OCR
Oxford Cambridge and RSA

F

Wednesday 18 November 2020 – Morning

GCSE (9–1) Biology B (Twenty First Century Science)

J257/02 Depth in Biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ru er (cm/mm)

You can use:
- an HB penc
- a sc ent f c or graph ca ca cu ator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

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

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

1 Cells contain DNA.

(a) Which **two** words describe the shape of a DNA molecule?

Tick (✓) **two** boxes.

Double ☐

Genome ☐

Single ☐

Helix ☐

Triple ☐

Nucleus ☐

[2]

(b) DNA is made from nucleotides.

Each nucleotide is made from a common sugar, a phosphate group and one other part.

What is the name of the other part?

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

(c) Put the structures in the correct order of size, from the largest to the smallest.

cell **chromosome** **gene** **nucleotide** **nucleus**

largest .....

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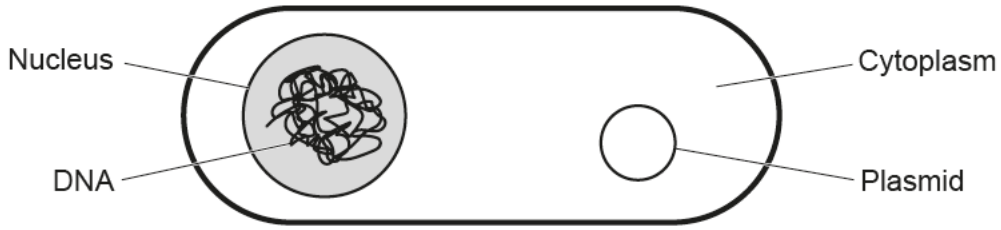
smallest .....

[4]

(d) Ali has made this diagram of a bacterium.



There is a mistake in Ali's diagram.

Identify **one** mistake in Ali's diagram of a bacterium.

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

2 Gametes are types of cells used in sexual reproduction.

(a) Human female gametes are called egg cells.

What is the name of the human **male** gametes?

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

(b) How many gametes are required to make a new human life during sexual reproduction?

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

(c) Fertilisation takes place. The male gamete has the sex chromosome Y.

What sex chromosomes will the baby have, and what sex will it be?

Sex chromosomes .....

Sex .....

[2]

(d) Human female gametes are released during ovulation. Ovulation can be prevented by taking hormone contraceptive pills.

Eve starts taking hormone contraceptive pills to prevent getting pregnant.

Explain why Eve could still become pregnant if she has unprotected sex after taking the contraceptive pill.

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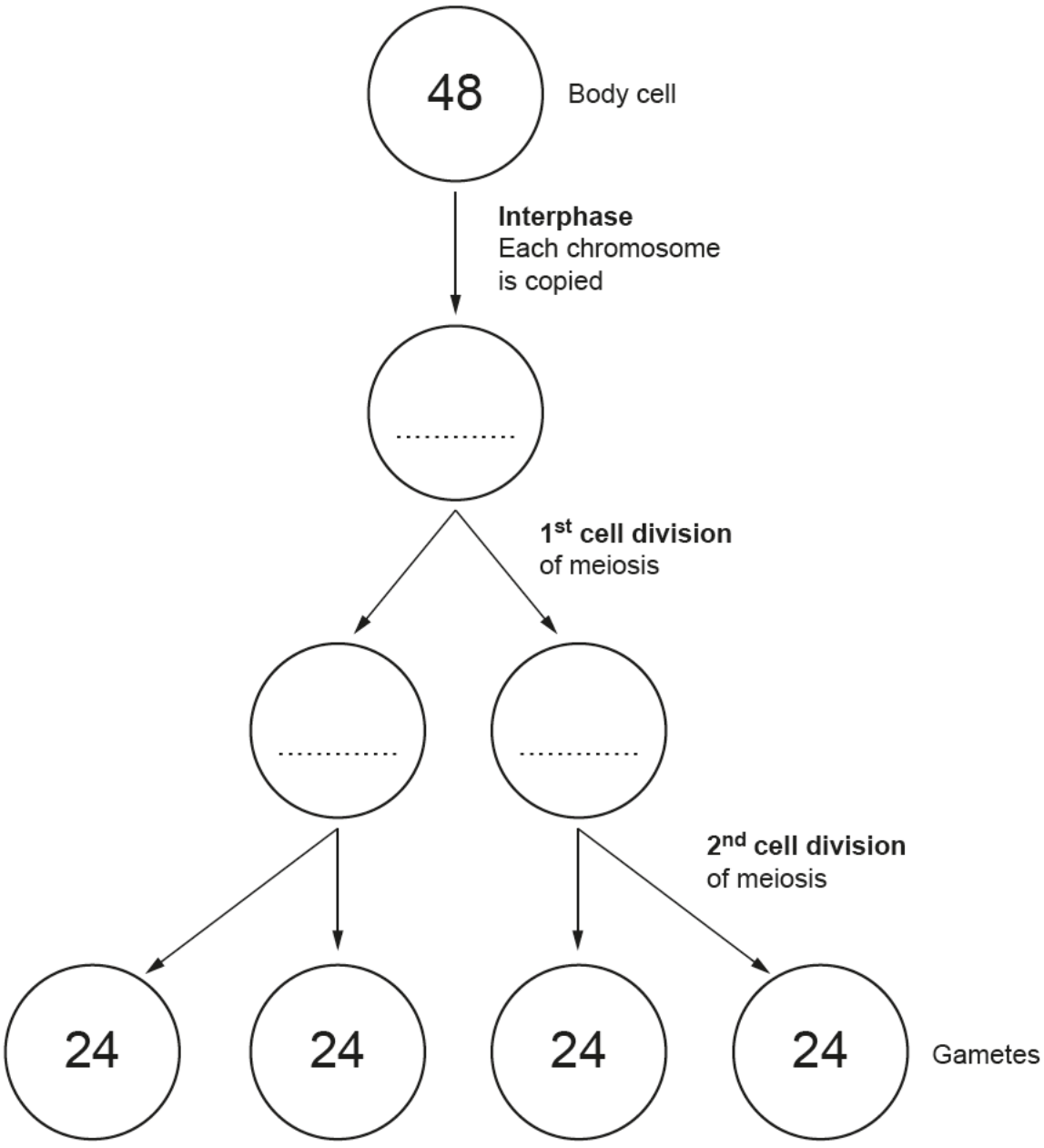
..... **[2]**

(e) Gametes are made by a type of cell division called meiosis.

Meiosis in monkeys is shown in the diagram and it starts with a body cell. In monkeys, each body cell has 48 chromosomes.

Complete the diagram by writing the number of chromosomes in each empty cell.



[2]

3 Our food and drink choices affect the environment.

Growing and transporting food releases greenhouse gases. These gases cause the Earth to warm up, which can have harmful effects on biodiversity.

The bar chart shows the amount of greenhouse gases released during the production of different foods.

(a) Which type of milk releases the most greenhouse gases per serving, and how much does it release?

Type of milk = ...

Greenhouse gases released per serving = ... kg **[2]**

(b) For his breakfast, Alex has sausages, tomatoes and coffee with cow's milk.

The total amount of greenhouse gases released by Alex's breakfast is 3 kg.

The amount of greenhouse gases released by the sausages is 1.8 kg.

What percentage of the total amount of greenhouse gases released by the production of Alex's breakfast is caused by the production of the sausages?

Percentage = ... % **[2]**

(c) The next day Alex decides to have eggs instead of sausages.

(i) Explain why this change will reduce the effect his breakfast has on the environment.

Use evidence from the graph to support your answer.

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..... **[3]**

(ii) Scientists have lots of data on the amount of greenhouse gases released by the production of different foods.

Give **two** reasons why it is important that scientists share this data with the public.

1 .....

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2 .....

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

(d) Greenhouse gases can cause changes in ecosystems.

Explain why these changes could reduce our supply of food.

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..... **[4]**

4 Human health can be affected by disease.

(a) Complete the sentences to describe the relationship between health and disease.

Use words from the list.

Each word can be used once, more than once, or not at all.

genes **lifestyle** **pathogens** **symptoms**

Health can be affected by diseases that are passed from a sick adult to a healthy adult.

These diseases are caused by ..... .

Health can be affected by diseases that are inherited.

These diseases are caused by a person's ..... .

Health can be affected by diseases that **cannot** be passed from one person to another. These diseases are caused by a person's ..... .

[3]

(b) Complete the table to describe common human diseases.

Disease	**Type of microorganism that causes the disease**	**How the microorganism is spread**
HIV/AIDS	.....	....
Malaria	Protist	....
Salmonella	.....	In food that is eaten

[4]

(c)* Jane has been infected with influenza.

Explain how she could have become infected with the influenza virus **and** how her immune system will respond to it.

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..... **[6]**

5 Mistletoe is a very unusual plant. Instead of growing in the ground, mistletoe grows on another plant such as a tree, as shown in **Fig. 5.1**.

Fig. 5.1

(a) Mistletoe takes most of the sugar it needs from a tissue in the tree. This tissue transports sugars around the tree.

A diagram of the tissue in the tree is shown in **Fig. 5.2**.

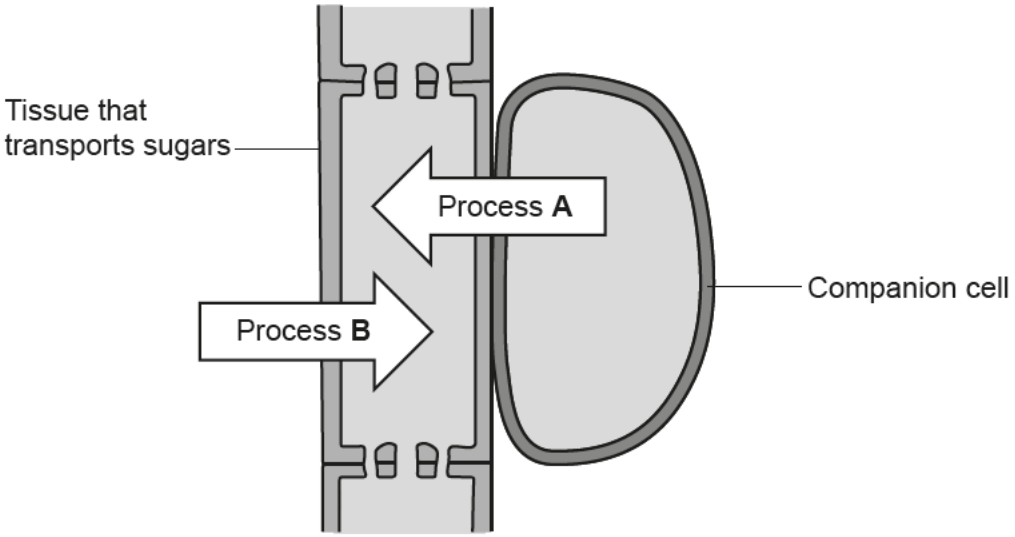

Fig. 5.2

(i) What is the name of the tissue in the tree that the mistletoe takes sugars from?

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

(ii) Process **A** transports sugars into the tissue in the tree.

What is the name of process **A**?

Put a (ring) around the correct answer.

active transport **osmosis** **translocation** **transpiration** **[1]**

(iii) Process **B** transports water into the tissue in the tree.

What is the name of process **B**?

Put a (ring) around the correct answer.

active transport **osmosis** **translocation** **transpiration** **[1]**

(b) Mistletoe does not have roots in the soil.

Mistletoe takes all the water it needs from a **different** tissue in the tree. This tissue transports water from the tree's roots to the tree's leaves.

A diagram of this tissue in the tree is shown in **Fig. 5.3**.

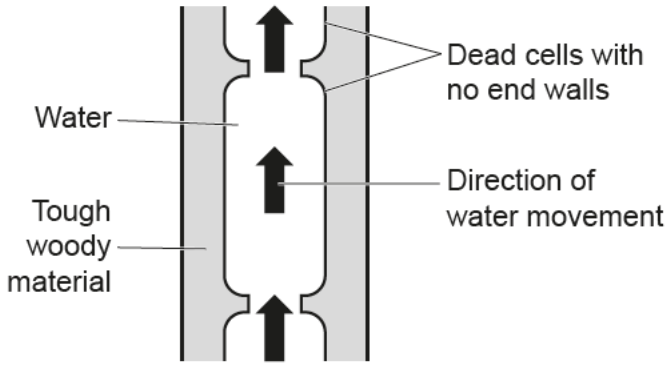

Fig. 5.3

(i) What is the name of the tissue in the tree that the mistletoe takes water from?

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

(ii) Explain why water moves through this tissue from the roots to the leaves in a normal tree.

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..... **[4]**

(c) Mistletoe can catch diseases from the tree it is growing on.

Sarah collects some microorganisms from a piece of mistletoe. She wants to use a light microscope, as shown in **Fig. 5.4**, to look at the microorganisms.

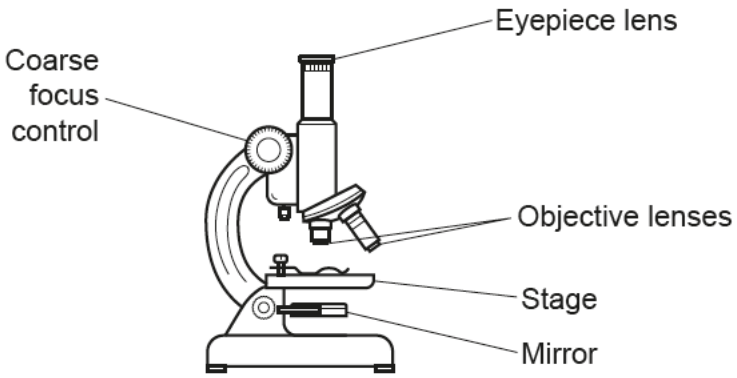

Fig. 5.4

(i) Sarah puts a slide with a sample of the microorganisms on the microscope stage.

She plans to use the microscope's mirror to reflect direct sunlight through the slide so she can see the microorganisms.

Explain why this is dangerous, and suggest what Sarah could do instead to be safer.

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

(ii) Sarah looks into the eyepiece lens and turns the coarse focus control to move the objective lens towards the slide.

Explain why this is dangerous, and suggest what Sarah could do instead to be safer.

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

(d) **Fig. 5.5** shows an image of some of the microorganisms from the mistletoe.

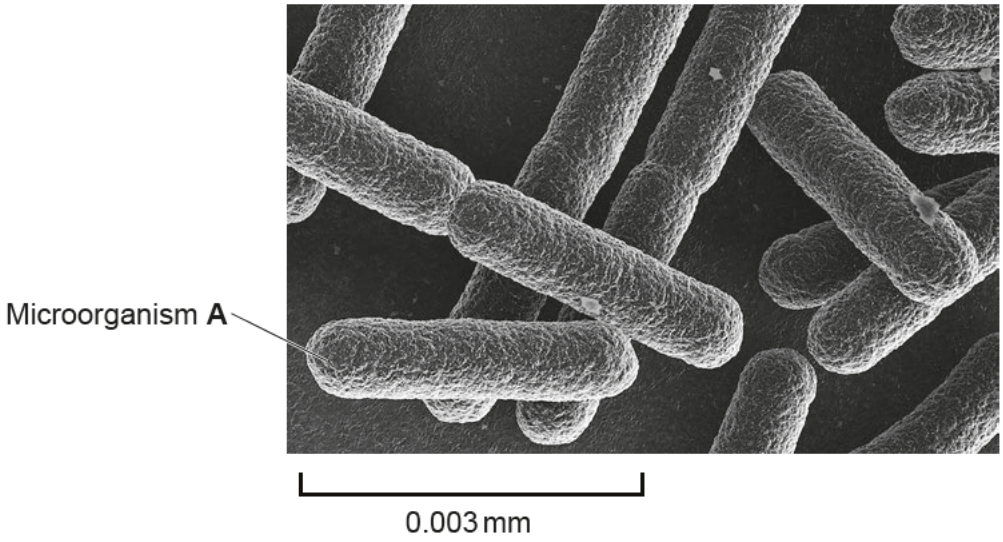

Fig. 5.5

The actual length of microorganism **A** is 0.003 mm. In the image in **Fig. 5.5** it appears to be 45 mm long.

Calculate the magnification of the image in **Fig. 5.5**.

Use the equation: magnification = measured size ÷ actual size

Magnification = × ..... **[2]**

(e) In Sarah's light microscope:

- The magnification of the eyepiece lens is ×10.
- The magnification of the most powerful objective lens is ×40.

Was the image in **Fig. 5.5** taken using Sarah's light microscope?

Yes ☐

No ☐

Explain your answer.

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

6 Some students are playing a game.

Their teacher has scattered small green straws and small red straws over a large area of grass.

In each round of the game, the students have to run around and pick up as many straws as they can in 10 seconds.

(a) The straws are like a population of prey.

Which statement is an example of **variation** between the straws?

Tick (✓) **one** box.

They are all small. ☐

They are different colours. ☐

They are in different places on the grass. ☐

They will not all be picked up. ☐

[1]

(b) The straws are 'hunted' by the students, who are like predators.

Explain why the **green** straws are better suited to 'survive' in the grassy environment.

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

(c) The students are in competition to pick up as many straws as they can.

Suggest **one** example of variation between students that could affect their ability to compete for the straws.

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

(d) Which biological process is the game a model of?

Tick (✓) **one** box.

Mutation ☐

Natural selection ☐

Reproduction ☐

Selective breeding ☐

[1]

(e) The students play several rounds of the game.

(i) Straws that have been picked up are **not** put back on the grass after each round.
The total population of straws left on the grass will therefore be smaller after several rounds.

Predict one **other** way in which the population of straws left on the grass will have changed after several rounds of the game.

Prediction .....

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

(ii) The student who picks up the **fewest** straws in each round has to drop out of the game.
The total population of students will therefore be smaller after several rounds.

Predict one **other** way the population of students will have changed after several rounds of the game.

Explain your answer.

Prediction .....

.....

Explanation .....

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

7* Nina is walking in her garden with no shoes or socks on.

She steps on a sharp stone.

The sharp stone hurts Nina. Her foot moves away from the sharp stone quickly and automatically. This is a reflex response. It happens because of a **reflex arc** in Nina's nervous system.

Explain how the structures of Nina's reflex arc work together to move her foot away from the sharp stone without her having to think about it.

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..... **[6]**

8 Beth is investigating the rate of anaerobic cellular respiration in yeast. She tests different sugar solutions to see what effect they have on the respiration of yeast. One of the solutions contains glucose.

(a) Beth starts by measuring out 30 cm^3 of glucose solution using a measuring cylinder.

Fig. 8.1 shows four attempts she made at doing this.

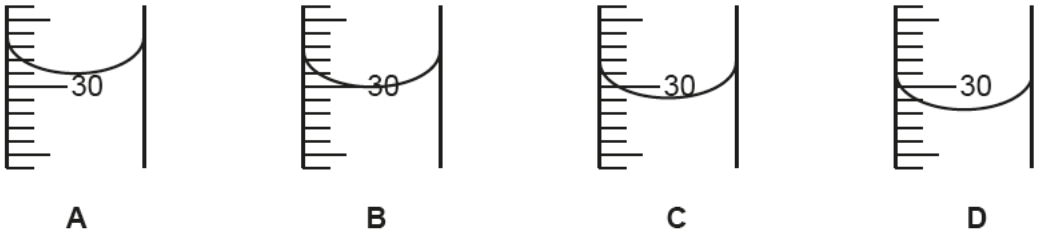

Fig. 8.1

In which attempt, **A**, **B**, **C** or **D**, did Beth have 30 cm^3 of glucose solution?

Attempt ..... **[1]**

(b) Beth sets up her materials and apparatus as shown in **Fig. 8.2**.

Anaerobic cellular respiration takes place in the yeast. This makes a gas.

Beth wants to collect the gas using a **measuring cylinder**.

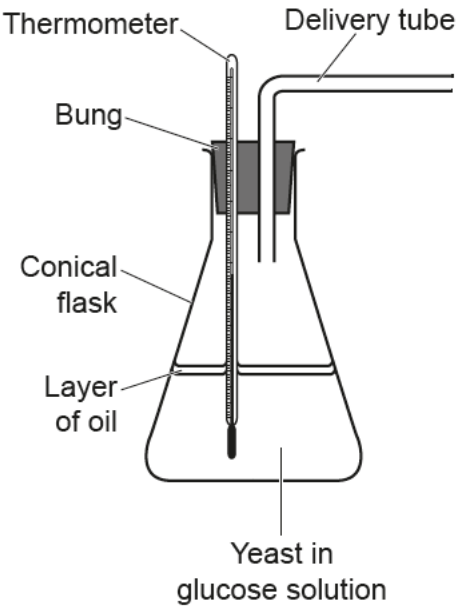

Fig. 8.2

Complete the diagram in **Fig. 8.2** to show how Beth should set up the **measuring cylinder** to collect the gas.

Add labels to your diagram. **[3]**

(c) Beth collects some of the gas made by the anaerobic cellular respiration.
She tests the gas by putting a glowing splint into it.

Table 8.1 describes the results she would see for different gases.

Gas	Result of the test
Air	The splint would continue glowing.
Carbon dioxide	The splint would stop glowing.
Hydrogen	There would be a squeaky pop.
Oxygen	The splint would start burning with a flame.

Table 8.1

What result would you expect to see for the gas Beth has collected?

Explain your answer.

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

(d) Beth noticed that the reading on the thermometer increased during the experiment.

The temperature in the room did **not** increase.

Explain why the glucose solution containing yeast warmed up.

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

Another student, Jamal, is also investigating the rate of anaerobic cellular respiration in yeast.

Jamal sets up his materials and apparatus differently to Beth, as shown in **Fig. 8.3**.

- He places the conical flask in a water bath at room temperature.
- He uses a gas syringe to collect the gas made by anaerobic cellular respiration.

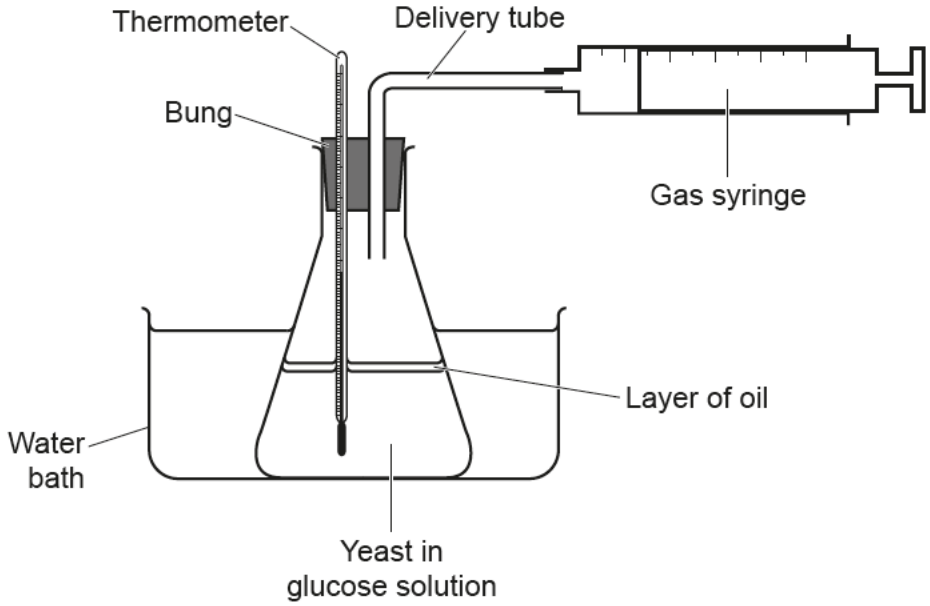

Fig. 8.3

Jamal wants to find out what effect different sugar solutions have on the rate of anaerobic cellular respiration in the yeast.

Jamal collects data from the yeast in the glucose solution and then from the yeast in sucrose solution.

(e) Using the water bath at room temperature will help Jamal to compare his results from the glucose and sucrose solutions more fairly.

Suggest **two** reasons why.

1 .....

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2 .....

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

Jamal plots his results on a graph, as shown in **Fig. 8.4**.

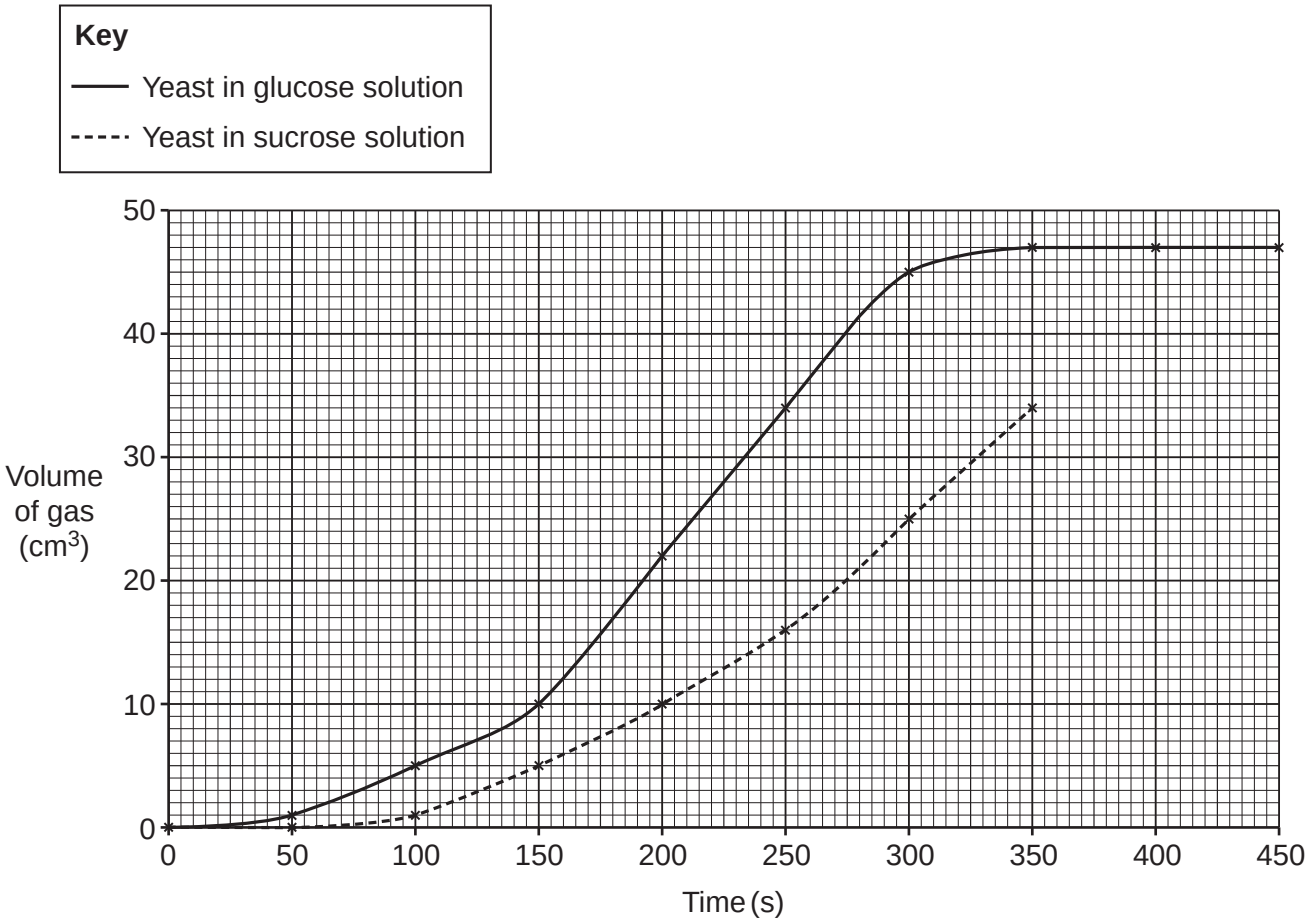

Fig. 8.4

(f) The final measurements for the yeast with the sucrose solution are shown in **Table 8.2**.

Time (s)	Volume of gas (cm^3)
400	42
450	45

Table 8.2

Plot the final measurements on the graph. **[1]**

(g) What volume of gas is collected from the yeast with the sucrose solution after 275 seconds?

Volume = ... cm^3 **[1]**

(h) How long did it take for the yeast to use all of the glucose from the glucose solution?

Explain your answer.

Time ..... s

Explanation .....

.....

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

(i) Calculate the rate of anaerobic respiration in the yeast with glucose solution between 150 seconds and 250 seconds.

Give the **appropriate units** in your answer.

Rate = ... units ..... **[3]**

(j) Jamal concludes that the rate of anaerobic cellular respiration is faster when yeast is in glucose solution.

Describe **two** pieces of evidence from the graph in **Fig. 8.4** that support Jamal's conclusion.

1 .....

.....

2 .....

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

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).