

19 What is produced by anaerobic respiration in human muscles?

|   | carbon dioxide | lactic acid | water |
|---|----------------|-------------|-------|
| A | ✓              | ✓           | ✗     |
| B | ✓              | ✗           | ✓     |
| C | ✗              | ✓           | ✗     |
| D | ✗              | ✗           | ✓     |

key  
✓ = substance is produced  
✗ = substance is **not** produced

**1** A student investigated the rate of respiration in yeast using different concentrations of glucose.

They used a 5% glucose solution to make a 1% glucose solution and a 4% glucose solution.

The student used this method:

Step 1 Label two small test-tubes **1%** and **4%**.

Step 2 Use a syringe to put 1 cm<sup>3</sup> of 5% glucose solution into the small test-tube labelled **1%**.

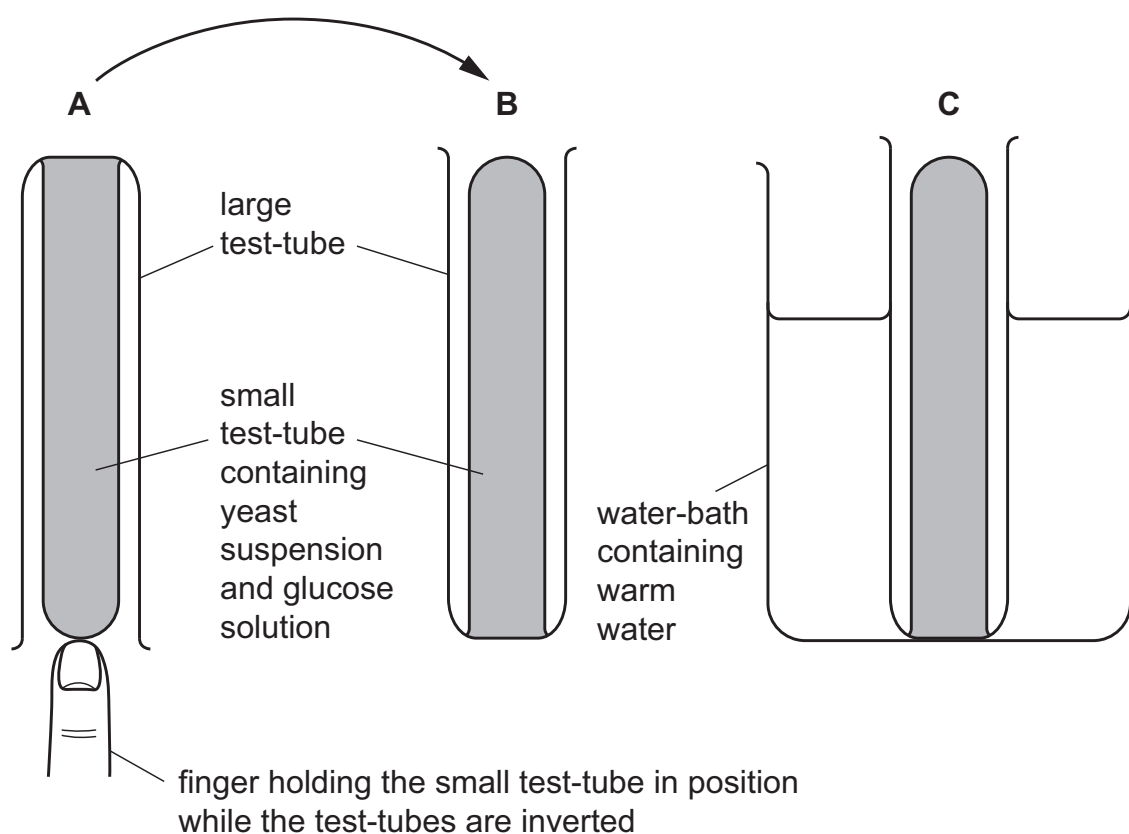
Put 4 cm<sup>3</sup> of 5% glucose solution into the small test-tube labelled **4%**.

Step 3 Use a clean syringe to put 4 cm<sup>3</sup> of distilled water into the small test-tube labelled **1%**.

Put 1 cm<sup>3</sup> of distilled water into the small test-tube labelled **4%**.

Step 4 Pour yeast suspension into the small test-tube labelled **1%** until it is completely full.

Step 5 Keep the small test-tube upright and carefully place a large test-tube over the top of the small test-tube labelled **1%**. Push the small test-tube up to the top of the large test-tube, as shown in Fig. 1.1A. Quickly invert the test-tubes, as shown in Fig. 1.1B.

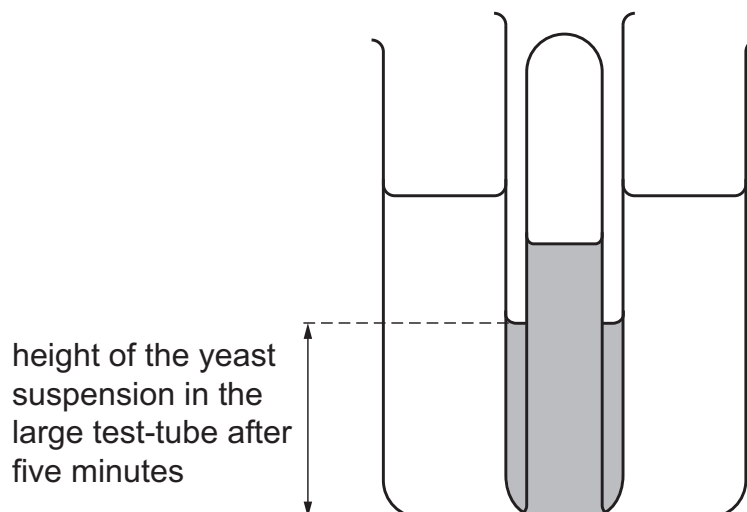


**Fig. 1.1**

Step 6 Put the large test-tube and the small test-tube labelled **1%** into a warm water-bath, as shown in Fig. 1.1C.

Step 7 Start the stop-clock and wait for five minutes.

Step 8 After five minutes, stop the stop-clock and use a ruler to measure the height of the yeast suspension in the **large** test-tube, as shown in Fig. 1.2.



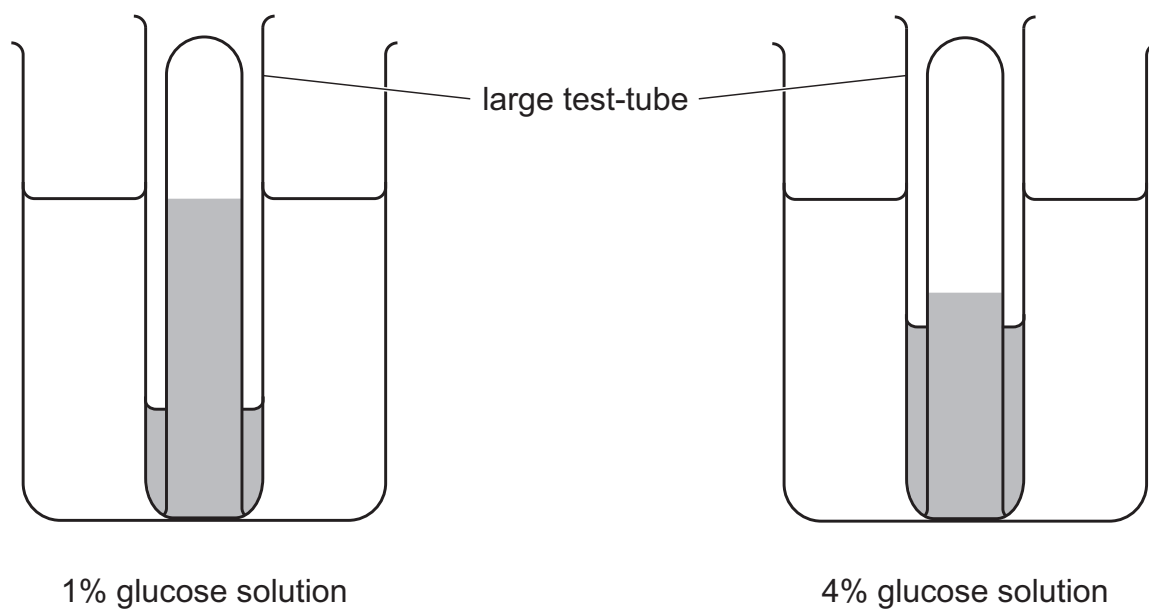
**Fig. 1.2**

Step 9 Remove the test-tubes from the warm water-bath and discard them.

Step 10 Pour yeast suspension into the small test-tube labelled **4%** until it is completely full.

Step 11 Repeat steps 5 to 8 with the small test-tube labelled **4%**.

(a) Fig. 1.3 is a diagram of the water-baths in steps 8 and 11.



**Fig. 1.3**

- (i) Measure the height of the yeast suspension in each of the **large** test-tubes shown in Fig. 1.3.

Prepare a table for the results and record your measurements from Fig. 1.3.

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

[1]

(iii) State the independent and dependent variables in this investigation.

independent variable

dependent variable

[2]

(iv) Describe how the temperature of the water-bath could be maintained.

[1]

(v) Explain why a clean syringe was used in step 3.

[1]

(b) A student extended the investigation by using more concentrations of glucose solution.

Calculate the volumes of 5% glucose solution and distilled water that are needed to make 5 cm<sup>3</sup> of a 3% glucose solution.

volume of 5% glucose solution ..... cm<sup>3</sup>

volume of distilled water ..... cm<sup>3</sup>

[1]

(c) Sports drinks often contain glucose, which is a reducing sugar.

State how you could test a sample of a sports drink for reducing sugar.

.....

.....

.....

.....

..... [2]

(d) (i) The ethanol emulsion test can be used to show that a sample of food contains fat.

State the result of a positive test.

..... [1]

(ii) Suggest **one** safety precaution that should be followed when using ethanol.

.....

.....

..... [1]

[Total: 14]



2 A student investigated the effect of temperature on the rate of respiration in yeast cells.

They used the apparatus shown in Fig. 2.1.

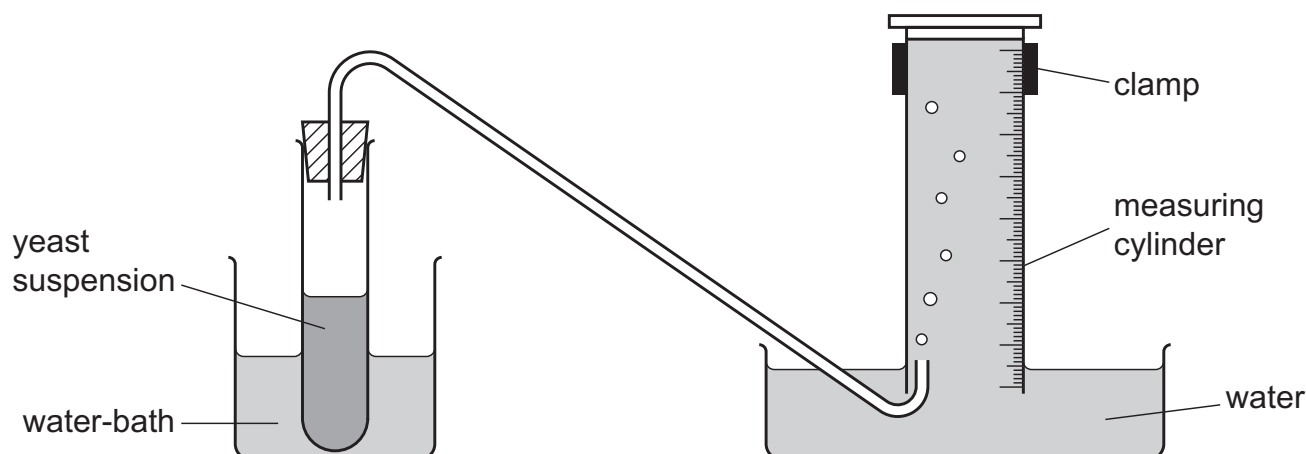


Fig. 2.1

The student used this method:

- Put 25 cm<sup>3</sup> of yeast suspension into a test-tube.
- Put the test-tube into a water-bath and add water at 10 °C to the water-bath.
- Leave the apparatus for five minutes before moving on to the next step.
- Start a stop-clock and count the number of bubbles produced by the respiring yeast cells in three minutes.
- Repeat the procedure using a water-bath maintained at different temperatures.

(a) (i) State **two** variables that the student kept constant in this investigation.

- 1 .....
- .....
- 2 .....
- .....

[2]

(ii) State **one** possible source of error when measuring the dependent variable **and** suggest an improvement to this method of measuring.

- error .....
- .....
- improvement .....
- .....
- .....

[2]



(b) Table 2.1 shows the results of the investigation.

Table 2.1

| water-bath temperature<br>/ °C | number of bubbles produced in<br>3 minutes | rate of bubble production<br>/ bubbles per minute |
|--------------------------------|--------------------------------------------|---------------------------------------------------|
| 10                             | 33                                         | 11                                                |
| 20                             | 45                                         | 15                                                |
| 30                             | 79                                         |                                                   |
| 40                             | 112                                        | 37                                                |
| 50                             | 124                                        | 41                                                |
| 60                             | 37                                         | 12                                                |

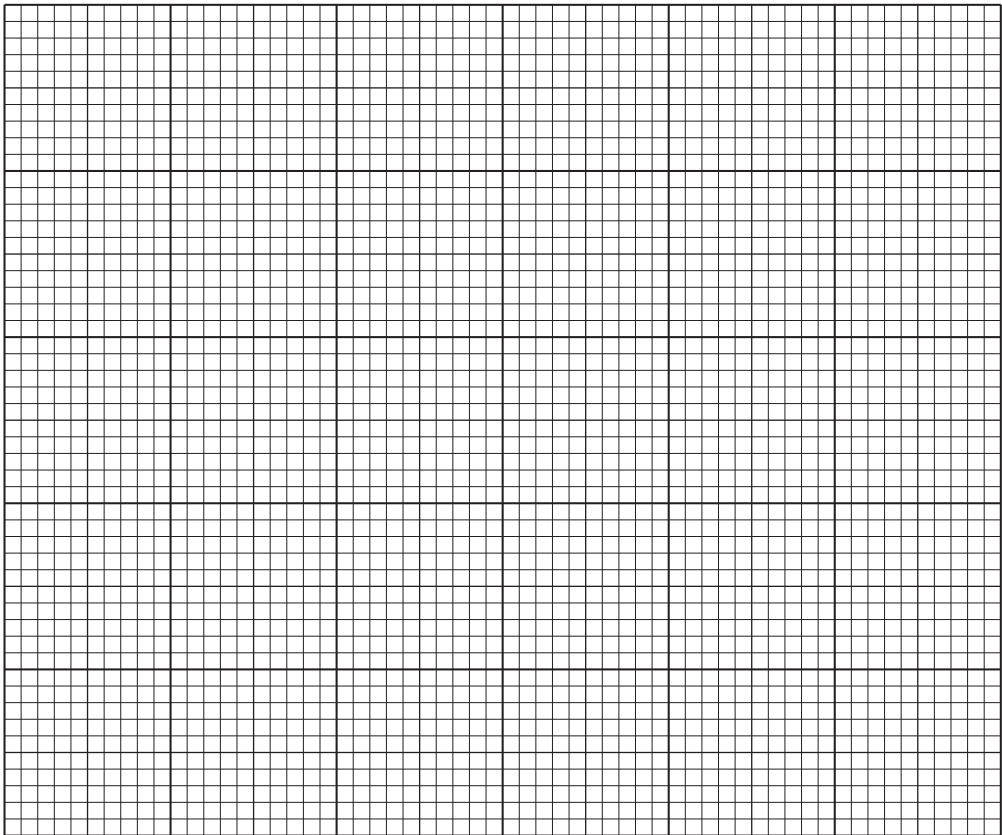
(i) Calculate the rate of bubble production at 30 °C.

Give your answer to an appropriate number of significant figures.

Space for working.

..... bubbles per minute [2]

(ii) Plot the data in Table 2.1 on the grid to show the effect of temperature on the **rate** of bubble production.



[4]

(iii) Describe the results of this investigation.

[2]

(c) Describe how the student could confirm that the gas produced is carbon dioxide.

[2]

[Total: 14]

2 (a) Alveoli are the gas exchange surface in humans.

State **three** features of alveoli that make them an effective gas exchange surface.

1 .....

2 .....

3 .....

[3]

(b) Fig. 2.1 is a diagram of the human breathing system.

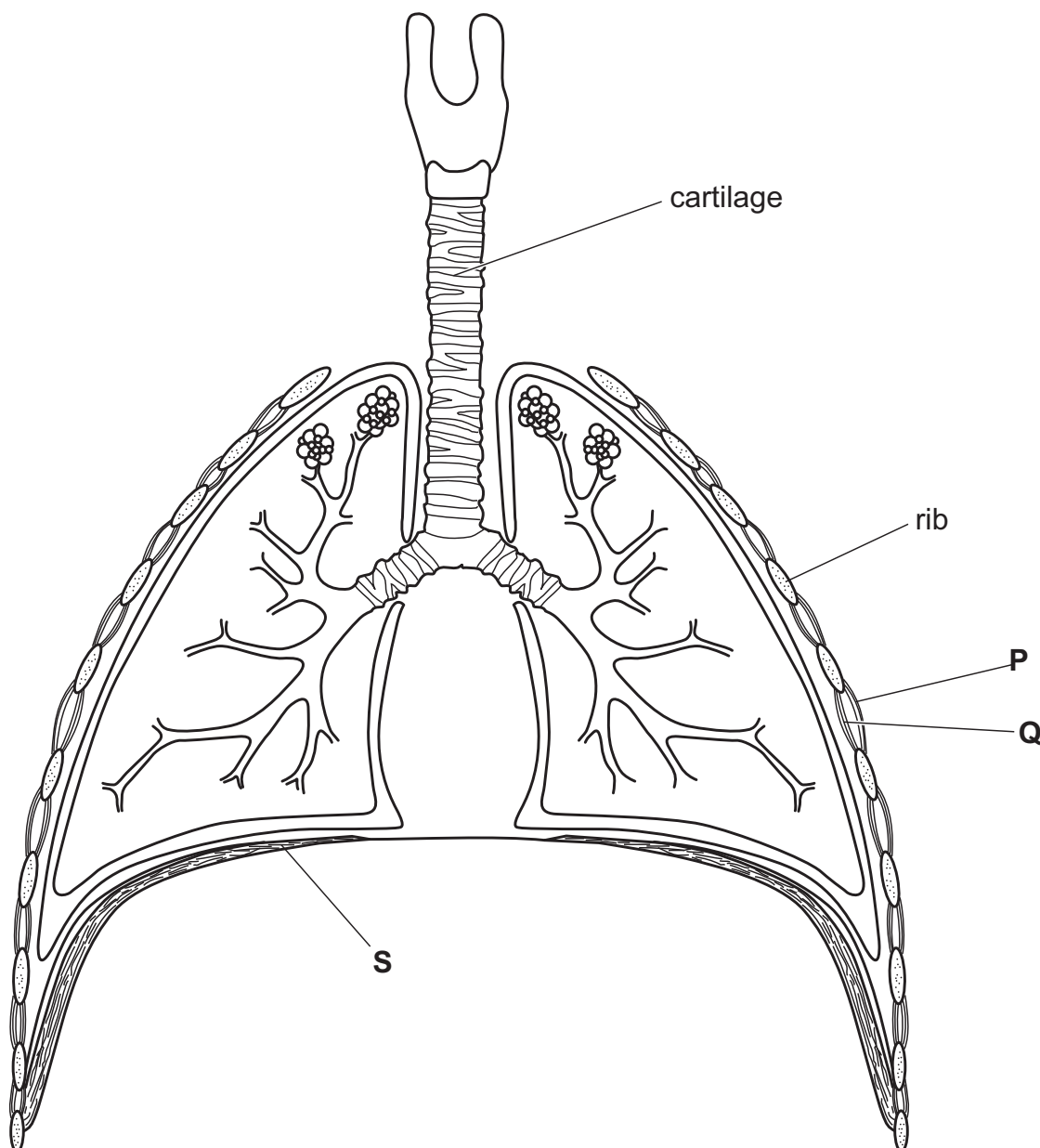


Fig. 2.1

(i) Three muscles involved in inspiration are labelled **P**, **Q** and **S** in Fig. 2.1.

Identify the letters in Fig. 2.1 that label the muscles which contract during inspiration.

..... [1]

(ii) State the function of cartilage in the breathing system.

[1]

(c) (i) State the balanced chemical equation for aerobic respiration.

[2]

(ii) During physical activity breathing changes.

Explain the mechanism that links the increase in physical activity to the changes in breathing.

[3]

[Total: 10]