Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3400UA0-1

S25-3400UA0-1

MONDAY, 9 JUNE 2025 – MORNING

BIOLOGY – Unit 1:
Cells, Organ Systems and Ecosystems

HIGHER TIER

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**11**	
3.	**8**	
4.	**10**	
5.	**6**	
6.	**15**	
7.	**11**	
8.	**10**	
Total	**80**	

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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 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 pages 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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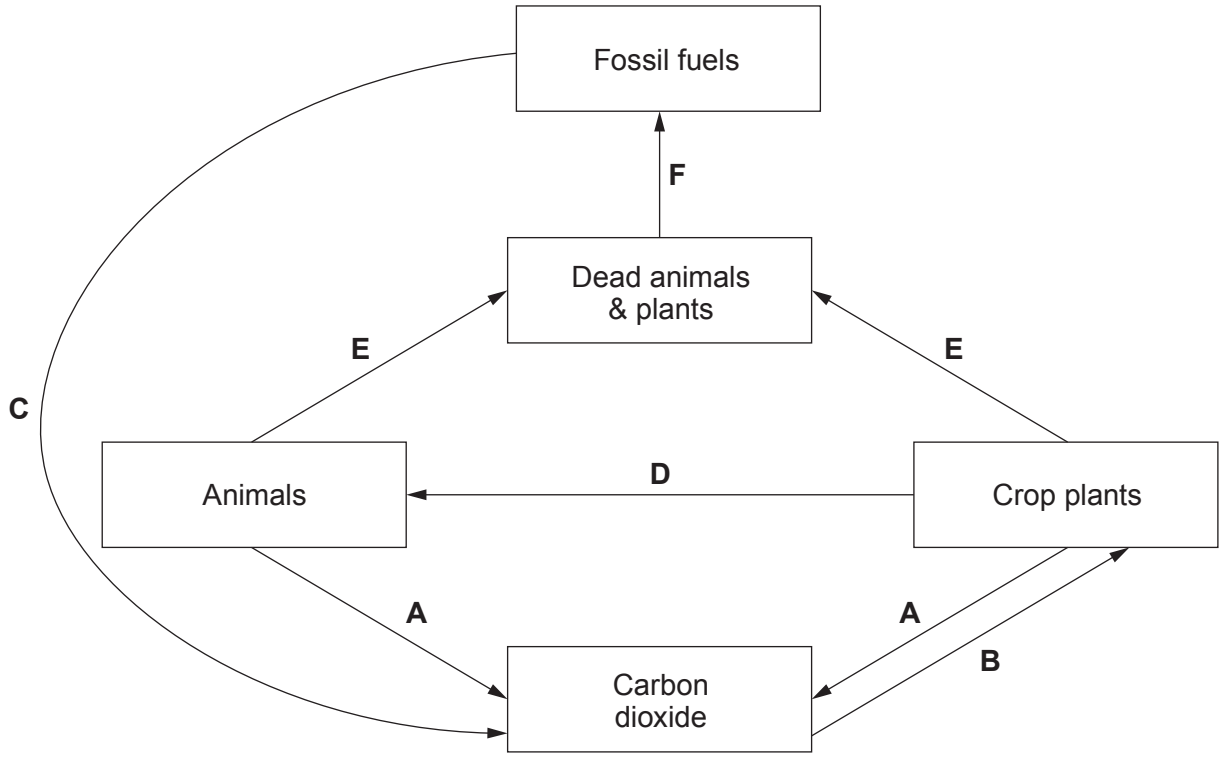
Answer **all** questions.

1. **Image 1** shows part of the carbon cycle.

Image 1



(a) (i) State the name of the processes **A**, **C** and **D**. [3]

A .....

C .....

D .....

(ii) State the name of process **B** which directly removes carbon dioxide from the air. [1]

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(iii) State **one** product of process **B** which contains carbon. [1]

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(b) Strawberry growers in Gower, near Swansea produced a yield of 21 500 kg in the summer of 2018. In 2019 the yield was 26 000 kg.

(i) Use the following equation: [2]

$$\text{Percentage increase in yield} = \frac{\text{yield in 2019 - yield in 2018}}{\text{yield in 2018}} \times 100$$

to calculate the percentage increase in yield

Percentage increase in yield = ...

(ii) Other than water and carbon dioxide, state **two** substances that could have been used to increase the strawberry yield. [2]

1. .....

2. .....

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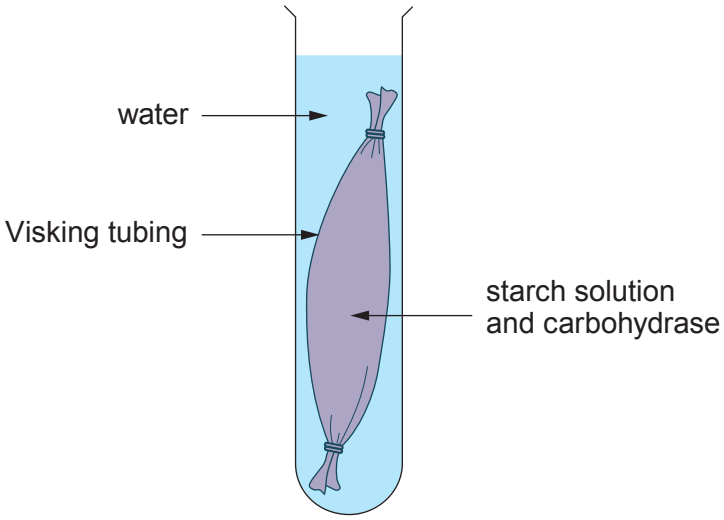
2. Students investigated the effect of temperature on a carbohydrase enzyme using the apparatus shown in **Image 2.1**.

Image 2.1



(a) State the name of the model that describes how enzymes work. [1]

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The experiment was carried out at 20 °C, 30 °C, 40 °C, 50 °C and 60 °C. After 5 minutes a sample of solution was removed from inside the Visking tubing and the percentage of starch remaining was determined. Some of the results are shown in **Table 2.2**.

Table 2.2

Temperature (°C)	Percentage of starch remaining in Visking tubing after 5 minutes
20	70
30	50
40	.....
50	75
60	100

(b) **Complete Table 2.2** using data from **Graph 2.3**. [1]

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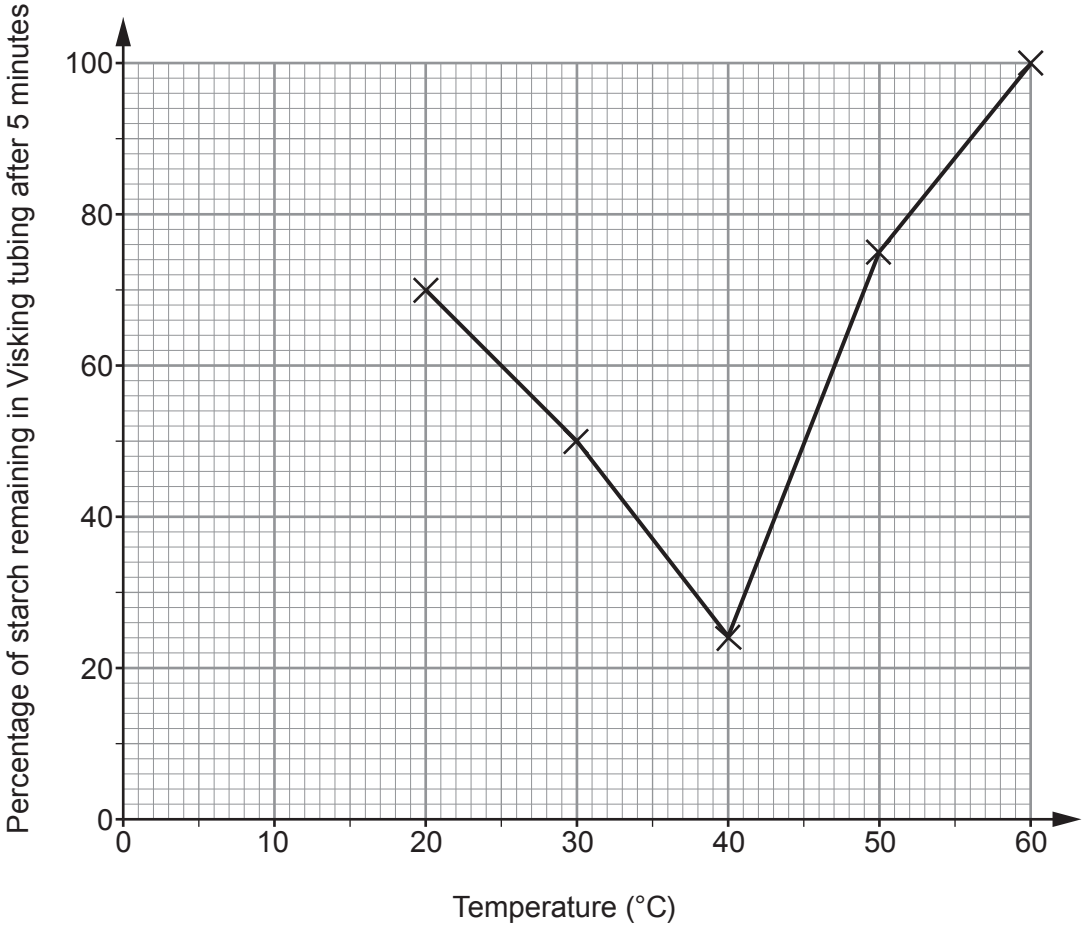
Graph 2.3



(c) (i) Identify the optimum temperature for the carbohydrase in this investigation. [1]

..... °C

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(ii) Describe how you could amend the method to identify the optimum temperature more accurately. [2]

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(iii) Explain the results at 60 °C. [3]

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(d) The water around the Visking tubing was also tested for starch.

(i) Name the reagent used to test for starch. [1]

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(ii) Predict the colour that would be seen at the end of the test **and** explain your answer. [2]

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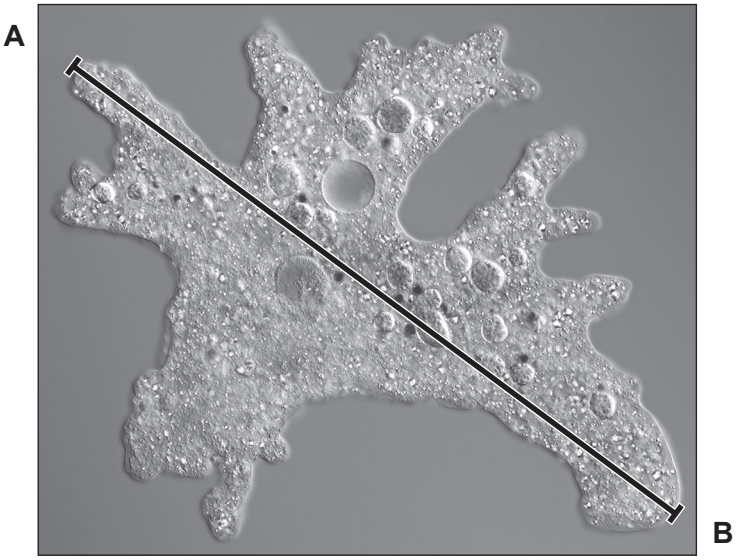
3. **Image 3** shows a single-celled organism called *Amoeba*.

Image 3



(a) (i) **Draw an arrow labelled C to identify the cell membrane** of the *Amoeba* in **Image 3**.

State the function of the cell membrane. [1]

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.....

(ii) The actual length along line **A–B** in the *Amoeba* is 700μm.
Calculate the magnification of the *Amoeba* in **Image 3**. (1mm = 1000μm). [3]

Magnification = × .....

(iii) State the name of the process by which *Amoeba* exchanges gases with its environment. [1]

.....

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(b) *Amoeba* do not need a complex respiratory system to allow gas exchange but humans do.

Explain how the volume of the human thorax changes to allow **inspiration** (breathing in) to take place. [3]

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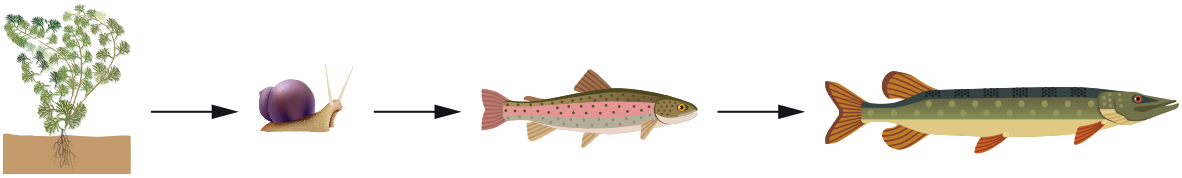
4. (a) The energy transferred to each organism in an aquatic food chain is shown in **Image 4.1**. Figures are in kJ / m^3 / year. Diagrams are not drawn to scale.

Image 4.1



Aquatic plants	Snails	Trout	Pike
10 000	850	160	31

(i) Suggest **one** reason why only a small percentage of the light energy available to plants is converted to chemical energy in biomass. [1]

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.....

(ii) Use the information in **Image 4.1** to calculate the efficiency of energy transfer between the aquatic plants and the snails. [2]

Efficiency = ... %

(iii) State **one** way in which energy is lost between each trophic level. [1]

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(iv) Explain why it is unlikely that this food chain could support another trophic level. [1]

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Table 4.2 shows the data that were collected for the food chain.

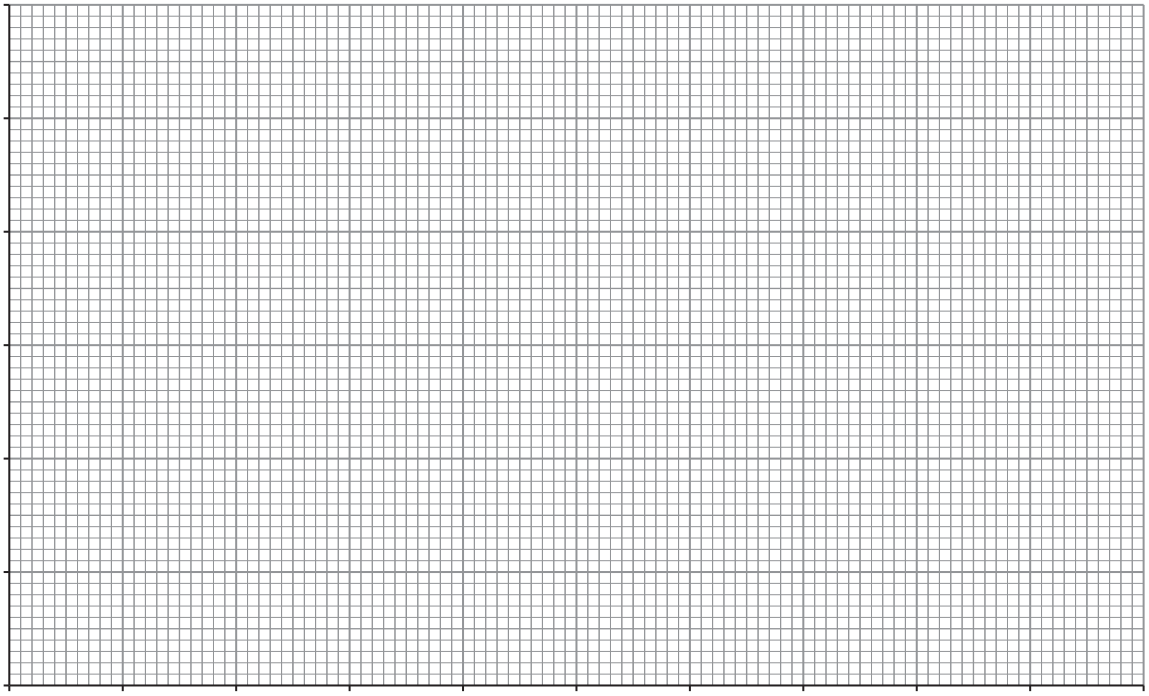
Table 4.2

Organism	Number of organisms present	Mean mass of each organism (kg)	Total biomass of organisms (kg)
aquatic plants	66 667	0.015	1000
snails	21 428	0.035	750
trout	35	10.0	350
pike	5	12.0	.....

(b) (i) Calculate the total biomass of the pike. **Write your answer in Table 4.2**. [2]

Space for working.

(ii) **Use a ruler** to draw a pyramid of **total biomass** for the organisms in **Table 4.2** on the grid below. **Your diagram must be to scale and each trophic level labelled**. [3]



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5. Scientists investigated the uptake of mineral ions by plants. Barley seedlings were grown with their roots in a solution of mineral ions for five days. Air was bubbled through the solution. The concentrations of the ions in the solution and the root tissue were measured. The apparatus is shown in **Image 5.1** and the results are shown in **Table 5.2**.

Image 5.1

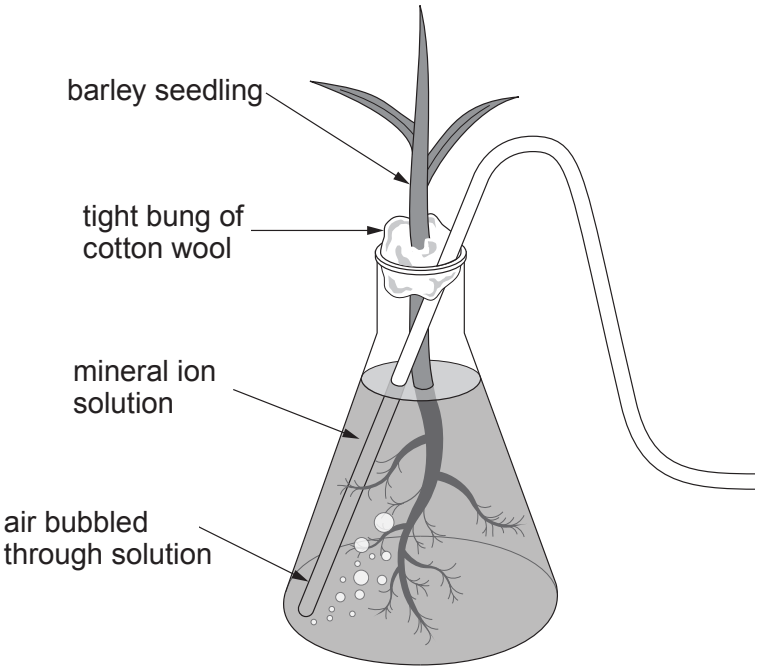

Table 5.2

Mineral ion	Mineral ion concentration (au)	
	In solution	In root
nitrate	3.1	80.0
potassium	1.2	250.0
phosphate	0.9	1.6

Use **Image 5.1** and the data in **Table 5.2** to explain how the mineral ions are absorbed by the plant **and** state the effect of a deficiency of **each** mineral ion on plants. [6 QER]

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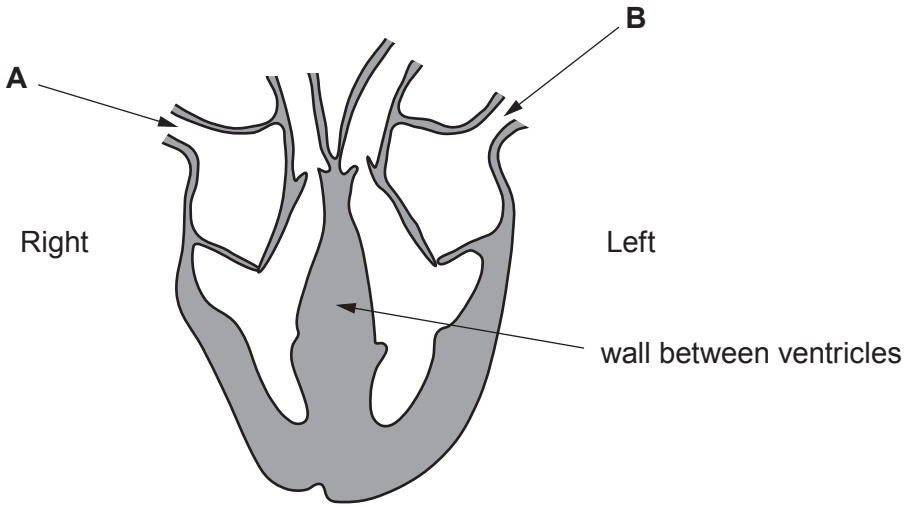
6. **Image 6.1** shows a human heart and its associated blood vessels.

Image 6.1



(a) (i) State the name of blood vessels **A** and **B**. [2]

A .....

B .....

(ii) State **two** pieces of evidence from **Image 6.1** which show the ventricles are contracting. [2]

I. .....

II. .....

(b) A hole in the wall between the ventricles is the most common heart defect at birth. Suggest the effects on an individual of a hole in the wall between the ventricles. [3]

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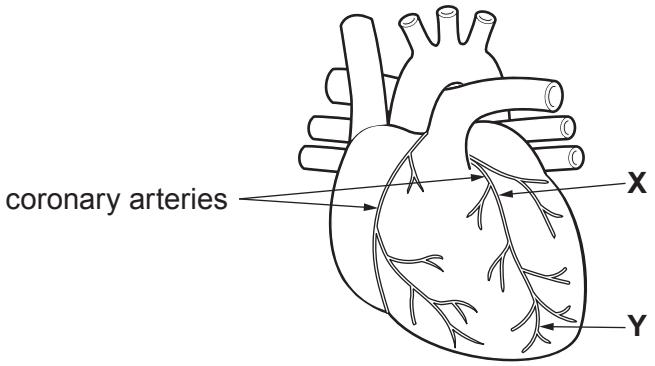
(c) Coronary arteries supply the heart muscle with blood. These are shown on **Image 6.2**.

Image 6.2



(i) Explain why atheroma in a coronary artery affects the function of the heart. [3]

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(ii) Suggest why atheroma forming at point **X** would be more serious than at point **Y**. [2]

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(iii) Name **and** describe the surgical procedure used to widen arteries affected by atheroma. [3]

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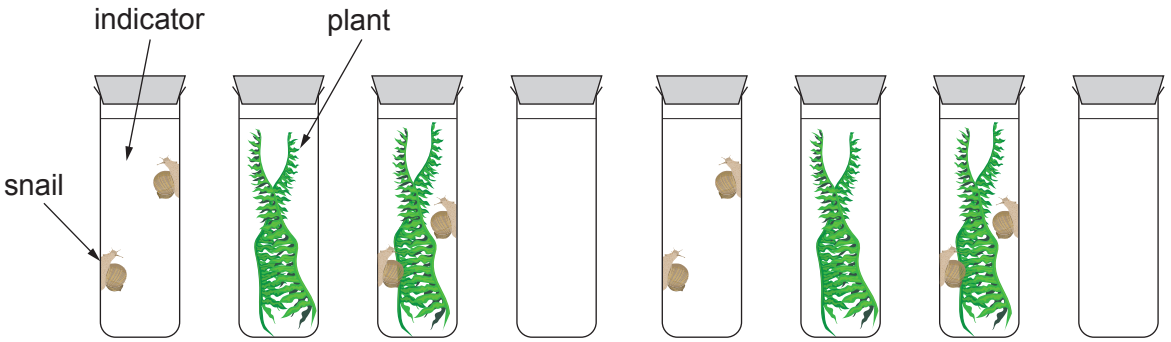
7. A group of students investigated different combinations of aquatic plants and animals in light and dark conditions. An indicator was used to show changes in the carbon dioxide concentration of the water. The colour changes are shown below.

Colour of indicator

Purple ← decreasing carbon dioxide — Red — increasing carbon dioxide → Yellow

The experiment was set up as shown in **Image 7.1** and after 12 hours the colour of the indicator was noted as shown in **Table 7.2**.

Image 7.1



A in light | **B** in light | **C** in light | **D** in light | **E** in the dark | **F** in the dark | **G** in the dark | **H** in the dark

Table 7.2

Tube	Light or dark	Organisms present	Colour of indicator after 12 hours
A	light	snails	yellow
B	light	plants	purple
C	light	snails and plants	yellow
D	light	none	red
E	dark	snails	yellow
F	dark	plants	yellow
G	dark	snails and plants	yellow
H	dark	none	red

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(a) (i) Explain the result for:

I. tube **A**; [2]

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II. tube **B**; [2]

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III. tubes **F** and **G**. [2]

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(ii) State the conclusion that can be made about tube **C**. [1]

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(iii) Explain the purpose of tubes **D** and **H**. [2]

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(b) Suggest **two** variables that the students should have kept constant in this investigation. [2]

(i) .....

(ii) .....

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8. Banana plants can be affected by the black Sigatoka disease, which is caused by a fungus. The fungus infects plants through natural openings in the leaves and causes dark leaf spots. The spots enlarge and cause much of the leaf to turn yellow and brown. Plants infected with the fungus produce bananas of such poor quality that they cannot be sold.
The climate of the tropical regions in which the bananas are grown is favourable for disease development.

Image 8.1 Banana leaf infected with black Sigatoka fungus

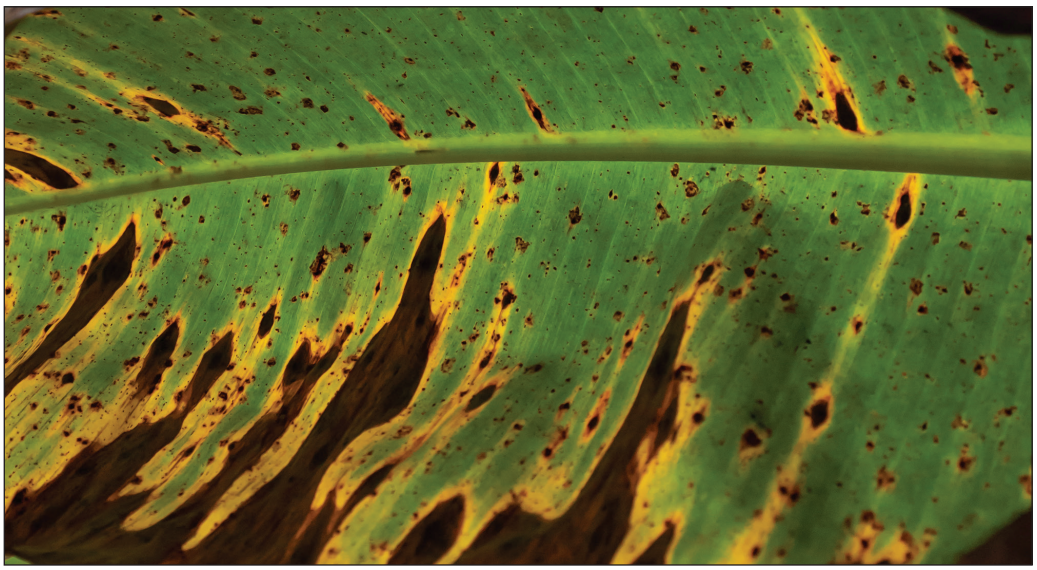
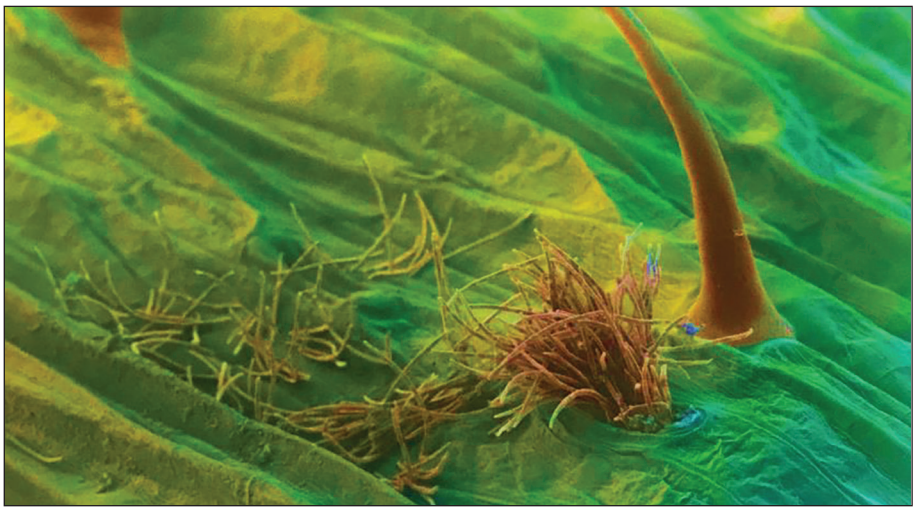


Image 8.2 Electron micrograph showing the fungus growing out from the underside of a leaf following infection.



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(a) (i) State the name of the natural openings in leaves through which the fungus infects plants. [1]

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(ii) **Image 8.2** was taken using an electron microscope.
State **one** advantage of using an electron microscope compared to a light microscope. [1]

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(iii) In 2017, the black Sigatoka disease reduced the yield of bananas by 60%. As a result only 114 million tonnes of bananas were sold for consumption worldwide. Using this information, calculate how many tonnes of bananas were lost to this disease. [3]

Answer = ... tonnes

(b) One way to prevent the spread of the fungus is to spray a type of pesticide called a fungicide onto banana plantations. In some cases this is repeated up to 50 times a year. An alternative method of reducing the spread of the disease involves removing diseased leaves.

(i) Explain the environmental impact of the large-scale use of these fungicides. [3]

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(ii) Suggest why farmers of banana plantations choose to use fungicides instead of removing the diseased leaves from the plants. [1]

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(c) Scientists predict a continued increase in global temperatures due to climate change. Suggest how this could increase the spread of black Sigatoka fungus. [1]

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END OF PAPER

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