Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430UA0-1

S25-3430UA0-1

MONDAY, 9 JUNE 2025 – 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.	**8**	
2.	**7**	
3.	**12**	
4.	**16**	
5.	**8**	
6.	**9**	
Total	**60**	

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01

ADDITIONAL MATERIALS

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(s) 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**(b) is a quality of extended response (QER) question where your writing skills will be assessed.

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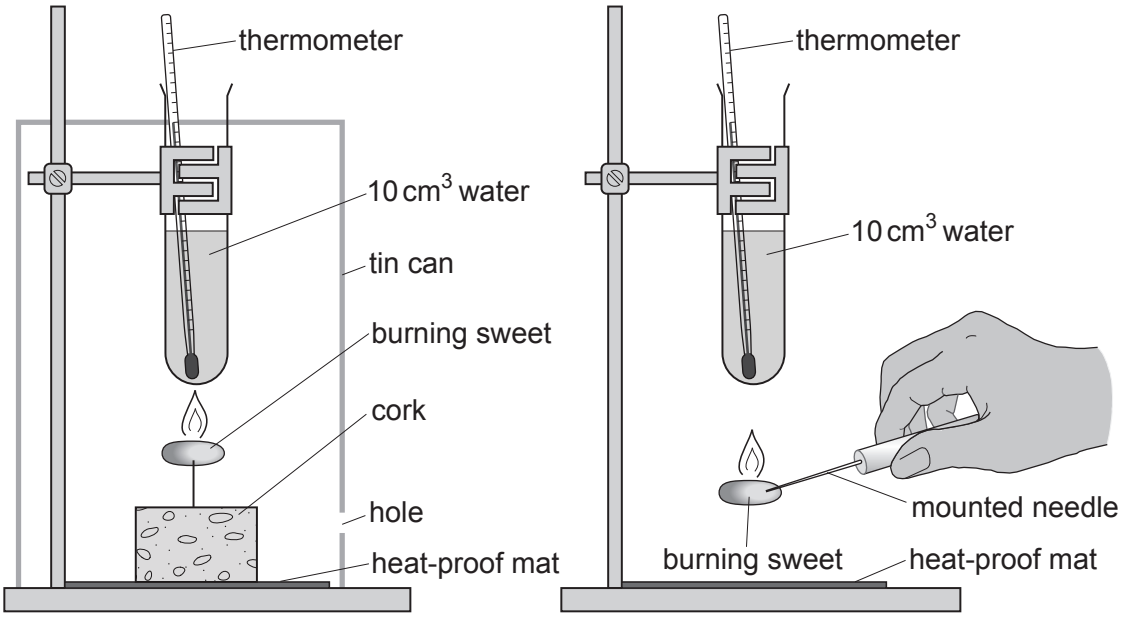
Answer **all** questions.

1. (a) Bethan used two different methods (**A** and **B**) to investigate the energy content of the same type of sweet, as shown in **Image 1.1**.

Image 1.1

Method A **Method B**



In method **A**, Bethan
- fixed a sweet on a pin mounted on a cork block
- ignited the sweet
- placed the remaining apparatus over the burning sweet

In method **B**, Bethan
- fixed a sweet on a mounted needle
- ignited the sweet
- held the burning sweet under the test tube

In **both** methods, Bethan
- recorded the mass of the sweet
- recorded the temperature of the water in the test tube at the start and when the sweet stopped burning
- did three trials

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The results of the investigation are shown in **Table 1.2**.

Table 1.2

Method	Trial	Mass of sweet (g)	Temperature of water (°C)			Energy content (J/g)	Mean energy content (J/g)
			start	end	increase		
A	1	10.0	20	45	25	105.0	107.4
	2	10.1	20	46	26	108.1	
	3	10.0	20	46	26	109.2	
B	1	9.9	20	38	18	76.4	90.9
	2	10.0	20	42	22	92.4	
	3	10.1	20	45	25	104.0	

(i) Use the formula below to calculate the percentage increase in mean energy content shown for method **A** compared to method **B**.
Give your answer to the **nearest whole number.** [3]

$$\text{Percentage increase in mean energy content} = \frac{\text{mean energy content for method } \mathbf{A} - \text{mean energy content for method } \mathbf{B}}{\text{mean energy content for method } \mathbf{B}} \times 100$$

Percentage increase in mean energy content = ...

(ii) I. Use **Image 1.1** to suggest an explanation for the percentage increase in mean energy content for method **A** compared to method **B**. [1]

.....

.....

II. There is a **greater range** in the results for method **B** than for method **A**. Use **Image 1.1** to suggest an inaccuracy in method **B** that could result in this variation. [1]

.....

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(b) State the form in which excess energy from food is stored in the body. [1]

.....

(c) State **two** health problems that might result from eating too much sugar. [2]

I. .....

II. .....

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2. (a) (i) State the name of the green pigment found in plant leaves. [1]

.....

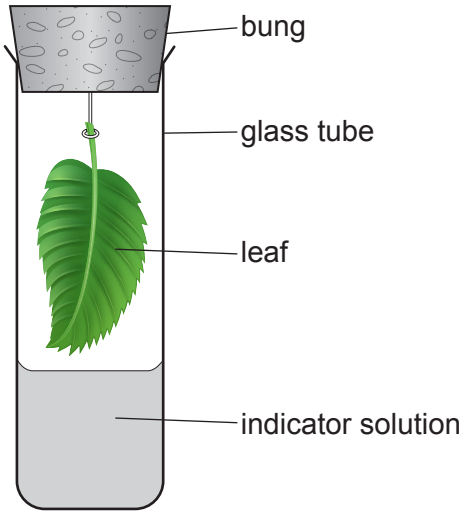
(ii) State the word equation for photosynthesis. [2]

..... + ... → ..... + ...

(b) Arwyn wanted to investigate both photosynthesis **and** respiration in plants.

He placed one leaf from a plant in a glass tube containing an indicator solution as shown in **Image 2.1**.

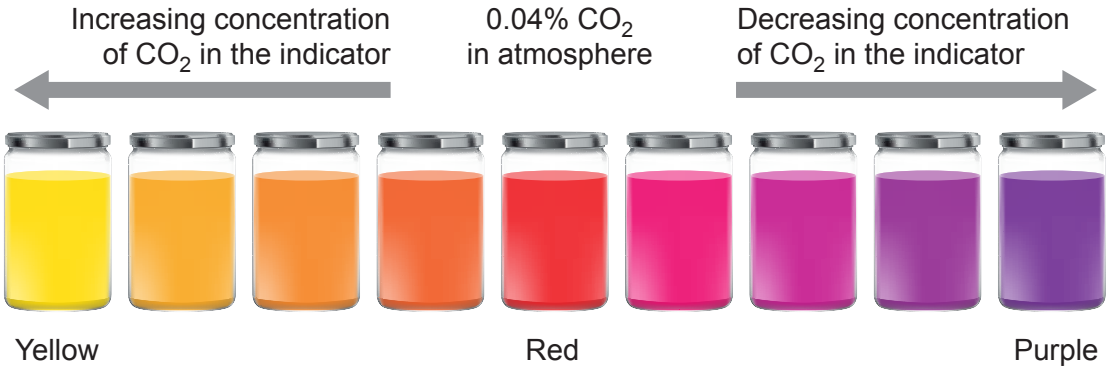
Image 2.1



He left the tube in **darkness** for 12 hours. He then recorded the colour of the indicator solution. He repeated the experiment but left the tube in **bright light** for 12 hours.

The red indicator changes colour in response to the concentration of carbon dioxide present in the solution. This is shown in **Image 2.2**.

Image 2.2



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Arwyn recorded his observations in **Table 2.3**.

Table 2.3

Tube kept in	Colour of indicator solution	
	start	at 12 hours
darkness	red	yellow
bright light	red	purple

(i) Describe how the **concentration of carbon dioxide** changed in each tube over the 12 hours. [1]

Tube kept in darkness: .....

Tube kept in bright light: .....

(ii) Use your knowledge of photosynthesis **and** respiration to explain the result for the tube kept in **darkness**. [3]

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3. Respiration in yeast is controlled by enzymes.

(a) State what is meant by the term enzyme. [2]

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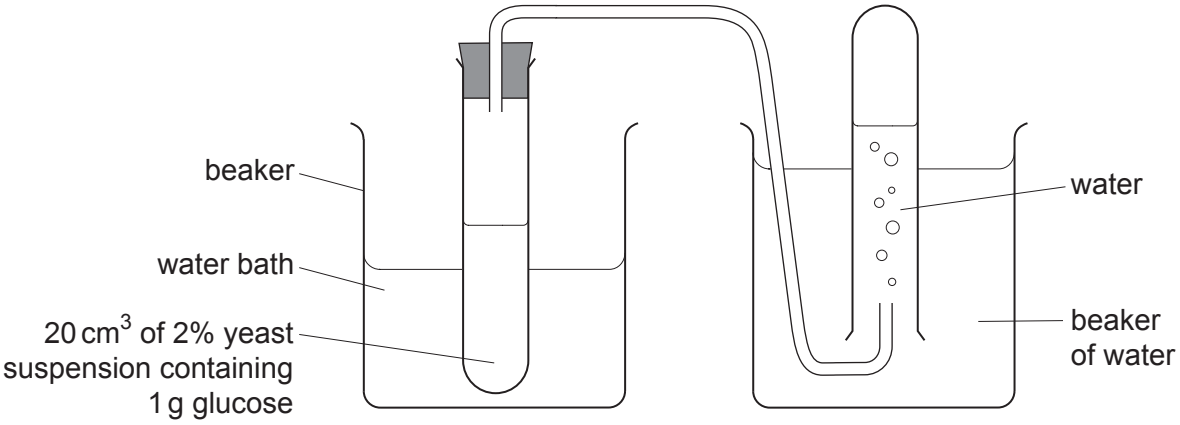
(b) Emyr investigated the effect of temperature on respiration in yeast using the method below:

1. Set up the apparatus shown in **Image 3.1** using water at 10°C.
2. Count the bubbles of gas produced from the yeast in 1 minute.
3. Repeat step 2 a total of three times.
4. Calculate the mean number of bubbles.
5. Repeat steps 2–4 using water at 20°C, 30°C, 35°C and 40°C.

Image 3.1



(i) State the following for this investigation: [2]

Independent variable

.....

Dependent variable

.....

(ii) Explain why Emyr carried out the experiment a total of three times for each temperature. [1]

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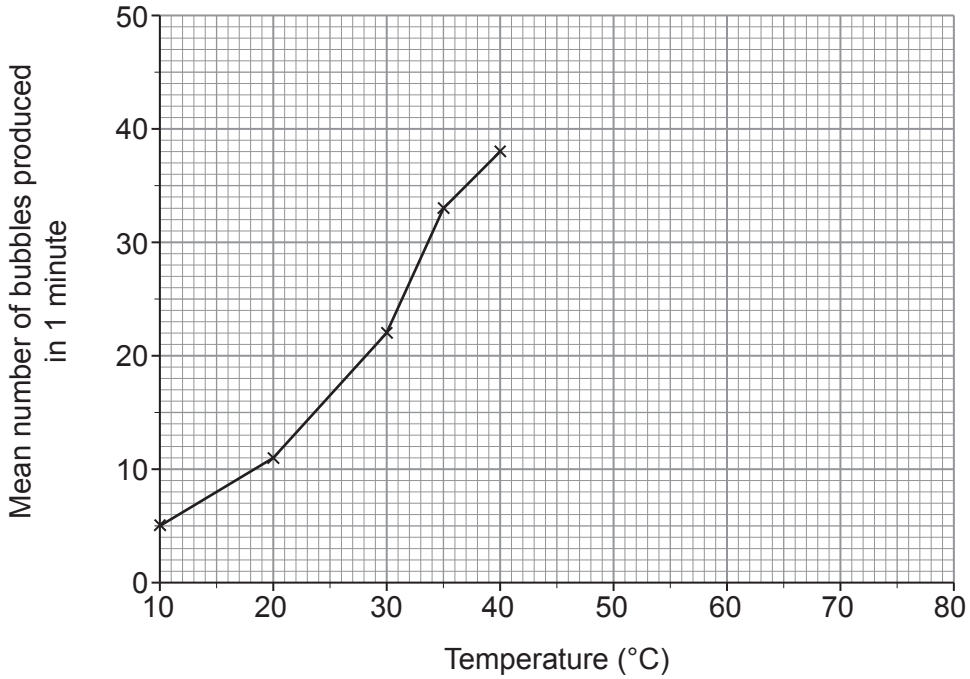
(c) The results he obtained are shown in **Graph 3.2**.

Graph 3.2



Use your knowledge of **enzymes** to explain the results shown in **Graph 3.2**. [3]

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(d) State **one** inaccuracy in Emyr's experimental method and how it could be improved. [2]

Inaccuracy:

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.....

Improvement:

.....

.....

(e) Emyr then carried out the experiment at 50°C, 60°C, 70°C and 80°C.

I. **Extend the line** on **Graph 3.2** to predict the results he would obtain. [1]

II. Explain why you have drawn the line in this position. [1]

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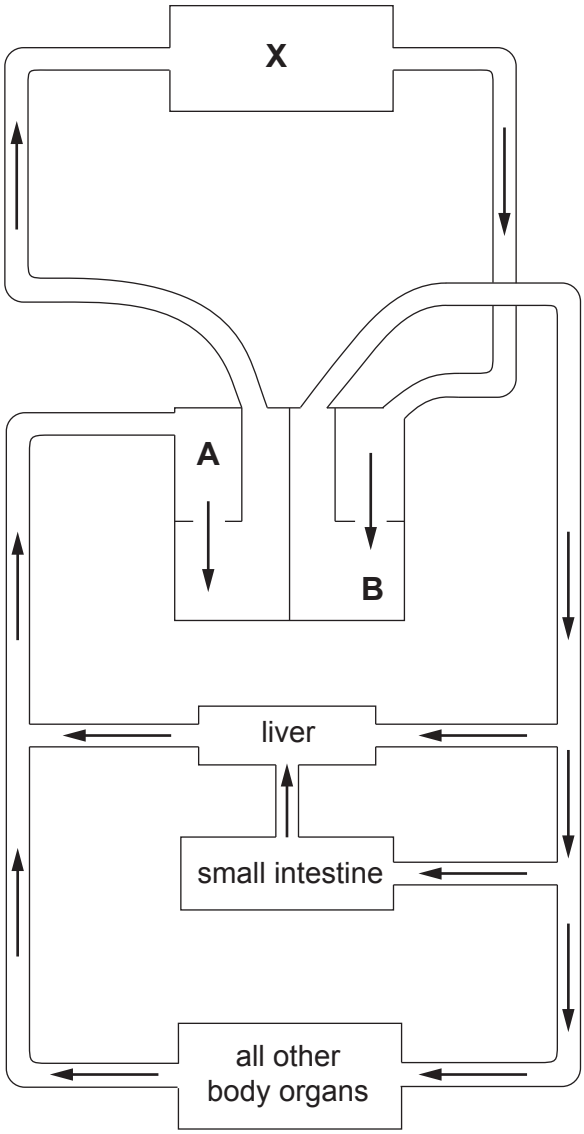
4. Humans have a double circulatory system.

Image 4 shows the double circulatory system in humans. The arrows represent the direction of blood flow.

Image 4



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(a) (i) Use **Image 4** to identify the following: [3]

structure **A** .....

structure **B** .....

organ **X** .....

(ii) I. On **Image 4**, **use the letter G** to label the blood vessel with the most glucose. [1]

II. Explain your reasoning. [1]

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.....

(iii) State what is meant by the term double circulatory system. [2]

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(b) Blood is a mixture of red blood cells, white blood cells and platelets suspended in a pale yellow liquid.

(i) State the name of the pale yellow liquid. [1]

.....

(ii) Give **two** functions of this liquid. [2]

I. .....

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II. .....

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(iii) An average adult makes approximately 2 million red blood cells per second. Calculate how many are produced in **one hour. Give your answer in standard form**. [3]

Number of red blood cells produced in one hour = ...

(iv) Many elite athletes prepare for competitions by training at high altitude where there is less oxygen available. This makes their bodies produce an increased number of red blood cells.
Explain how this could help improve their performance. [3]

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5. A student investigated the effect of different concentrations of salt solutions on water movement in and out of potato cylinders. She used the following method:

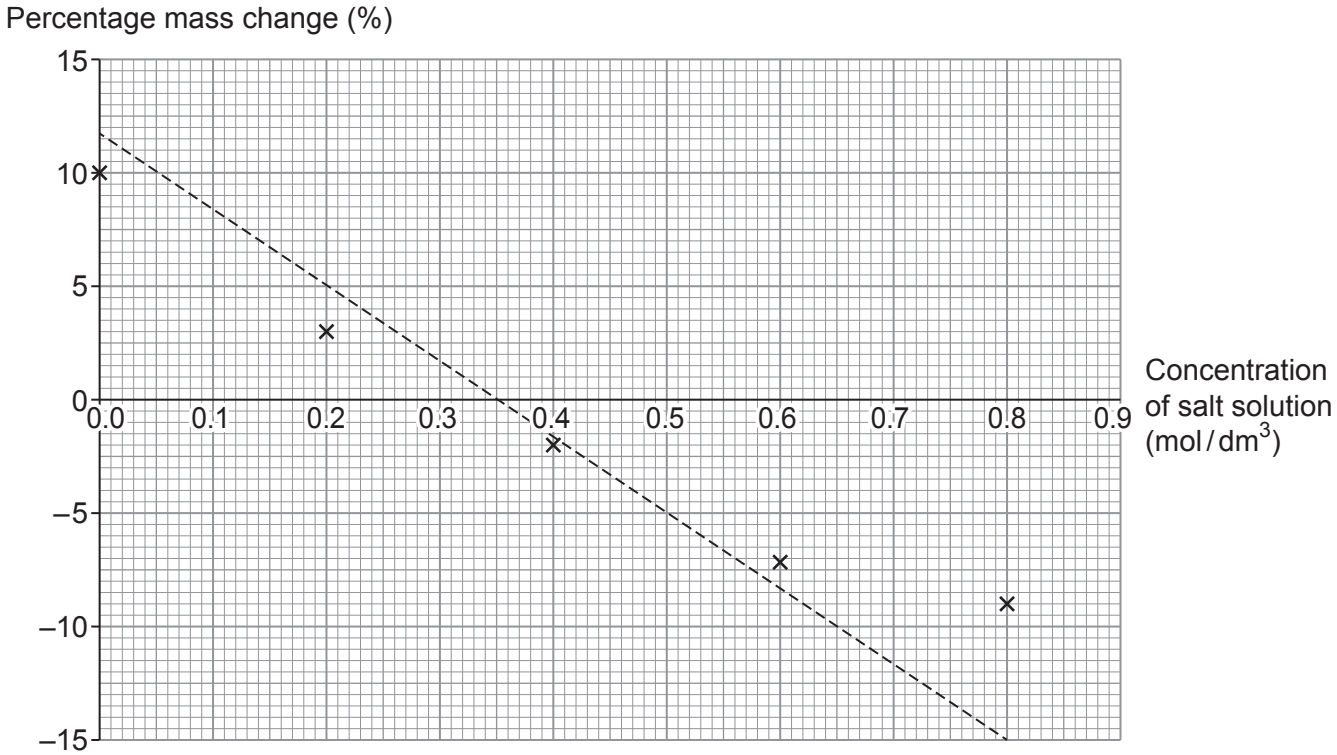
- Weigh 5 potato cylinders and record the mass of each.
- Place each cylinder of potato into a different concentration of salt solution for 30 minutes.
- Remove the potato cylinders, blot them and re-weigh.
- Calculate the percentage change in mass for each cylinder and plot the results on a graph.

Table 5.1 shows the results she obtained. The percentage change in mass for each cylinder is plotted in **Graph 5.2**.

Table 5.1

Concentration of salt solution (mol/dm^3)	Start mass (g)	End mass (g)	Change in mass (g)	Percentage change in mass (%)
0.0	3.80	4.18	+0.38	+10.00
0.2	3.69	3.80	+0.11	+2.98
0.4	2.88	2.82	-0.06	-2.08
0.6	3.98	3.70	-0.28	-7.04
0.8	3.44	3.13	-0.31	-9.01

Graph 5.2



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(a) Explain why the student:

I. plotted the percentage change in mass of potato rather than mass change; [1]

.....

.....

II. blotted the potato cylinders before re-weighing. [1]

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.....

(b) Use **Graph 5.2** to describe and explain the percentage change in mass of the potato cylinders at the following three concentrations:
- 0.00 mol/dm^3
- 0.35 mol/dm^3
- 0.70 mol/dm^3 [6 QER]

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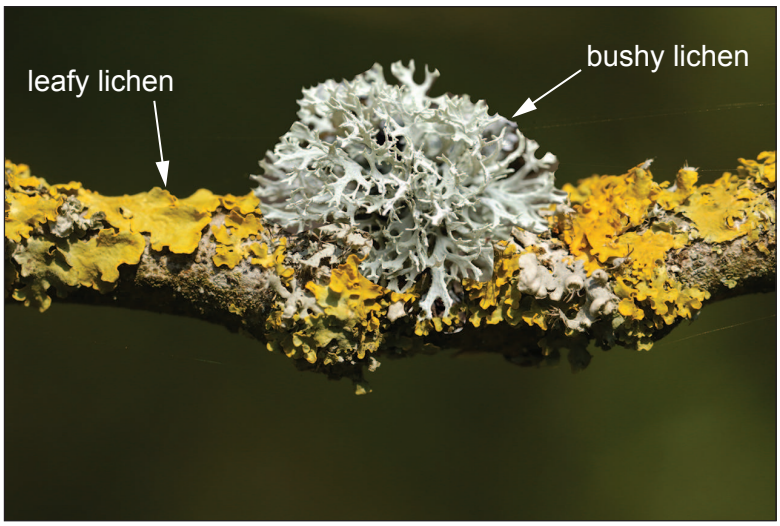
6. Lichens can be used as indicators of air pollution. They grow on trees and absorb molecules directly from the atmosphere through their surface.

Two different types of lichen (leafy and bushy) are shown in **Image 6.1.**

Image 6.1



(a) Bushy lichens are more sensitive to air pollution than leafy lichens.
Use **Image 6.1** to suggest why bushy lichens are more sensitive to air pollution. [2]

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(b) Ammonia gas (NH_3) is one of the main sources of nitrogen pollution in the air. It is produced as nitrogen-containing manure breaks down.

Scientists carried out an investigation to assess the impact of ammonia in the air on lichens in Pont-faen Park, Ceredigion. They used the following method:

- Select an oak tree in each of five sites (1–5) within the park.
- Record the lichen species present on each oak tree.
- Use the results to calculate a lichen indicator score (LIS).

Graph 6.2 shows the relationship between LIS and nitrogen pollution in the air.

Graph 6.2

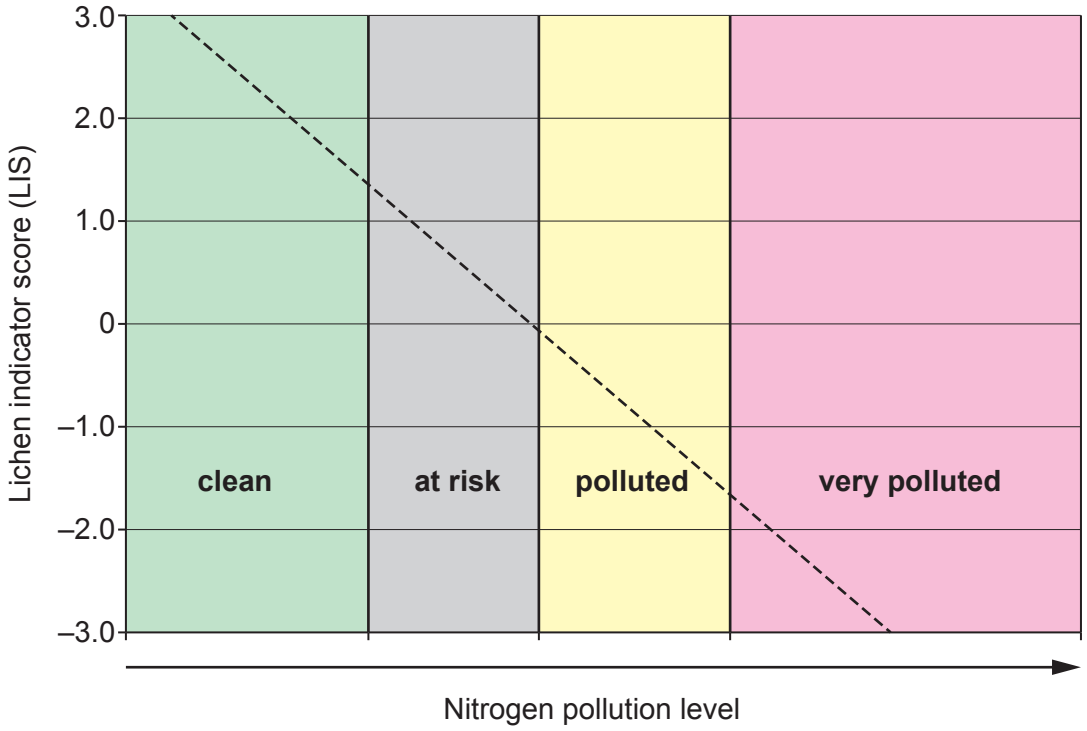

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Table 6.3 shows the results obtained by the scientists at the five different sites.

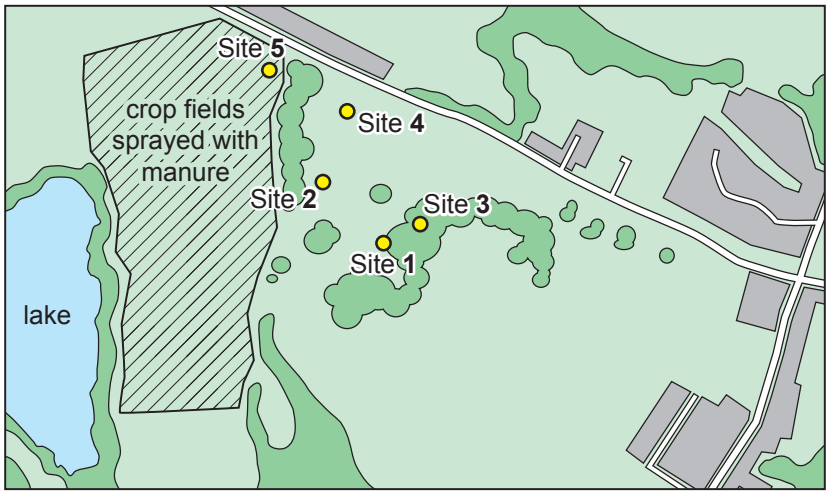
Table 6.3

Site	LIS	Nitrogen pollution level in the air
1	-0.8	.....
2	-1.8	very polluted
3	0.5	at risk
4	-1.8	very polluted
5	-2.0	very polluted

(i) **Complete Table 6.3** by using the data in **Graph 6.2** to determine the nitrogen pollution level for site **1**. [1]

(ii) **Image 6.4** shows the positions of the five sample sites.

Image 6.4



Use **Table 6.3** and **Image 6.4** to state the conclusion that can be made from the investigation. [1]

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.....

(iii) State how the scientists could increase their confidence in the conclusion. [1]

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(c) Excess manure spread onto fields can be washed into nearby waterways during heavy rainfall. This has the same effect as excess fertiliser and can lead to a decrease in the number of fish.

Explain how manure in waterways could cause the number of fish to decrease. [4]

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

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