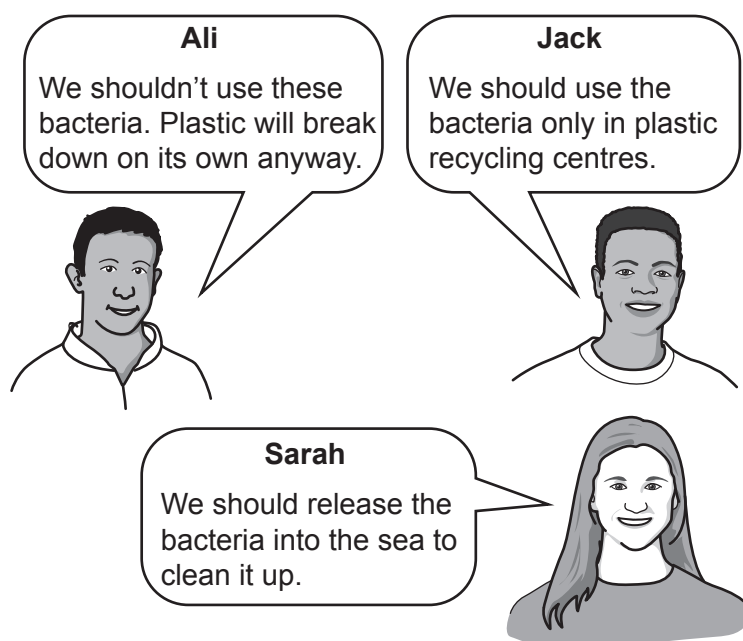
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..... [2]

- (c) Scientists have discovered some bacteria in a rubbish dump.

These bacteria break down plastic into very small pieces. The pieces can be used to make new plastic products.

People have suggested different ways of using these bacteria.



Whose suggestion would have benefits for the sea **and** minimise the possible risks?

Explain your answer.

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..... [3]

#### 4 Fossils provide evidence for evolution.

- (a) A fossil of an extinct animal called *Archaeopteryx* was discovered in 1861. A photo of the fossil is shown in **Fig. 4.1**.

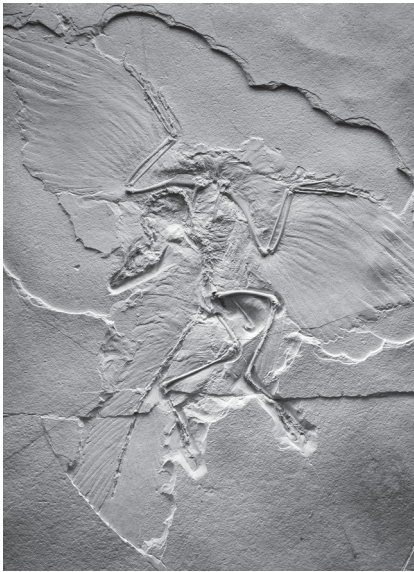


**Fig. 4.1**

*Archaeopteryx* has:

- wings and feathers, like a bird
- teeth and three fingers with claws, like many dinosaurs.

- (i) How does the *Archaeopteryx* fossil provide evidence that birds evolved from dinosaurs?

Tick (✓) **one** box.

It has features of both birds and dinosaurs.

☐

It is now extinct.

☐

It is part of the fossil record.

☐

It shows natural selection.

☐

**[1]**

- (ii) Twelve fossils of *Archaeopteryx* have been found.

The twelve *Archaeopteryx* fossil animals vary in appearance.

Suggest what could have caused these differences in appearance.

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..... **[2]**

(b) Read the article.

### Early humans on Flores

A population of early humans became trapped on an island called Flores 100 000 years ago.

The average height of these early humans was 1.79 m. Their maximum body mass was 68 kg.

There was a very limited amount of food on the island.

Small human skeletons found on the island show that by 50 000 years ago:

- the average height of the humans on Flores had decreased to about 1 m
- the maximum body mass had decreased to 25 kg.

(i) Explain how **natural selection** caused the humans on the island to become smaller over many generations.

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..... [5]

(ii) Some scientists think the small Flores humans from 50 000 years ago should be classified as a different species of humans.

Suggest why they could be classified as a different species.

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..... [2]

5 Cystic fibrosis is a disease caused by a person's DNA.

(a) Describe the structure of DNA.

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..... [4]

Cystic fibrosis is caused by a single gene.

There are two alleles of the gene:

- the dominant allele, **F**, does not cause cystic fibrosis
- the recessive allele, **f**, causes cystic fibrosis.

(b) (i) What is the phenotype of a person who has the alleles **FF**?

..... [1]

(ii) What is the phenotype of a person who has the alleles **Ff**?

..... [1]

(iii) What is the genotype of a person who has cystic fibrosis?

..... [1]

- (c) A couple is thinking about having a baby.

The woman and the man both have the alleles **Ff**.

The Punnett square shows the possible combinations of alleles in their offspring.

|          |          |          |
|----------|----------|----------|
|          | <b>F</b> | <b>f</b> |
| <b>F</b> | FF       | Ff       |
| <b>f</b> | Ff       | ff       |

Use the Punnett square to help you answer the questions.

- (i) What proportion of their offspring is likely to have the allele combination **FF**?

..... in every ..... [1]

- (ii) What percentage of their offspring is likely to have the allele combination **Ff**?

Percentage = ..... % [2]

- (iii) What is the probability that any one of their offspring will have cystic fibrosis?

Probability = ..... [2]

**(d)\*** A different couple is also thinking about having a baby.

- The woman has had a genetic test. It showed that she has the **f** allele.
- She does **not** have cystic fibrosis.
- The man does not know what alleles he has.
- He does **not** have cystic fibrosis.

Explain the possible genotypes and phenotypes of their baby **and** explain what things the couple should consider before deciding to have a baby.

[6]

17  
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## 6 Photosynthesis takes place in plants.

(a) Put **one** tick in each row of the table to show the function of each plant structure.

| Plant structure | Function                                  |                                              |                                             |
|-----------------|-------------------------------------------|----------------------------------------------|---------------------------------------------|
|                 | Transports sugars made by photosynthesis. | Carries out the reactions of photosynthesis. | Transports water needed for photosynthesis. |
| Chloroplast     |                                           |                                              |                                             |
| Phloem          |                                           |                                              |                                             |
| Xylem           |                                           |                                              |                                             |

[1]

Eve is investigating the effect of temperature on photosynthesis in pondweed.

This is her method.

1. Put a piece of pondweed in a boiling tube.
2. Cover the pondweed with sodium hydrogen carbonate solution (a source of carbon dioxide).
3. Put the boiling tube in a beaker of water at one of six temperatures.
4. Use a gas syringe to collect the bubbles of gas released from the pondweed.
5. Record the volume of gas collected in five minutes.
6. She repeats the experiment three times at each temperature.

**Fig. 6.1** shows the apparatus Eve uses.

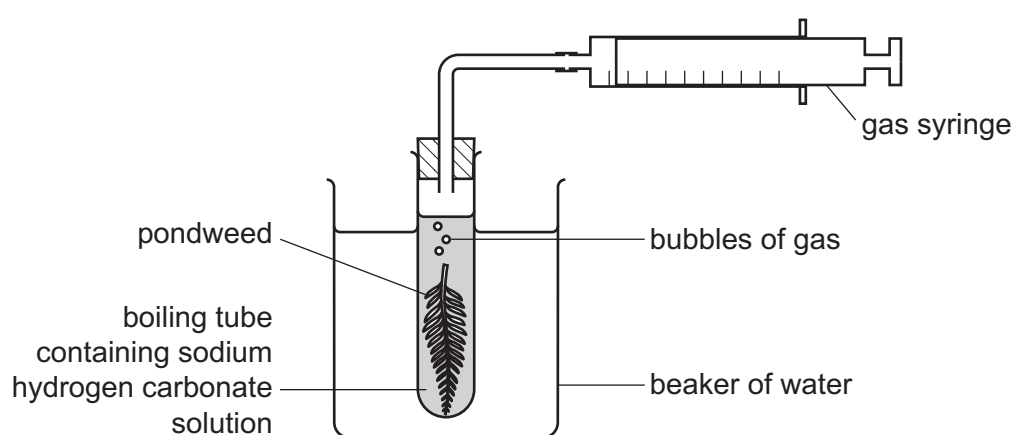


**Fig. 6.1**

- (b) Temperature is the variable that Eve will change.

Write down **one** variable that Eve should control **and** describe how she could control it.

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..... [2]

- (c) After she has finished the investigation, Eve uses her data to plot the graph in **Fig. 6.2**.

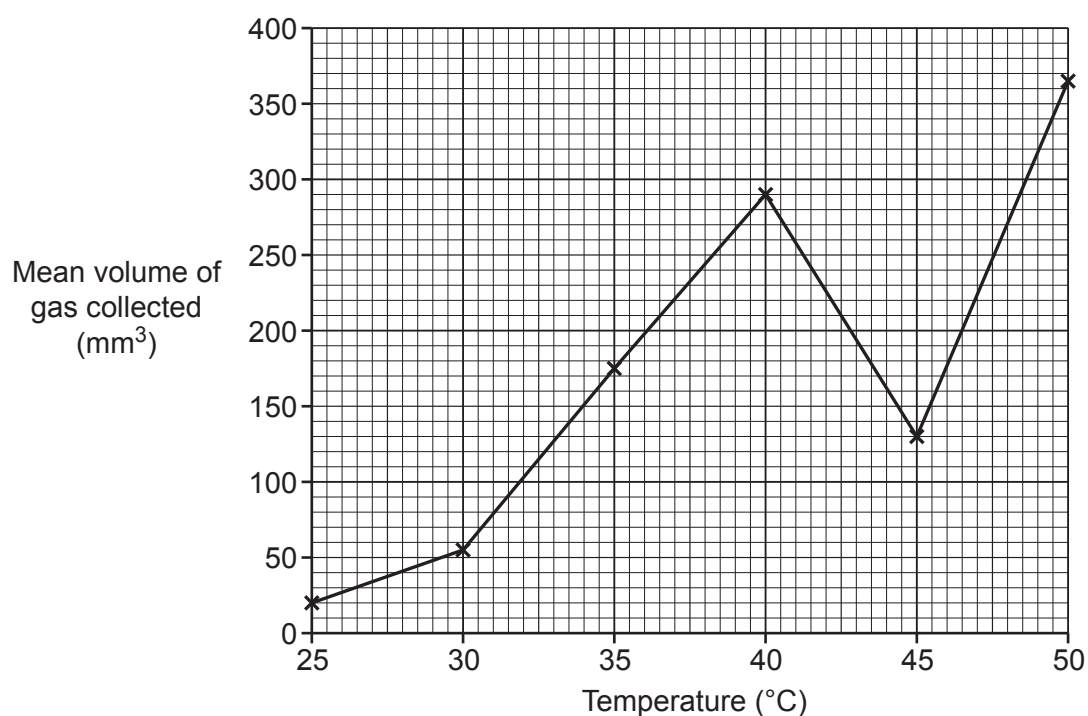


**Fig. 6.2**

- (i) Eve decides to repeat the experiment at 45 °C so that she can take new measurements at this temperature.

Use evidence from **Fig. 6.2** to justify Eve's decision.

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..... [2]

(ii) Here are Eve's new measurements.

| Temperature (°C) | Volume of gas collected (mm <sup>3</sup> ) |          |          |
|------------------|--------------------------------------------|----------|----------|
|                  | Repeat 1                                   | Repeat 2 | Repeat 3 |
| 45               | 354                                        | 360      | 351      |

Use Eve's new measurements to complete the graph in **Fig. 6.3**.

You may use the space below for working out.

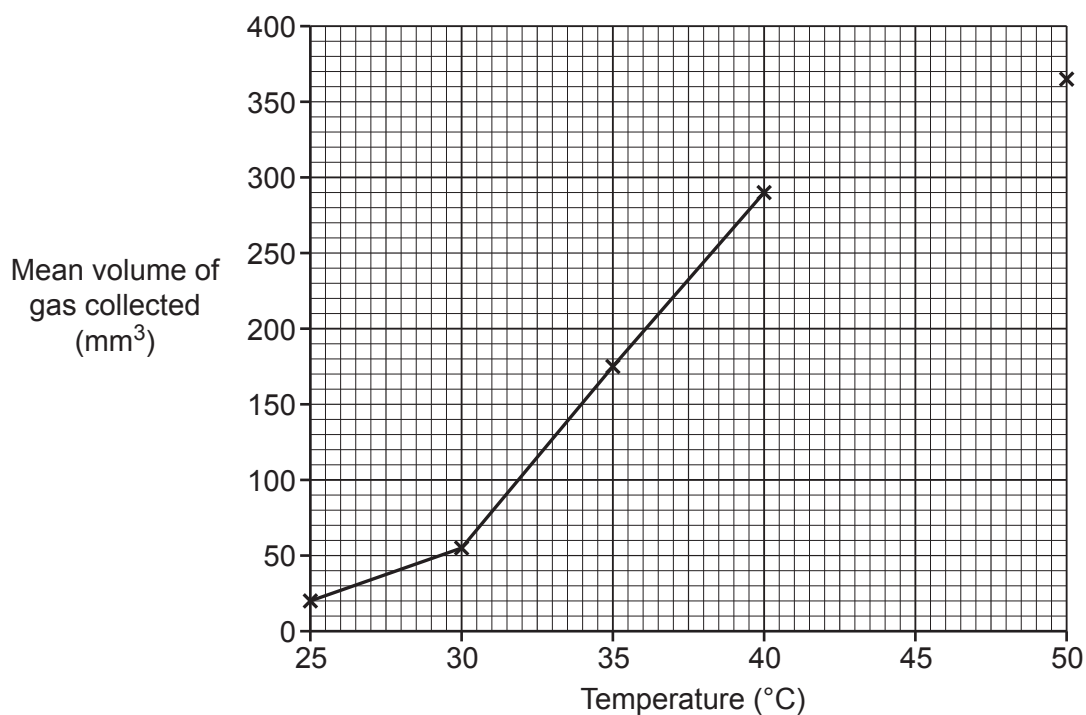


**Fig. 6.3**

[2]

- (d) Describe the trend in the data shown in the graph in **Fig. 6.3**.

Use data from **Fig. 6.3** to support your answer.

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..... [3]

- (e) The volume of gas collected changed as the temperature changed.

Calculate the change in volume per degree between 35 °C and 40 °C.

Change in volume per degree = .....  $\text{mm}^3/\text{°C}$  [2]

**7\*** Layla is a doctor. She works with patients in a hospital.

Explain why it is good that Layla does the following things:

- She washes her hands regularly while she is at work.
- Each day she drinks a yogurt drink that contains living bacteria.

[6]

**END OF QUESTION PAPER**

This image shows a blank sheet of white paper designed for handwriting practice. It features a solid vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced horizontal dashed lines, providing guides for letter height and placement. There are no other markings, text, or illustrations on the page.

Oxford Cambridge and RSA

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