

2.7 Cellular Respiration

Question Paper

Course	DP IB Biology
Section	2. Molecular Biology
Topic	2.7 Cellular Respiration
Difficulty	Medium

Time allowed: 60
Score: /48
Percentage: /100

Question 1a

- a) ATP is a chemical substance generated in cellular respiration; it is an immediate source of energy for the cell. ATP can easily be hydrolysed or re-synthesised.

State **two** products created when ATP is hydrolysed by water.

[2 marks]

Question 1b

- b) Cells hydrolyse ATP to provide energy for other reactions, or to add phosphate to other substances to make them more reactive. However, ATP needs to be re-synthesised to provide energy for future reactions.

Describe how ATP may be re-synthesised.

[2 marks]

Question 1c

- c) Give **two** ways in which the properties of ATP make it a suitable source of energy for biological processes.

[2 marks]

Question 1d

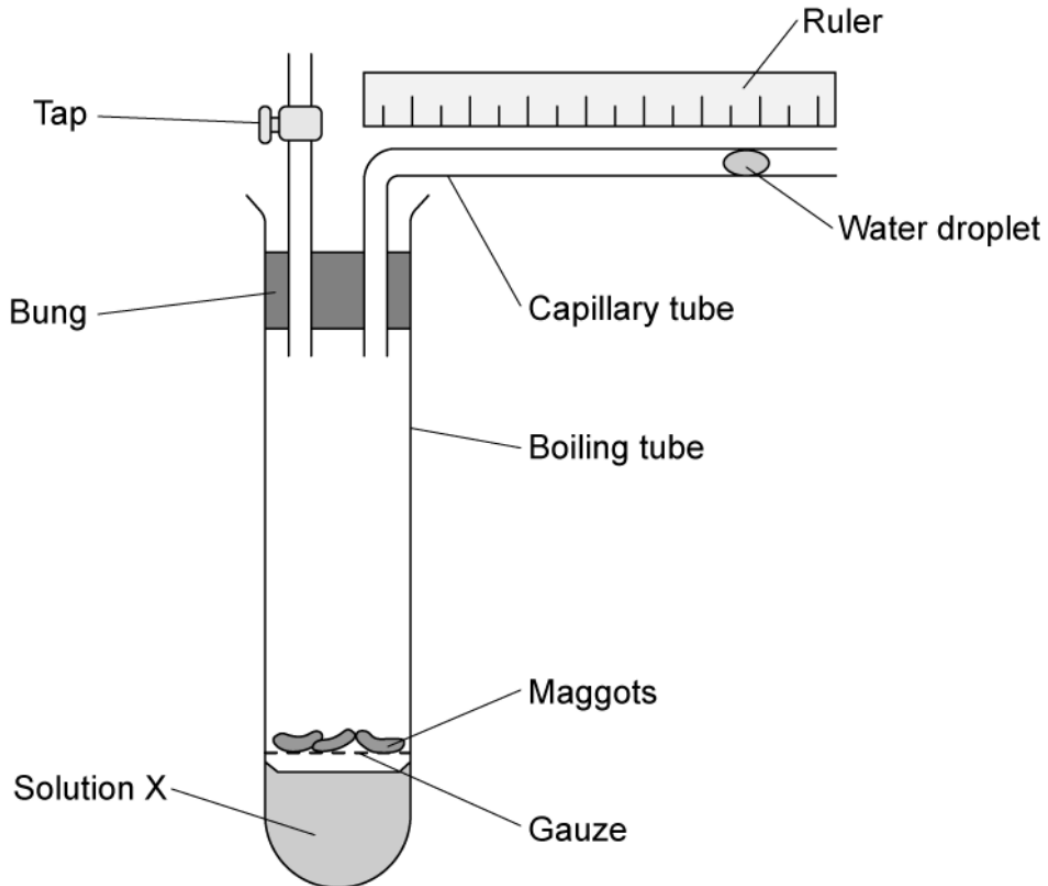
- d) Each day, the human body synthesises more than its weight in ATP during aerobic respiration.

Explain why it is necessary to synthesise such large amounts of ATP.

[2 marks]

Question 2a

- a) The following apparatus was set up to measure the rate of aerobic respiration by a student.



Suggest what solution **X** might be and its function within the experiment.

[2 marks]

Question 2b

- b) Describe what ethical concerns the student should consider during this experiment.

[3 marks]

Question 2c

- c) The student found the water droplet had moved by 2 cm in 24 hours. The diameter of the lumen of the tube is 1 mm.

The volume of the tubing is given by the equation $\pi r^2 l$;

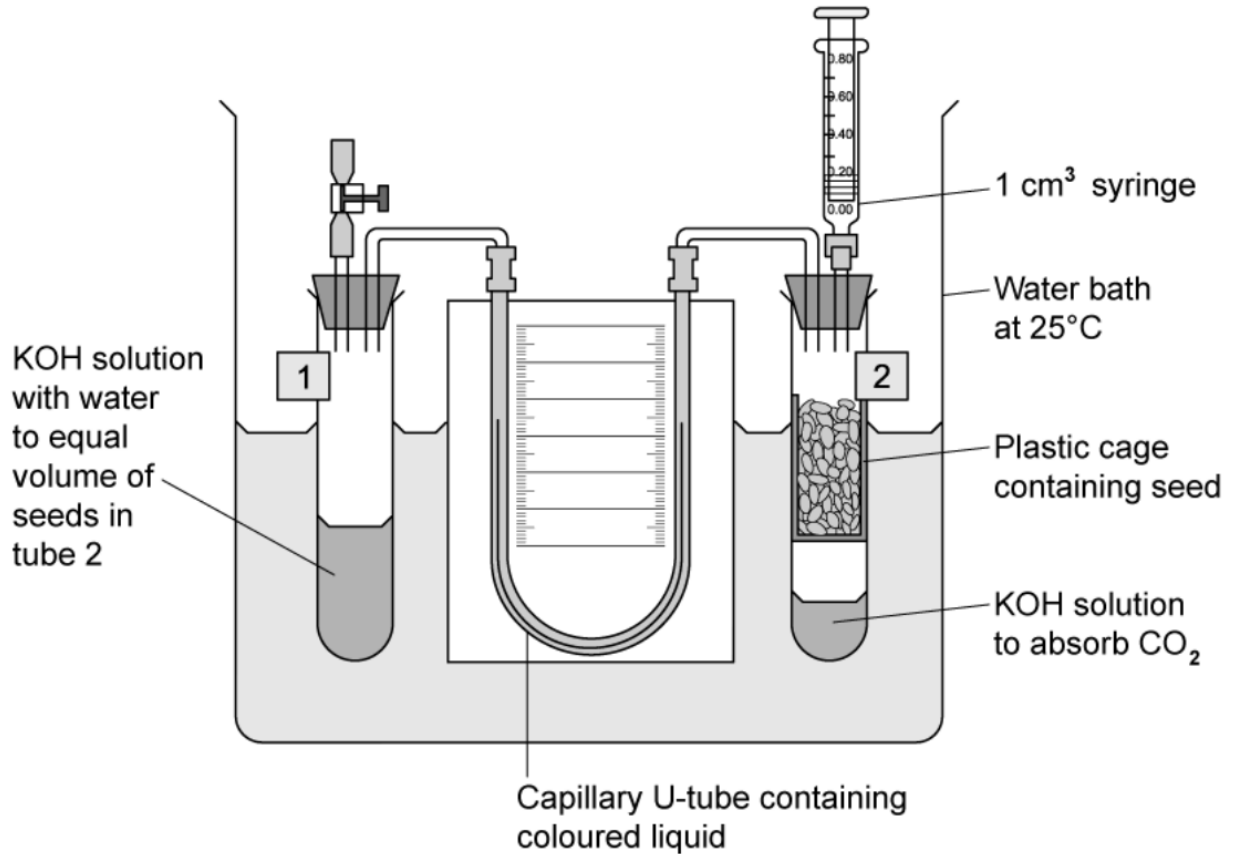
Use the value of 3.14 to represent π and note that l refers to the length.

Use the equation to calculate the volume of gas produced in $\text{cm}^3 \text{ hour}^{-1}$, give your answer in standard form.

[3 marks]

Question 3a

- a) The diagram below shows the respirometer apparatus used by a teacher for measuring the rate of oxygen consumption of seeds during aerobic respiration.



For the first 12 minutes, the tap attached to tube **1** was left open and the syringe from tube **2** was taken away.

Suggest **two** reasons why this was done.

[2 marks]

Question 3b

- b) A temperature of 25 °C was used during the experiment. The teacher explained it was very important to keep the temperature constant.

Explain why it is important to keep the temperature constant.

[2 marks]

Question 3c

- c) After 12 minutes, the tap connected to tube **1** was closed and the syringe was attached to tube **2**. Every 60 seconds, the syringe plunger was moved to make the levels in the U-tube identical. The reading on the volume scale of the syringe was then recorded. The results are shown in the table below.

Time (minutes)	Reading on volume scale of syringe (cm ³)
0	0.86
1	0.83
2	0.80
3	0.77
4	0.75
5	0.73
6	0.70
7	0.68
8	0.65
9	0.62
10	0.59
11	0.57
12	0.54

Predict, with a reason, whether the coloured liquid in the U-tube would move towards tube **1** or tube **2** during the experiment.

[3 marks]

Question 3d

- d) The mass of the seeds was 1.8 g.

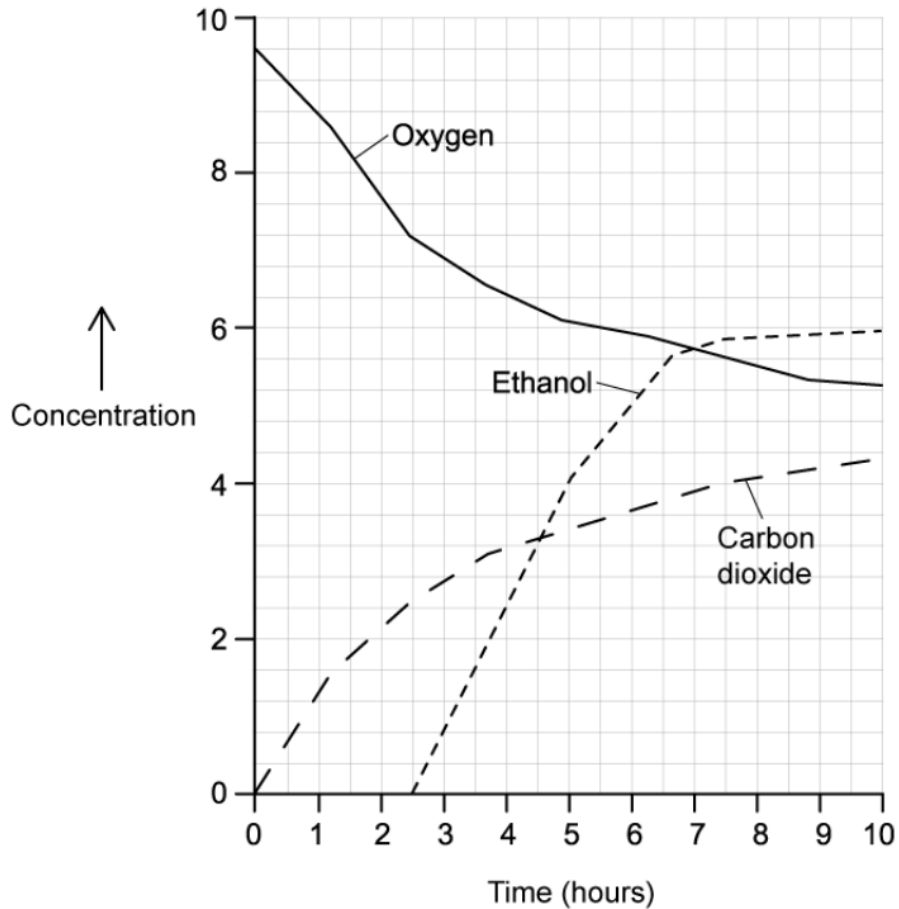
Using the information provided in the table, calculate the rate of oxygen consumption $\text{cm}^3 \text{g}^{-1} \text{hour}^{-1}$ by the seeds. Show your working.

[2 marks]

Question 4a

- a) A researcher investigated the use of a new carbohydrate source (substance **L**) for the production of ethanol as biofuel. The aim was to find the optimum length of time to leave a mixture of yeast and substance **L** to produce ethanol. They set up an airtight container containing yeast and substance **L**, then measured the concentrations of oxygen, carbon dioxide and ethanol over 10 hours.

The results of this experiment are shown in the graph below.



Give **three** reasons why the container, containing the mixture, had to be airtight.

[3 marks]

Question 4b

- b) Explain the relationship seen between the concentration of oxygen and the concentration of carbon dioxide between 0 and 2.5 hours.

[2 marks]

Question 4c

- c) A student concluded that the yeast started to respire anaerobically when the oxygen concentration fell below a certain concentration.

Suggest, with a reason, at what time in the experiment this occurred.

[2 marks]

Question 4d

- d) State the equation to show the type of respiration carried out by the yeast after 2.5 hours.

[1 mark]

Question 5a

One mark is available for clarity of communication throughout this question.

- a) Compare and contrast aerobic respiration and anaerobic respiration.

[5 marks]

Question 5b

- b) During sprint exercise or weight lifting, the body relies on anaerobic respiration to maximise the power of muscle contraction.

Explain why anaerobic respiration can only be sustained for short periods of time.

[4 marks]

Question 5c

- c) Describe and explain the use of yeast in baking.

[6 marks]