



General Certificate of Secondary Education
2024–2025

Centre Number

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Candidate Number

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Double Award Science: Biology

Unit B1

Higher Tier



[GDW12]

GDW12

TUESDAY 13 MAY 2025, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete questions in black ink and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use a scientific calculator.

Quality of written communication will be assessed in Question 2.

14874



24GDW1201

- 1 Sea otters live in most coastal areas of the Pacific Ocean.

Photograph **A** shows a sea otter feeding on a sea urchin. Photograph **B** shows kelp.



Photograph **A**



Photograph **B**

The statements give information about sea otters and some other organisms in their food web.

Kelp is a large sea plant that carries out photosynthesis.
Sea urchins, mussels and fish feed on kelp.
Starfish feed on mussels.
Gulls feed on fish.
Bald eagles feed on gulls.
Sea otters feed on sea urchins and starfish.



(a) Use the statements to complete the food web.

gulls

sea urchins

mussels

[4]

(b) (i) Name the producer in this food web.

[1]

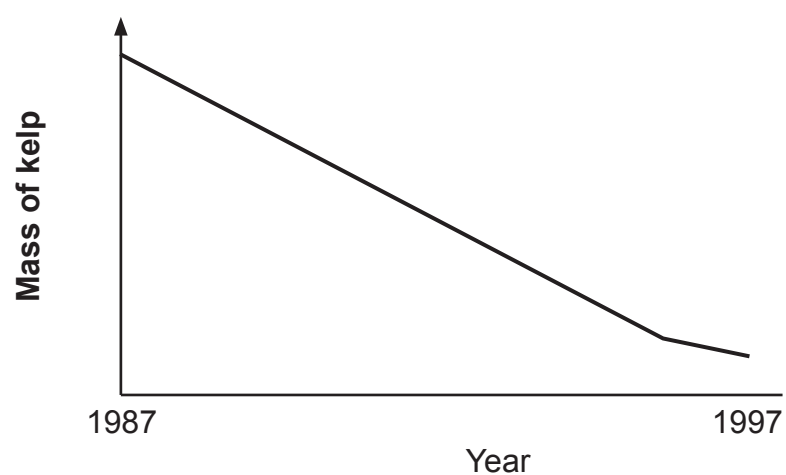
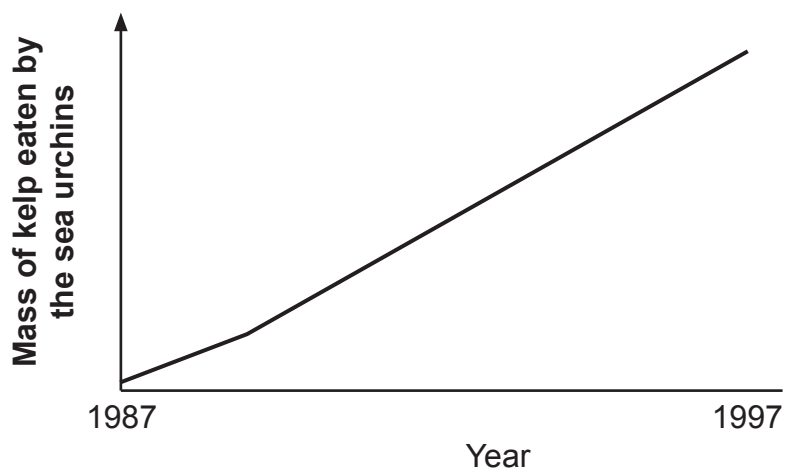
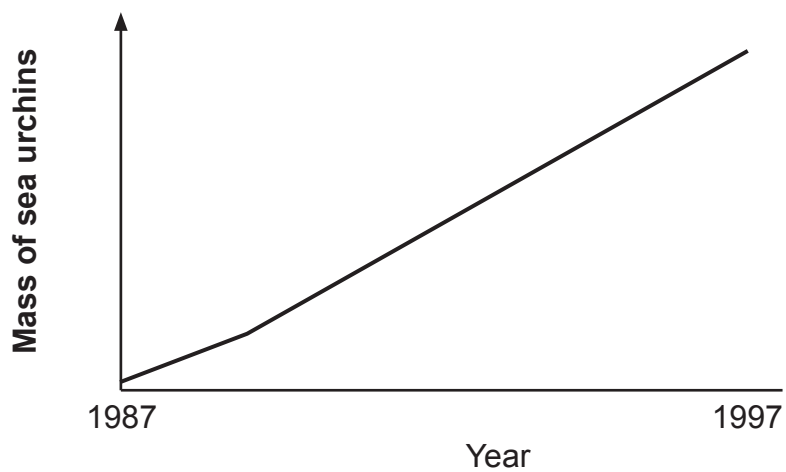
(ii) Name the organism that is both a secondary and tertiary consumer in this food web.

[1]

[Turn over



The graphs show the results of some investigations on this food web between 1987 and 1997.



Certain factors caused the population of sea otters to decrease in this area of the Pacific Ocean between 1987 and 1997. This affected the food web.

- (c) Use the graphs and the information provided to describe and explain what happened to the **mass of kelp** as a result of the **decrease** in the population of sea otters.

Description _____

Explanation _____

[3]

[Turn over



- (d) In one other area of the Pacific Ocean, there were no sea otters. Scientists introduced some sea otters into this area and monitored their population from 1989 to 2017.

The population of sea otters was:

- 208 in 1989.
- 2058 in 2017.

Calculate the percentage (%) increase in the population of sea otters in this area between 1989 and 2017.

Show your working out.

Give your answer to **two** decimal places.

_____ % [4]



24GDW1207

3 The excretory system carries out osmoregulation and produces urine.

(a) Name the organ that produces urine.

[1]

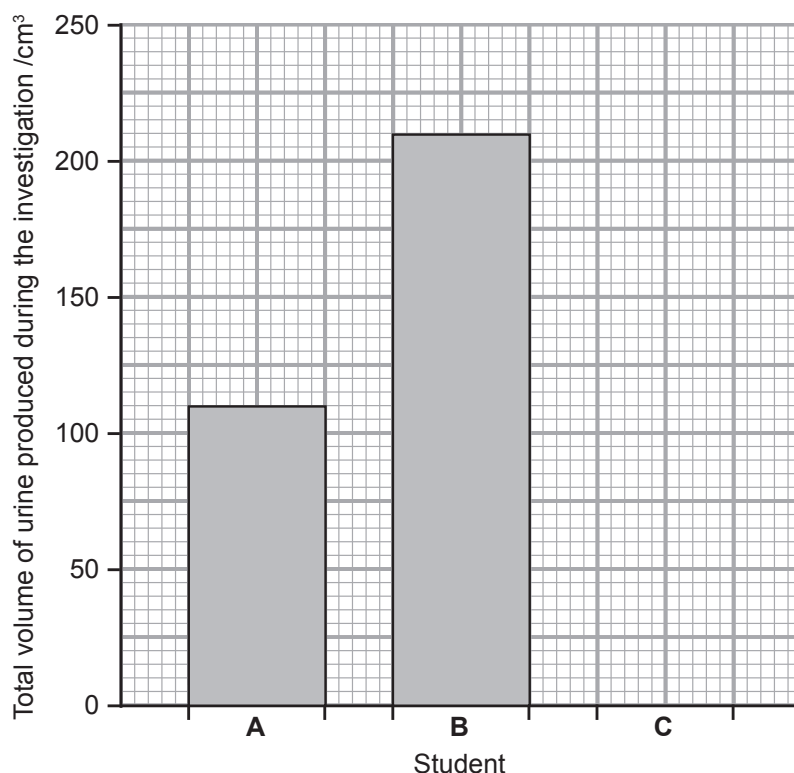
In an investigation, three students, **A**, **B** and **C**, each drank the same volume of water at the same time.

Each student measured the volume of urine they produced at 10, 40, 70 and 100 minutes after drinking the water.

The table shows some of the results for the volume of urine produced by students **A**, **B** and **C** at the different times.

Student	Volume of urine produced at each time /cm ³			
	10 min	40 min	70 min	100 min
A	10	20	30	
B	30	30	70	80
C	30	40	80	100

The bar chart shows some of the results for the **total** volume of urine produced by students **A**, **B** and **C** during the investigation.



- (b) Use the table **and** the bar chart to calculate the volume of urine produced by student **A** at 100 minutes.

Show your working out.

_____ cm³ [3]

- (c) (i) Use the table to calculate the total volume of urine produced by student **C** during the investigation.

Show your working out.

_____ cm³ [2]

- (ii) Complete the bar chart by drawing the bar for the total volume of urine produced by student **C** during the investigation.
Shade the bar you have drawn. [1]

- (d) (i) One student exercised vigorously just before drinking the water.
Use the bar chart to identify this student and use data to explain your choice.

_____ [2]

[Turn over



(ii) Give **two** reasons why exercising vigorously caused a change in the volume of urine produced by this student.

1. _____

2. _____

[2]



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(Questions continue overleaf)

14874

[Turn over



24GDW1211

- 4 (a) The diagrams show three experiments set up to investigate phototropism in plants.

Use the instructions below to **complete** the boxes in the diagrams about the experiments.

Experiment 1:

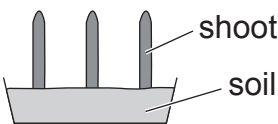
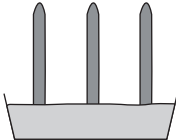
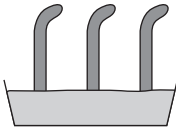
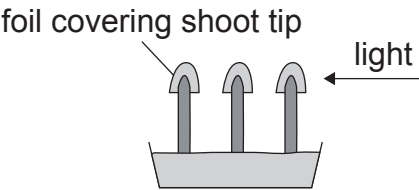
- Add an arrow to show the direction of light shining on the shoots at the **start** of the experiment.

Experiment 2:

- Draw the three shoots at the **start** of the experiment.
- Add an arrow to show the direction of light shining on the shoots at the **start** of the experiment.

Experiment 3:

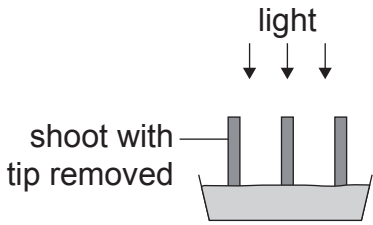
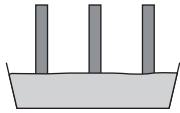
- Draw the three shoots as they would appear **after four days**.

Experiment	Start	After four days
1		
2		
3		

[6]



The diagram below shows the results of another experiment set up to investigate phototropism in plants.

Experiment	Start	After four days
4	 shoot with tip removed	

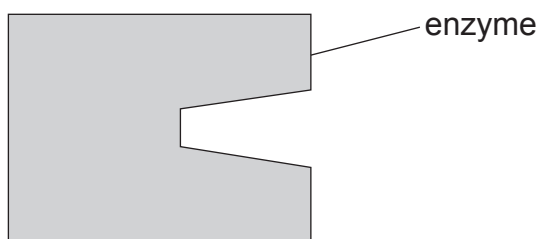
(b) Describe and explain the results shown after four days in experiment 4.

[2]

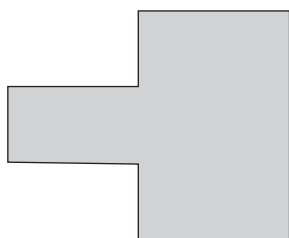
[Turn over



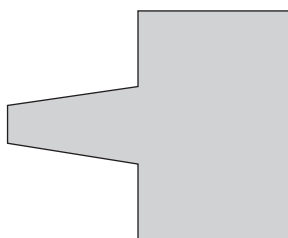
- 5 (a) A student carried out an investigation into the effect of an inhibitor on an enzyme.
The diagram represents the enzyme used.



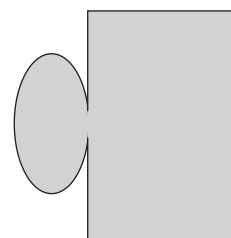
The diagrams below represent possible **substrate** molecules for this enzyme.



A



B

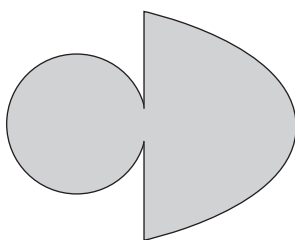


C

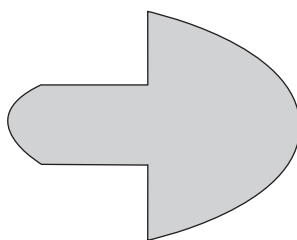
- (i) Give the letter of the diagram that represents the substrate molecule for this enzyme.

[1]

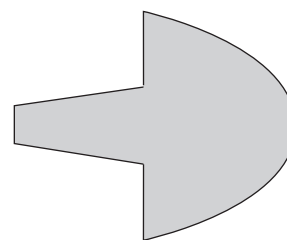
The diagrams below represent possible **inhibitor** molecules for this enzyme.



X



Y



Z

- (ii) Give the letter of the diagram that represents the inhibitor molecule for this enzyme.

[1]



The student set up two test tubes.
 She added the same volumes of enzyme and substrate to both test tubes.
 No inhibitor was added to test tube **1** but inhibitor was added to test tube **2**.
 She left both test tubes for 5 minutes.

The table shows the contents of both test tubes and the results of her investigation.

Test tube	Contents of test tube	Result after 5 minutes
1	enzyme and substrate	large number of product molecules present
2	enzyme, substrate and inhibitor	very few product molecules present

(b) Place a tick (✓) in the empty boxes to show all the statements that are **true** for this investigation.

- The number of successful **collisions** of the substrate with the enzyme was:

the same in test tubes 1 and 2	
greater in test tube 1 than in test tube 2	
less in test tube 1 than in test tube 2	

- In **test tube 2**:

some inhibitor joined to the active sites of the enzymes	
no inhibitor joined to the active sites of the enzymes	
some substrate joined to the active sites of the enzymes	
no substrate joined to the active sites of the enzymes	

- The rate of product formation in **test tube 2** was:

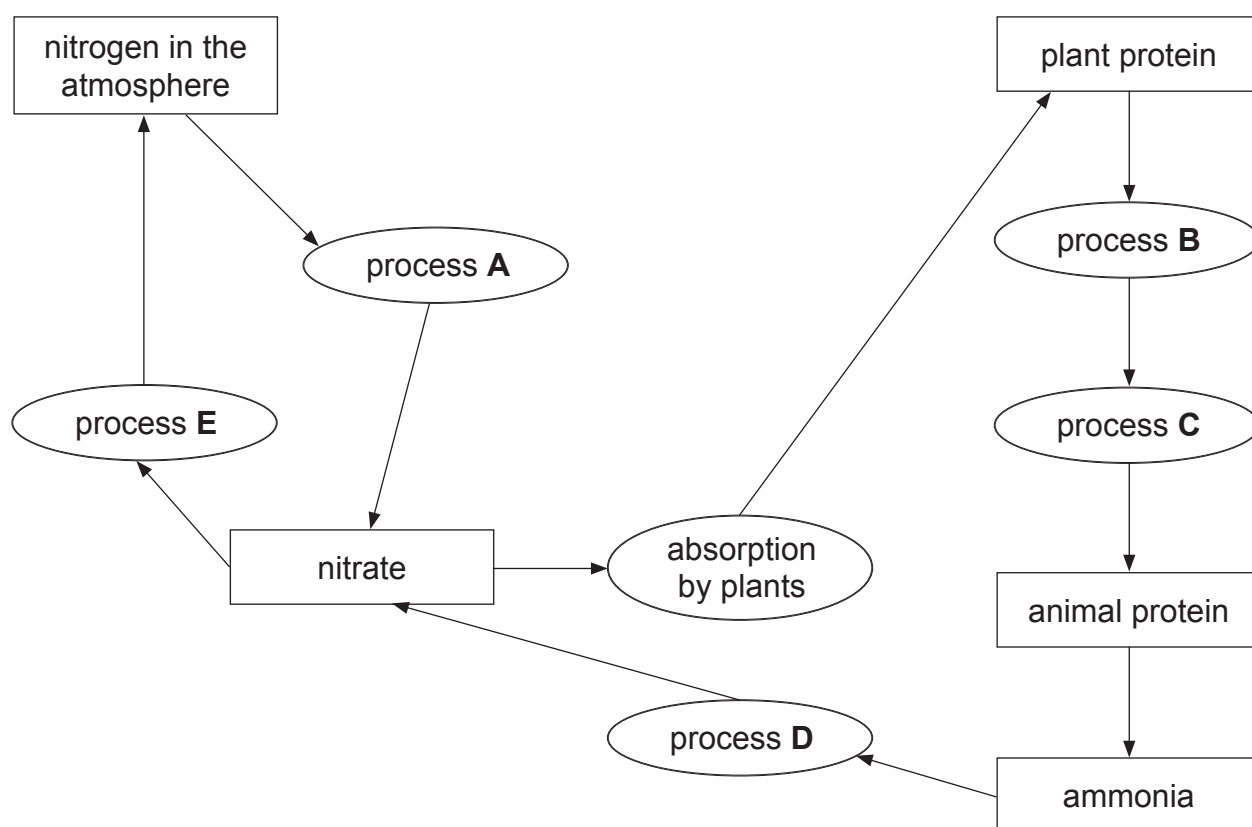
faster than test tube 1	
slower than test tube 1	
the same as test tube 1	

[4]

[Turn over



6 The diagram shows part of the nitrogen cycle.



(a) Name processes A, B, C and D.

A _____

B _____

C _____

D _____

[4]

(b) (i) Describe the type of soil conditions that reduce nitrate levels in the soil.

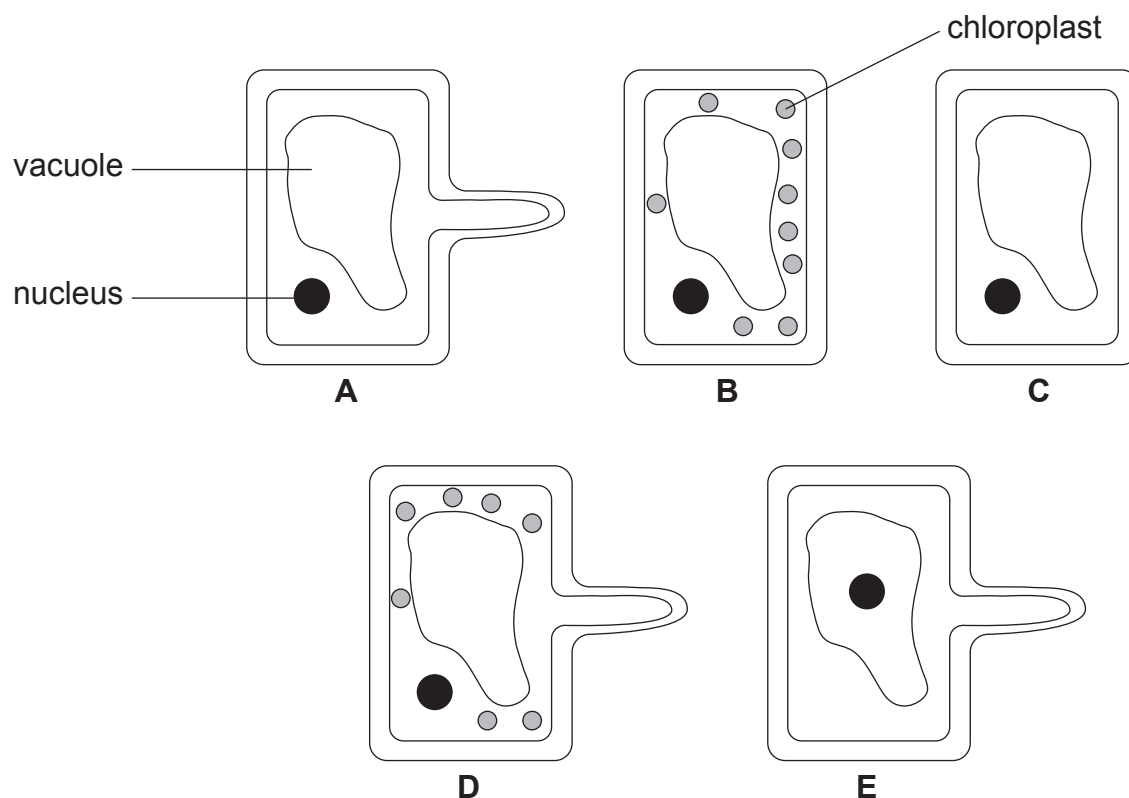
[1]

(ii) Name the type of nitrogen bacteria that are found in large numbers in this type of soil.

[1]



- 7 The diagrams show possible examples of plant cells.
Diagram **A** shows a root hair cell.



- (a) (i) Explain why diagram **C** **cannot** be a diagram of a root hair cell.

_____ [1]

- (ii) Explain why diagram **D** **cannot** be a diagram of a root hair cell.

_____ [1]

- (iii) Explain why diagram **E** **cannot** be a diagram of a root hair cell.

_____ [1]

[Turn over]



(b) Describe and explain the process of active uptake/transport in root hair cells.

[4]



- 8 Eutrophication occurred in a lake after the release of a pollutant containing nitrates. The boxes show the sequence of events that took place during eutrophication.

Complete the sequence of events by writing on the lines in the boxes.

The pollutant, for example, _____ entered the lake.

Aquatic plants _____ due to the nitrates present in the pollutant.

Nitrate depletion and _____ of aquatic plants occurred.

Aquatic plants died.

Aquatic plants were _____ by bacteria.

These bacteria in the lake used up _____.

Fish and aquatic animals died.

[5]

[Turn over

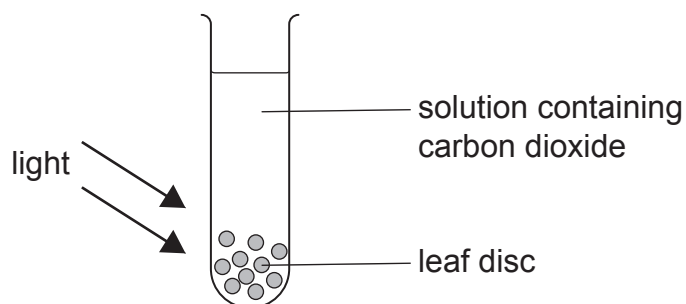


9 A student carried out an investigation into the effect of light intensity on leaf discs.

He placed 10 leaf discs into a test tube with a solution that contained carbon dioxide and placed the test tube in **dim light**.

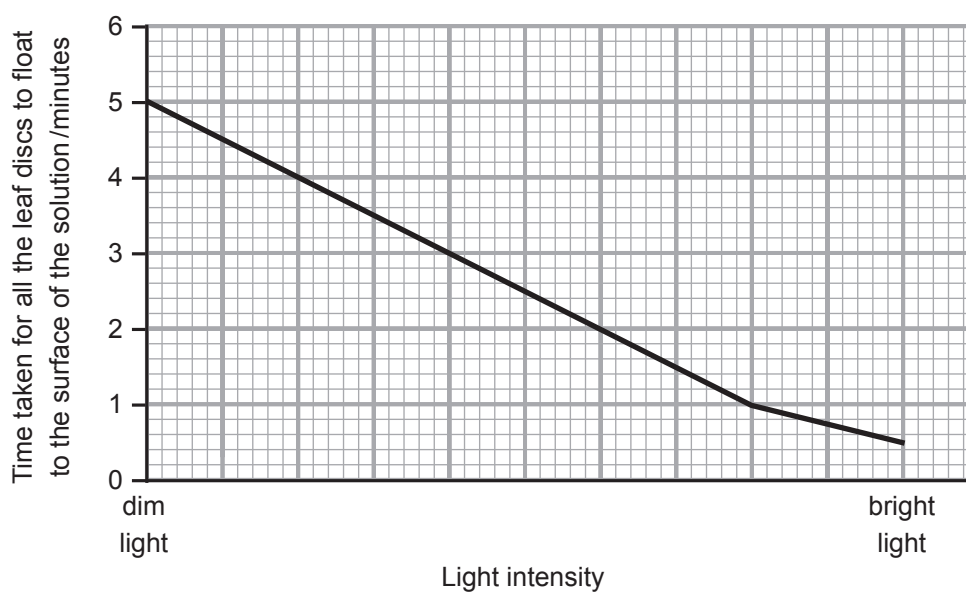
When the leaf discs produced **oxygen** gas, they **floated** to the surface of the solution.

The student measured the time taken for all the leaf discs to float to the surface of the solution.



The student repeated the experiment at different light intensities.

The graph shows the student's results.



(a) (i) Describe the trend shown by these results.

[1]

(ii) Give an explanation for this trend.

[1]

(b) When all the leaf discs had floated to the surface of the solution, the student added hydrogencarbonate indicator to the test tube that had been in **bright light**.

What colour was the solution in this test tube after hydrogencarbonate indicator was added?

[1]

[Turn over



This test tube (that had been in bright light) was then placed in the **dark**. Eventually, all the leaf discs sank to the bottom of the solution.

- (c) (i) Choose the letters of the **three** statements that explain why all the leaf discs sank to the bottom of the solution.

Write your answers on the lines below the table.

Letter	Statement
A	the leaf discs became lighter
B	no oxygen was produced
C	oxygen was used up in respiration
D	oxygen was produced in respiration
E	the rate of respiration was the same as the rate of photosynthesis
F	the rate of photosynthesis was greater than the rate of respiration
G	there was no photosynthesis

Letters _____ [3]

- (ii) What colour was the hydrogencarbonate indicator in this test tube after all the leaf discs sank to the bottom of the solution?

_____ [1]



- (iii) Choose the letter of the statement that explains the colour of the hydrogencarbonate indicator in this test tube when all the leaf discs sank to the bottom of the solution.

Write your answer on the line below the table.

Letter	Statement
H	there was the same amount of carbon dioxide used as produced
I	there was no carbon dioxide used but carbon dioxide was produced
J	there was more carbon dioxide used than produced

Letter _____

[1]

THIS IS THE END OF THE QUESTION PAPER



Sources:

Question 1.....© Getty Images × 2

Question 1(c)..Modified from J.A. Estes et al., *Killer Whale Predation on Sea Otters Linking Oceanic and Nearshore Ecosystems*. *Science* 282, 473-476 (1998). DOI: 10.1126/science.282.5388.473

Question 4(a)..Principal Examiner

Question 5(a)..Principal Examiner

Question 7.....Principal Examiner

Question 9.....Principal Examiner

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For Examiner's use only	
Question Number	Marks
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Examiner Number

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