Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430UA0-1

Z22-3430UA0-1

WEDNESDAY, 15 JUNE 2022 – MORNING

SCIENCE (Double Award)

Unit 1: BIOLOGY 1
HIGHER TIER

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**6**	
3.	**8**	
4.	**12**	
5.	**6**	
6.	**12**	
7.	**7**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.
You may use a pencil for graphs and diagrams only.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
Question **5** is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions.

1. The nutrition information in **Table 1.1** is taken from a pack of dried pasta.

Table 1.1

TYPICAL VALUES	Per 100 g (of dried pasta)
Energy	761 kJ
Fat	1.3 g
of which – saturated	0.1 g
of which – unsaturated	.... g
Carbohydrates	25.0 g
of which – sugars	2.3 g
Fibre	7.7 g
Protein	13.0 g
Salt	0.05 g

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(a) (i) Calculate the value for unsaturated fats. **Write your answer in Table 1.1**. [1]

Space for working.

(ii) State the name of the nutrient which makes up most of the carbohydrates in the dried pasta. [1]

....

(iii) State the importance of a low-salt diet. [1]

....

....

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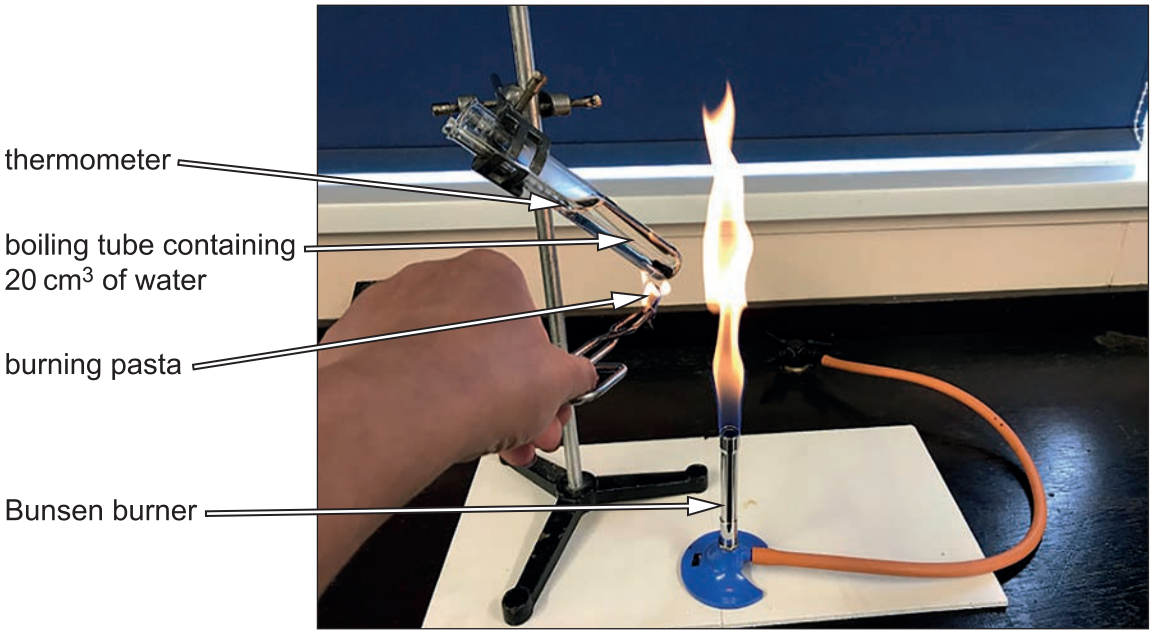
(b) Lloyd and Emma carried out an experiment to compare the energy values in **Table 1.1** with values they obtained using the apparatus shown in **Image 1.2**.

Image 1.2



They ignited a 1.6 g piece of dried pasta using the Bunsen burner and immediately held the burning pasta at the base of the boiling tube until it stopped burning. The results Lloyd and Emma obtained are shown in **Table 1.3**.

Table 1.3

Mass of pasta (g)	Initial temperature of water (°C)	Final temperature of water (°C)	Increase in temperature of water (°C)	Energy released per gram of food (kJ)
1.6	14	58	44	....

(i) Use the following formula to calculate the energy released per gram of food (kJ). **Write your answer in Table 1.3**. [2]

$$\text{Energy released per gram (kJ)} = \frac{\text{volume of water (cm}^3\text{)} \times \text{temperature increase (°C)} \times 0.0042}{\text{mass of pasta sample (g)}}$$

Space for working

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(ii) I. State how the energy content of dried pasta in **Table 1.3** compares to the energy content indicated in **Table 1.1**. You must use numerical data in your answer. [2]

....

....

....

....

II. Give **one** reason for the difference between the energy content of dried pasta obtained by Lloyd and Emma, as shown in **Table 1.3** and the energy content indicated in **Table 1.1**. [1]

....

....

(iii) Evaluate the arrangement of the apparatus shown in **Image 1.2** by identifying **one** source of error. [1]

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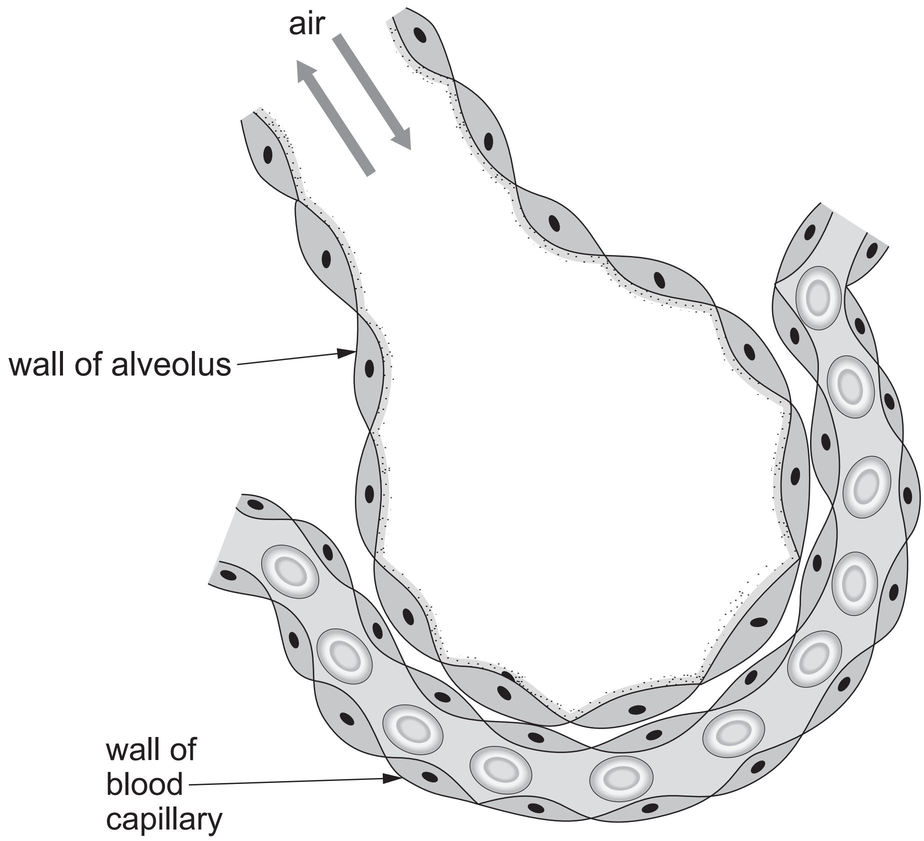
2. **Image 2.1** shows an alveolus.

Image 2.1



(a) **Use labelled arrows** to identify the following structures on **Image 2.1**: [2]

(i) bronchiole;

(ii) blood plasma.

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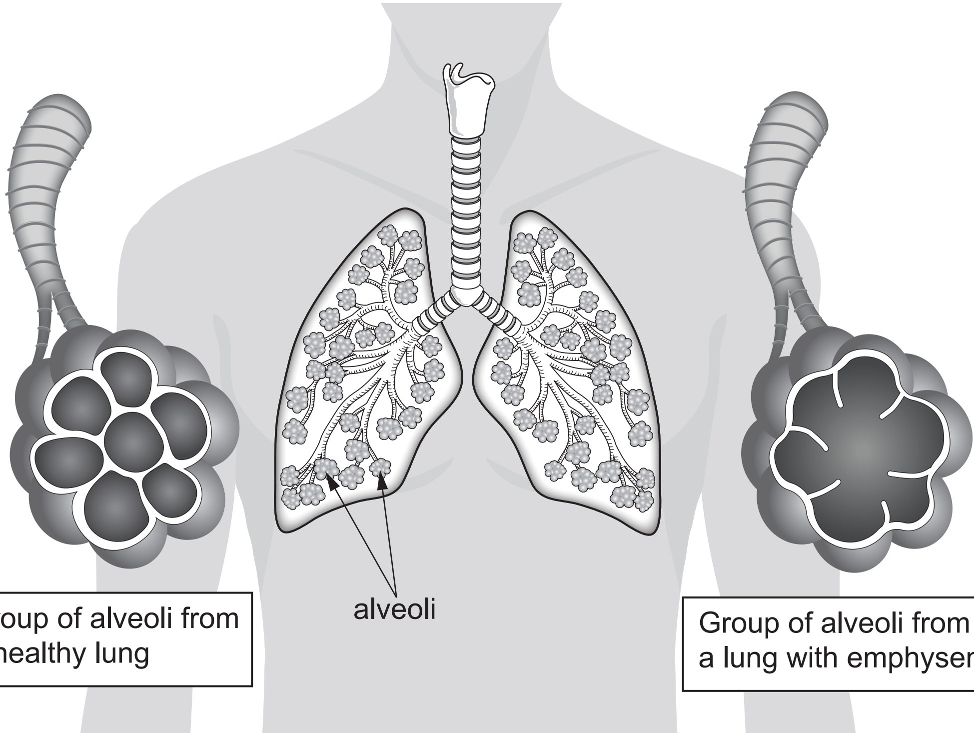
(b) **Image 2.2** shows groups of alveoli from a healthy lung and from a lung of a person with emphysema. The tables below **Image 2.2** show the concentrations of oxygen and carbon dioxide in the blood capillaries.

Image 2.2



Healthy lung	
Gas	Concentration of gases in the blood capillaries (arbitrary units)
oxygen	86
carbon dioxide	45

Lung with emphysema	
Gas	Concentration of gases in the blood capillaries (arbitrary units)
oxygen	53
carbon dioxide	62

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(i) Using **Image 2.2**, explain the differences in the concentrations of gases in the blood capillaries of a healthy lung and a lung with emphysema. [2]

....

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(ii) State the effect on breathing of the difference in concentrations of these gases for a person suffering from emphysema. [1]

....

(iii) State **one** cause of emphysema. [1]

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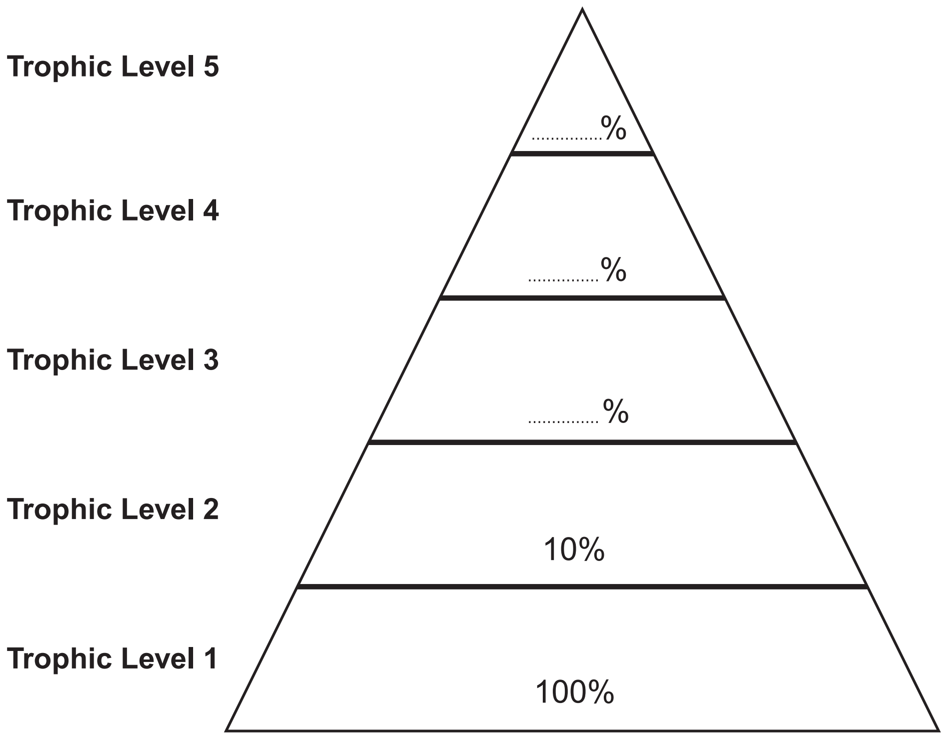
3. **Image 3.1** represents a five-stage food chain drawn as a pyramid of biomass. The energy retained or stored in the form of new biomass in trophic levels **1** and **2** is represented as a percentage.

Image 3.1



(a) State:

(i) the source of energy for this food chain. [1]

....

(ii) the scientific term used to describe the organisms found at trophic level **1**. [1]

....

(iii) a term that can be used to describe the organisms at trophic levels **2–5**. [1]

....

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(b) (i) The efficiency of energy transfer between one trophic level and the next is **10%**. Calculate the percentage of the energy entering trophic level **1** that reaches trophic levels **3**, **4** and **5**. **Write your answers in the pyramid in Image 3.1**. [2]

Space for working.

(ii) Suggest why the food chain represented by the pyramid of biomass in **Image 3.1** could not sustain a trophic level **6**. [1]

....

....

(iii) State **one** way in which energy is lost from a food chain. [1]

....

(c) Underline **one** correct statement about pyramids of biomass from the following list. [1]

As you go up most pyramids of biomass from one trophic level to the next the:

- size of the organisms decreases and their numbers increase.
- size of the organisms decreases and their numbers decrease.
- size of the organisms increases and their numbers increase.
- size of the organisms increases and their numbers decrease.

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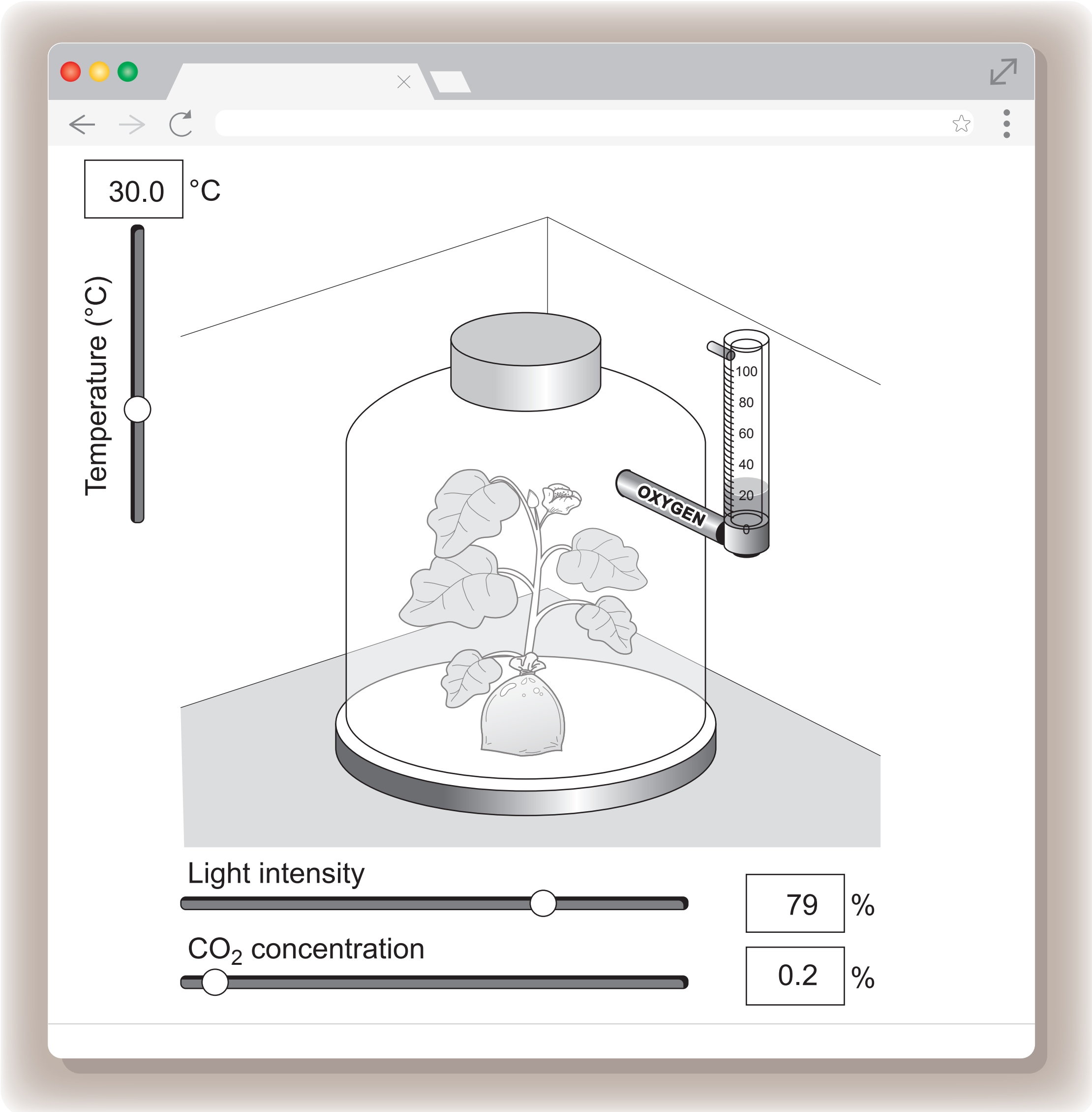
4. (a) State the word equation for photosynthesis. [2]

....

(b) Students used a computer simulation to investigate how the limiting factors of photosynthesis affect its rate. A screenshot from the simulation is shown in **Image 4.1.**

Image 4.1



The simulation allowed the students to carry out investigations into the rate of photosynthesis by adjusting the temperature, light intensity and carbon dioxide concentration the plant received. The rate of photosynthesis was then calculated by measuring the volume of **oxygen** produced by the plant per hour. The computer then produced a graph of the results as shown in **Graph 4.2**.

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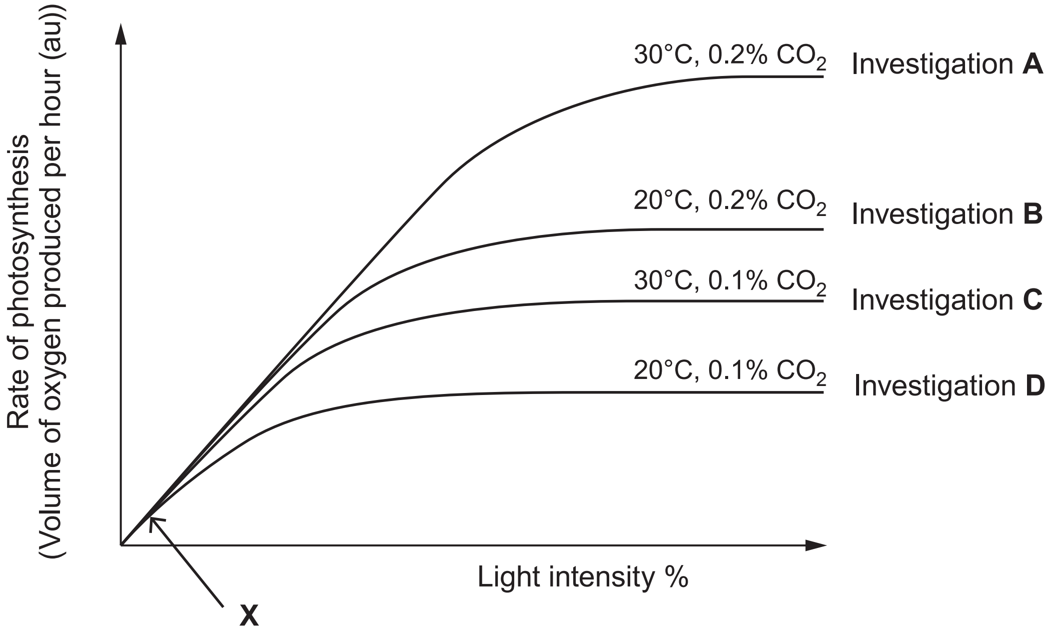
Graph 4.2



(i) With reference to limiting factors, explain why the rate of photosynthesis is:

I. lower in investigation **C** than in investigation **A**; [2]

....

....

....

....

II. higher in investigation **C** than in investigation **D**. [2]

....

....

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....

(ii) Suggest how you could increase the rate of photosynthesis in investigation **A**. [1]

....

....

(iii) State the limiting factor which is controlling the rate of photosynthesis at point **X** on **Graph 4.2**. [1]

....

Turn over.

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(iv) The levels were adjusted to the following:

- light intensity to bright daylight levels
- CO_2 concentration to 0.04%
- temperature to 80 °C.

I. Suggest how a temperature of 80 °C would affect the rate of photosynthesis and explain your answer. [2]

....

....

....

....

II. Suggest why a CO_2 concentration of 0.04% was chosen. [1]

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....

(c) Explain why the volume of oxygen produced by the plant per hour can be used as a measurement of the rate of photosynthesis. [1]

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5. Describe the pathway taken by the blood in a double circulatory system. Start your account with the return of blood along the pulmonary vein from the lungs to the left atrium of the heart. Your account must include details of how backflow of blood is prevented. [6 QER]

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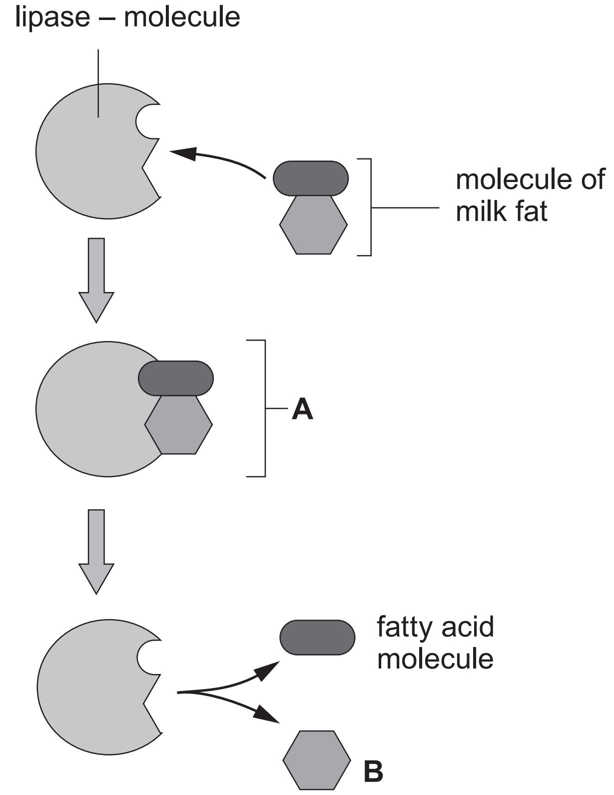
6. **Image 6.1** represents the lock and key model of enzyme action involving lipase and milk fat.

Image 6.1



(a) State the name of:

(i) structure **A**; [1]

....

(ii) molecule **B**. [1]

....

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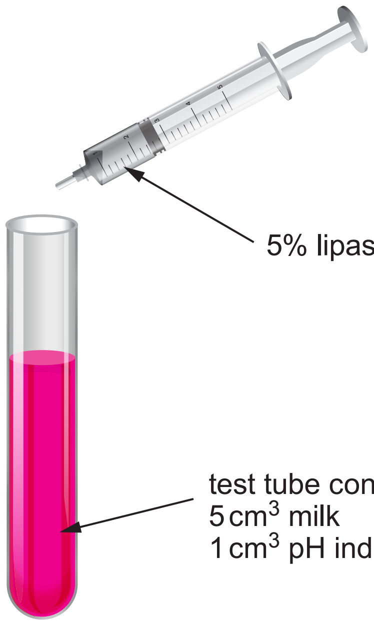
(b) A class of students investigated how lipase activity changes with temperature. They used a pH indicator that is pink in alkaline solutions of about pH 10. When the pH drops below pH 8 it goes colourless.
A solution of full-fat milk, lipase and indicator at pH 10 will change from pink to colourless as the **fat** in milk is broken down producing **fatty acids**. This reduces the pH to below 8. The time taken for this reaction to occur is affected by temperature.

The students worked in pairs and set up the apparatus as shown in **Image 6.2**.

Image 6.2



Each pair of students investigated a different temperature.

- The test tube and syringe were placed in a water bath.
- At 5 minutes, 1 cm^3 of lipase solution from the syringe was added to the test tube.
- The time taken for the solution in the test tube to change from pink to colourless was recorded.
- The experiment was carried out three times for each temperature.

The class results are shown in **Table 6.3**.

Table 6.3.

Temperature (°C)	Time for indicator to become colourless (s) Trial 1	Trial 2	Trial 3	Mean	Rate of reaction 1 ÷ mean time (per second)
0 (ice bath)	no change	no change	no change	no change	0.00
20	8.0	6.0	7.0	7.00	0.14
40	5.0	4.0	5.0	4.67	0.21
60	10.0	9.0	9.0	9.33	....
80	no change	no change	no change	no change	0.00

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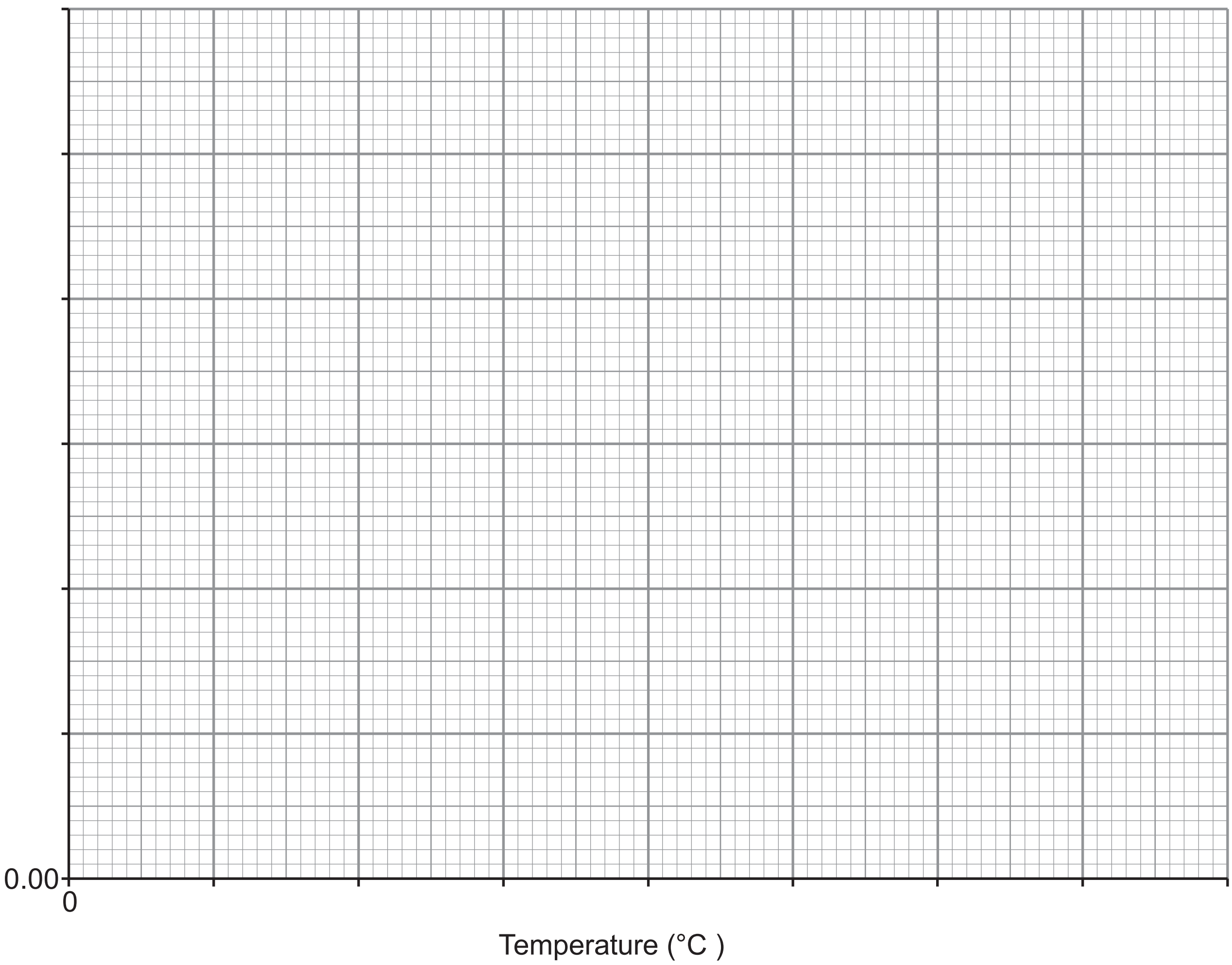
(i) The mean time for each temperature can be converted to rate of reaction by calculating 1 ÷ mean time.
Complete Table 6.3 by calculating the rate of reaction at 60 °C. **Give your answer to 2 decimal places**. [1]
Space for working.

(ii) On the grid below, draw a **line graph** of **rate of reaction** against temperature. You should join the plots with a ruler. [4]



(iii) Describe the effect of temperature on the rate of reaction of lipase. [1]

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(iv) Explain the effect of temperature on the rate of reaction between 0°C and 40°C. [2]

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(c) State why the test tube and syringe were left in the water bath for 5 minutes before the lipase solution was added to the test tube. [1]

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(d) Suggest why skimmed milk could not be used in this experiment. [1]

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7. (a) **Complete the following table** about the processes by which substances move through cell membranes. [3]

Place a tick (✓) or a cross (×) in each box to indicate if the statement applies to each process or not.

	Active transport	Osmosis	Diffusion
Energy (ATP) needed	....	....	....
Against a concentration gradient	....	....	....
Down a concentration gradient	....	....	....

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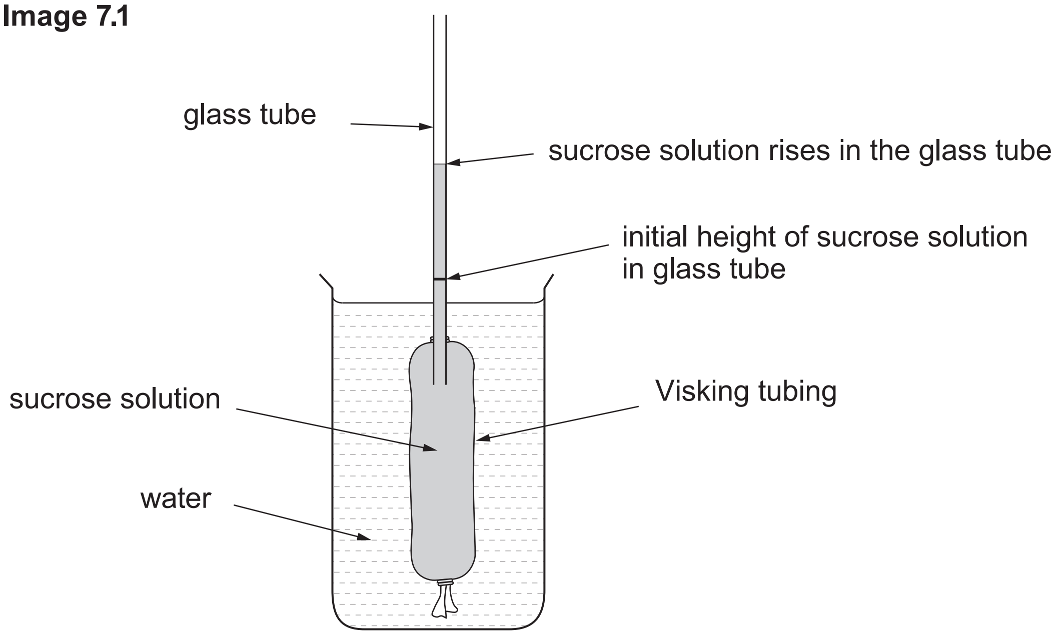
(b) The apparatus shown in **Image 7.1** was set up using a piece of Visking tubing filled with sucrose solution. The Visking tubing was knotted at its bottom end and tied at its top end to a length of glass tube. The Visking tubing was then placed in a beaker of water and left for 1 hour. At the end of this time the sucrose solution had risen up the tube.

Image 7.1



Explain why the sucrose solution moved up the glass tube. [4]

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END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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