Cambridge IGCSE Biology

Classified Past Papers
Paper 6

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1 A student investigated the effect of glucose concentration on the rate of anaerobic respiration in yeast.

Anaerobic respiration in yeast breaks down glucose to form ethanol and carbon dioxide.

Anaerobic respiration in yeast causes the blue dye, methylene blue, to become colourless. The time taken for the blue colour to disappear can be used as a measure of the rate of anaerobic respiration in yeast.

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The student used this method:

Step 1 Label one test-tube **0.0%**, one test-tube **0.5%** and one test-tube **1.0%**.

Step 2 Put 5.0 cm^3 of water into the test-tube labelled **0.0%**.

Step 3 Put 2.5 cm^3 of 1.0% glucose solution and 2.5 cm^3 of water into the test-tube labelled **0.5%**.

Step 4 Put 5.0 cm^3 of 1.0% glucose solution into the test-tube labelled **1.0%**.

Step 5 Stir the contents of the beaker containing the yeast suspension with the glass rod.

Step 6 Add 5.0 cm^3 of the yeast suspension to each of the test-tubes labelled **0.0%**, **0.5%** and **1.0%**.

Step 7 Put all three test-tubes into a water-bath at 40 °C.

Step 8 Start the stop-clock and wait for three minutes.

Step 9 After three minutes, remove the test-tubes from the water-bath and place them in a test-tube rack.

Step 10 Use a pipette to add **one** drop of methylene blue dye to each of the test-tubes. Carefully mix the contents of each test-tube with the glass rod.

Step 11 Use a second pipette to slowly add a layer of oil to each of the test-tubes.

The layer of oil will float on top of the yeast suspension and methylene blue mixture, as shown in Fig. 1.1.

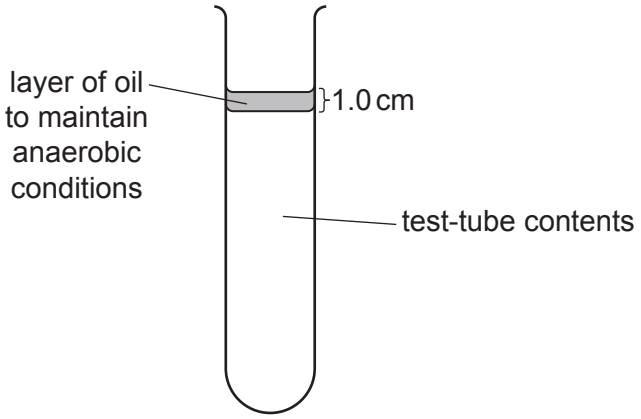


Fig. 1.1

Step 12 Put the test-tubes back into the water-bath and restart the stop-clock.

Step 13 Measure the time taken for the blue colour in each of the test-tubes to disappear.

Record the time taken in seconds for each test-tube.

The student stopped timing if the blue colour had not disappeared after 10 minutes. They recorded this result as >600 in their table.

The stop-clocks from step 13 are shown in Fig. 1.2.

0.0% 0.5% 1.0%

Fig. 1.2

CLICK FOR EXPLANATION

(a) (i) Prepare a table to record the results of the investigation.

Convert the times on the stop-clocks shown in Fig. 1.2 to seconds and record these times in your table.

percentage concentration of glucose / %	time taken for blue colour to disappear / s
0	600
0.5	362
1	132

[4]

(ii) State a conclusion for the results of this investigation.

The higher the concentration of glucose the faster the rate of respiration

[1]

(iii) State the independent variable in this investigation.

concentration of glucose [1]

(iv) State **one** variable that was kept constant in this investigation.

total volume of solutions/equilibration time / temperature [1]

CLICK FOR EXPLANATION

(v) Explain why it was important to stir the yeast suspension in step 5.

to distribute the yeast evenly / to ensure that the yeast concentration is the same all over the suspension [1]

(b) One way to improve this investigation would be to use an increased number of different concentrations of glucose.

(i) Suggest **two** other ways to improve this investigation.

1 repeat the investigation at each concentration 5x

2 use a colorimeter to find the end point more accurately

[2]

(ii) Describe how you would make 5.0 cm^3 of 0.25% glucose solution using a 0.50% glucose solution and distilled water.

Dissolve 2.5 cm3 of the 0.5% in 2.5 cm3 of distilled water

[2]

(iii) Describe the method you would use to test a solution for the presence of glucose.

Add Benedict's solution

and heat in a water bath at 80 oC

the colour will change into brick red / orange / green

CLICK FOR EXPLANATION

..... [2]

(c) A student investigated the effect of temperature on the rate of respiration in yeast at 25 °C and 35 °C.

In one experiment, the student measured the volume of carbon dioxide produced by the yeast every 5 minutes for a total of 30 minutes.

(i) Describe suitable apparatus that could be used to collect and measure the volume of carbon dioxide produced.

Use a gas syringe

..... [1]

The student did three experiments at each temperature. They used the results to calculate the mean volume of carbon dioxide produced.

Part of the student's results table for the experiments at 35 °C is shown in Table 1.1.

Table 1.1

time / minutes	volume of carbon dioxide produced at 35 °C / cm^3			
	experiment 1	experiment 2	experiment 3	mean
15	1.8	3.2	2.0	1.9

(ii) The student decided that the result of one of the experiments shown in Table 1.1 was anomalous.

State what is meant by an anomalous result.

An outlier result that doesn't fit the pattern of the other results

..... [1]

(iii) Describe how the student calculated the mean volume of carbon dioxide produced shown in Table 1.1.

The student didn't include the anomalous result in the calculation

..... [1]

The results of the whole investigation about the effect of temperature on the rate of respiration in yeast at 25 °C and 35 °C are shown in Table 1.2.

Table 1.2

time /minutes	mean volume of carbon dioxide produced at 25 °C / cm^3	mean volume of carbon dioxide produced at 35 °C / cm^3
5	0.0	0.1
10	0.0	0.8
15	0.1	1.9
20	0.2	2.7
25	0.5	3.2
30	1.1	3.2

CLICK FOR EXPLANATION

(iv) Using the data in Table 1.2, compare the mean volumes of carbon dioxide produced at 25 °C and 35 °C.

The volume of carbon dioxide is always higher at 35 oC

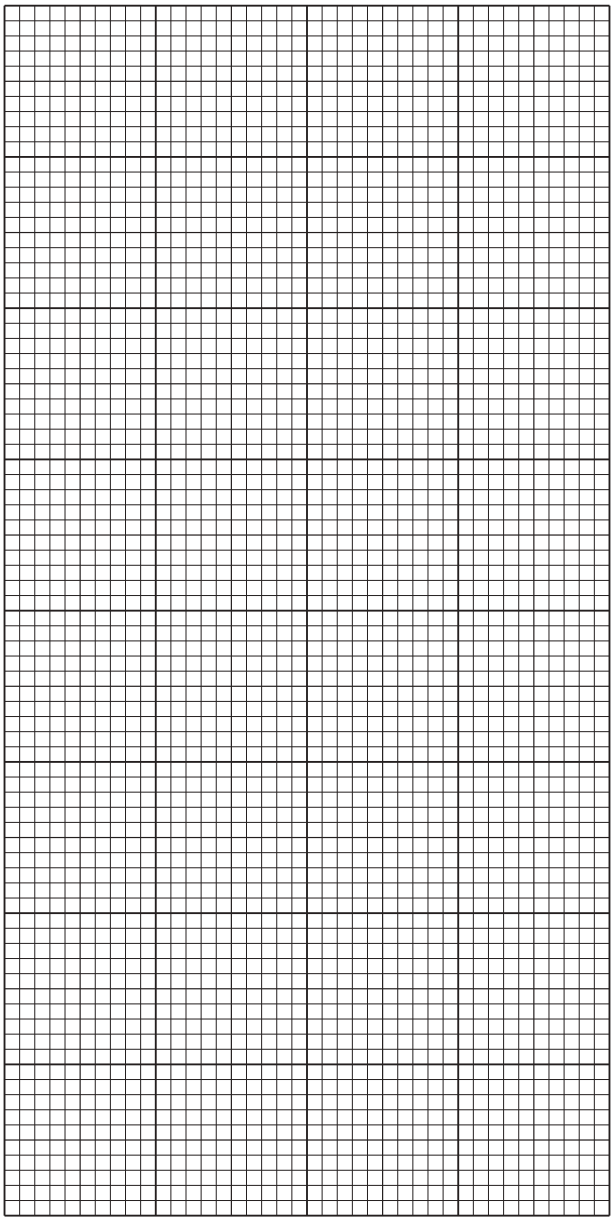
The volume becomes constant at 35 oC but continues to increase at 25 oC

..... [2]

(v) Plot a line graph on the grid of mean volume of carbon dioxide produced against time, using all of the data in Table 1.2.

You will need to plot the data for each temperature as separate lines on your graph.

Include a suitable key.



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[5]

(vi) Estimate the time taken to produce 3.0 cm^3 of carbon dioxide at 35 °C.

Show on the graph how you obtained your estimate.

22–23 ..... minutes

[2]

(d) Carbon dioxide gas was bubbled through hydrogencarbonate indicator solution.

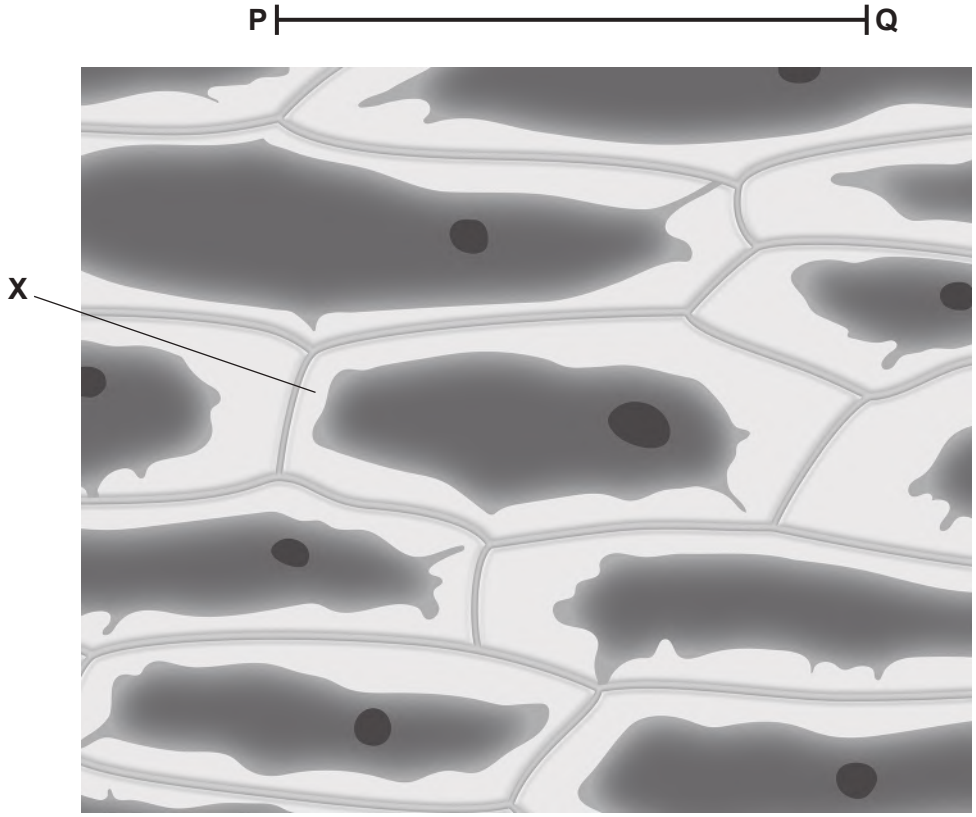
The indicator was red before the gas was bubbled through.

State the colour change that would occur.

turns from red to yellow ..... [1]

[Total: 27]

2 **(a)** Fig. 2.1 shows epidermal cells from a red onion.



magnification ×340

Fig. 2.1

(i) Draw a large diagram of the cell labelled **X** in Fig. 2.1.

CLICK FOR EXPLANATION

[4]

(ii) Line **PQ** on Fig. 2.1 represents the length of cell **X**.

Measure the length of line **PQ** on Fig. 2.1.

length of **PQ** ..... 70 ..... mm

Calculate the actual length of cell **X** using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line } \mathbf{PQ} \text{ in Fig. 2.1}}{\text{actual length of cell } \mathbf{X}}$$

Give your answer to **three** significant figures.

Space for working.

70 ÷ 340 = 0.206

..... 0.206 ..... mm

[3]

(b) Water moves into and out of cells by osmosis.

Plan an investigation to determine the effect of the concentration of sodium chloride solution on osmosis in plant tissue.

Prepare five different solutions of sodium chloride, all of the same volume.

Cut cylinders of the same size from the same onion.

Measure the initial mass of these cylinders.

Soak the cylinders in each solution for 48 hours.

Then, calculate percentage change in mass

Repeat at each concentration and find the average

Wear gloves for safety.

[6]

[Total: 13]

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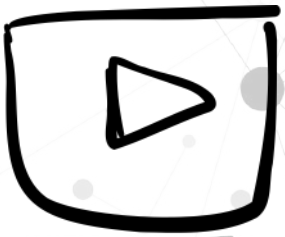

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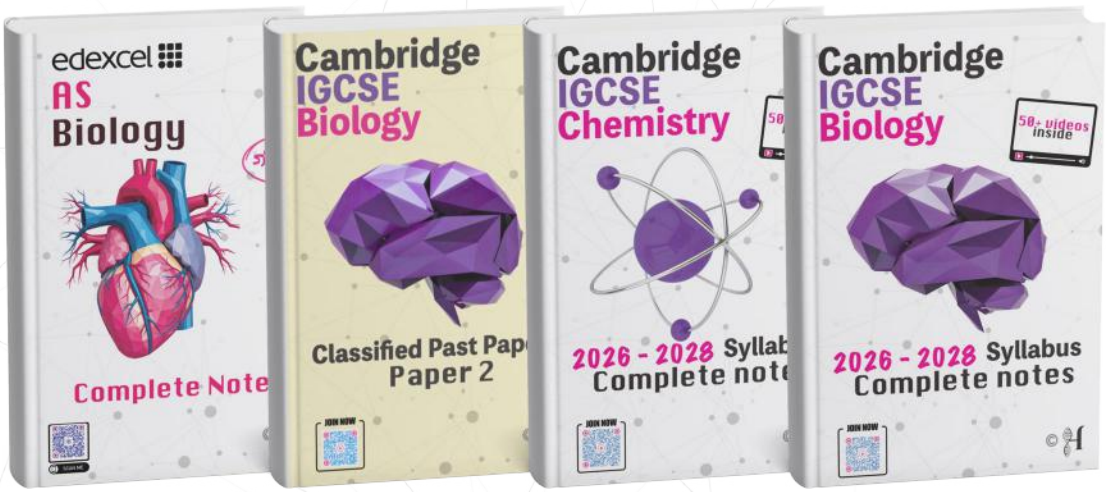

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