



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education  
2014–2015

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## Double Award Science: Biology

Unit B1

Higher Tier

[GSD12]

MV18

WEDNESDAY 12 NOVEMBER 2014, MORNING

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### TIME

1 hour, plus your additional time allowance.

### INSTRUCTIONS TO CANDIDATES

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

Write your answers in the spaces provided in this question paper.

Answer **all seven** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **3(d)** and **7**.

1 (a) A man trips on a footpath. He is immediately aware that he has tripped. About three seconds later his heart rate increases and he feels the shock of nearly falling.

(i) Name the organ system which is responsible for the man's **immediate** awareness of nearly falling.  
[1 mark]

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(ii) A chemical messenger, called adrenaline, causes his heart rate to increase.

What type of chemical is adrenaline? [1 mark]

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(iii) Suggest how adrenaline is transported around the body. [1 mark]

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(b) Insulin is a chemical messenger used to control blood glucose levels.

(i) Where is insulin made in the body? [1 mark]

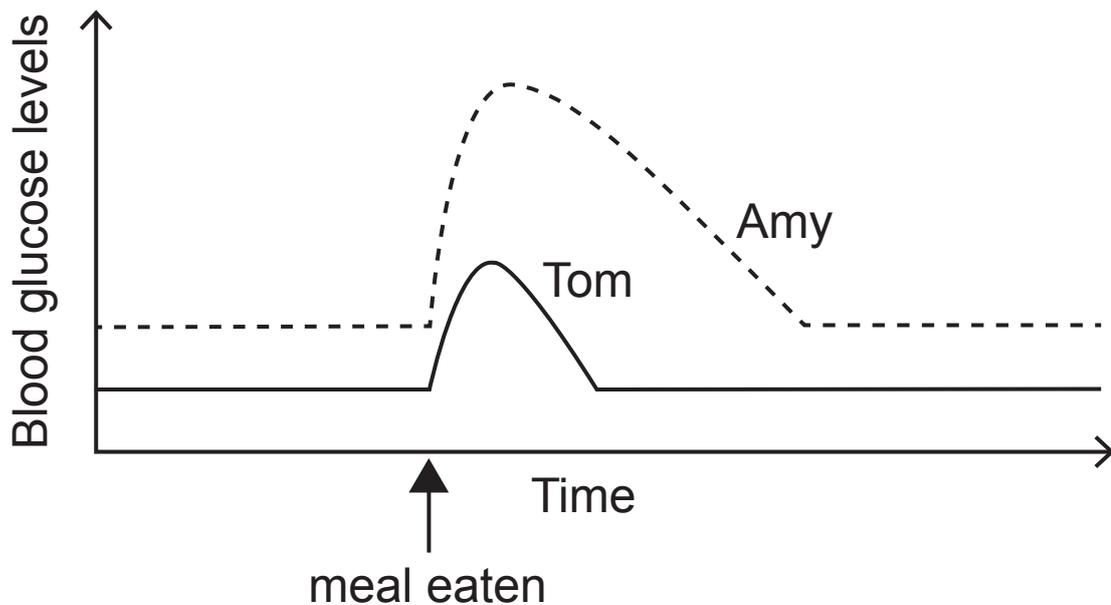
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(ii) Describe how insulin lowers blood glucose levels.  
[2 marks]

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\_\_\_\_\_  
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(c) Diabetes is a condition in which the blood glucose control mechanism fails.

The graph shows how blood glucose levels change for Tom and Amy, after they have eaten an identical meal. Tom does not have diabetes.



Give **two** pieces of evidence from the graph which suggest Amy may have diabetes. [2 marks]

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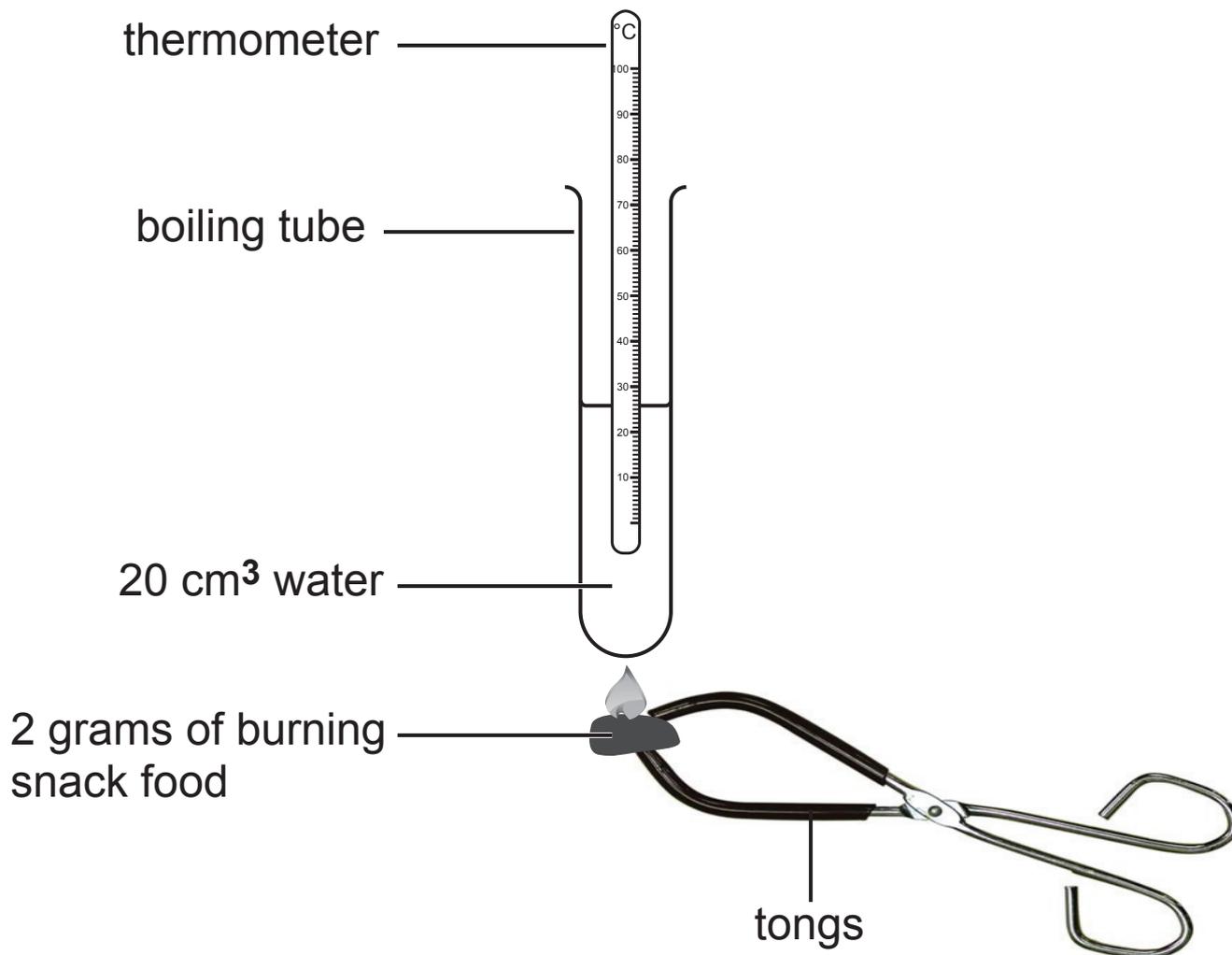
2. \_\_\_\_\_

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2 Harry and James investigated the energy content of four different snack foods.

The diagram shows how they carried out their investigation.



They measured the temperature of 20 cm<sup>3</sup> of water before and after **completely** burning **2 grams** of each snack food. They calculated the rise in temperature for each snack food.

The table shows the results obtained.

Snack food	Temperature of 20 cm <sup>3</sup> of water/°C		Rise in Temperature /°C
	Before burning	After burning	
Cheesy crackers	19	47	28
Potato crisps	19	40	21
Plain biscuit	19	37	
Chocolate biscuit	19	54	35

(a) (i) Complete the table to show the rise in water temperature for the plain biscuit. [1 mark]

- (ii) The equation below is used to calculate how much energy 1 gram of each snack food contains.

<b>Energy in food /J per gram</b>	<b>=</b>	$\frac{\text{Rise in water temperature}/^{\circ}\text{C} \times \text{Volume of water}/\text{cm}^3 \times 4.2}{\text{Mass of food burned in grams}}$
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Use this equation to calculate the energy content in **1 gram of the potato crisps.**

Show your working. [3 marks]

\_\_\_\_\_ J

- (iii) Before Harry and James calculated the energy content of the snack foods, Harry looked at the table of results and said “I think the chocolate biscuit has the highest energy content.”

What information from the table of results supports Harry’s statement? [1 mark]

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(iv) James suggested repeating the chocolate biscuit experiment three times.

What is the advantage of doing this? [1 mark]

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(b) The energy content of 1 gram of potato crisps is much higher than the value calculated by Harry and James.

Suggest a reason why the experimental result is lower. [1 mark]

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(c) Give **one** health problem that could result from eating too many snack foods. [1 mark]

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3 A student carried out an experiment to find out which food groups are in a cheese sandwich.

(a) Complete the table by writing in the missing colours for the two food tests shown. [2 marks]

Food group	Test reagent	Colour of test reagent at start	Colour of test reagent if food group present
Starch	Iodine solution	Yellow/brown	
Protein	Biuret solution		Purple

(b) Describe how the student would test for fat in a sample of the cheese sandwich. Give the positive result for a fat test. [3 marks]

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(c) Amylase is the enzyme that breaks down starch.

Another student investigated how pH affects the breakdown of starch.

The table shows the results of this investigation.

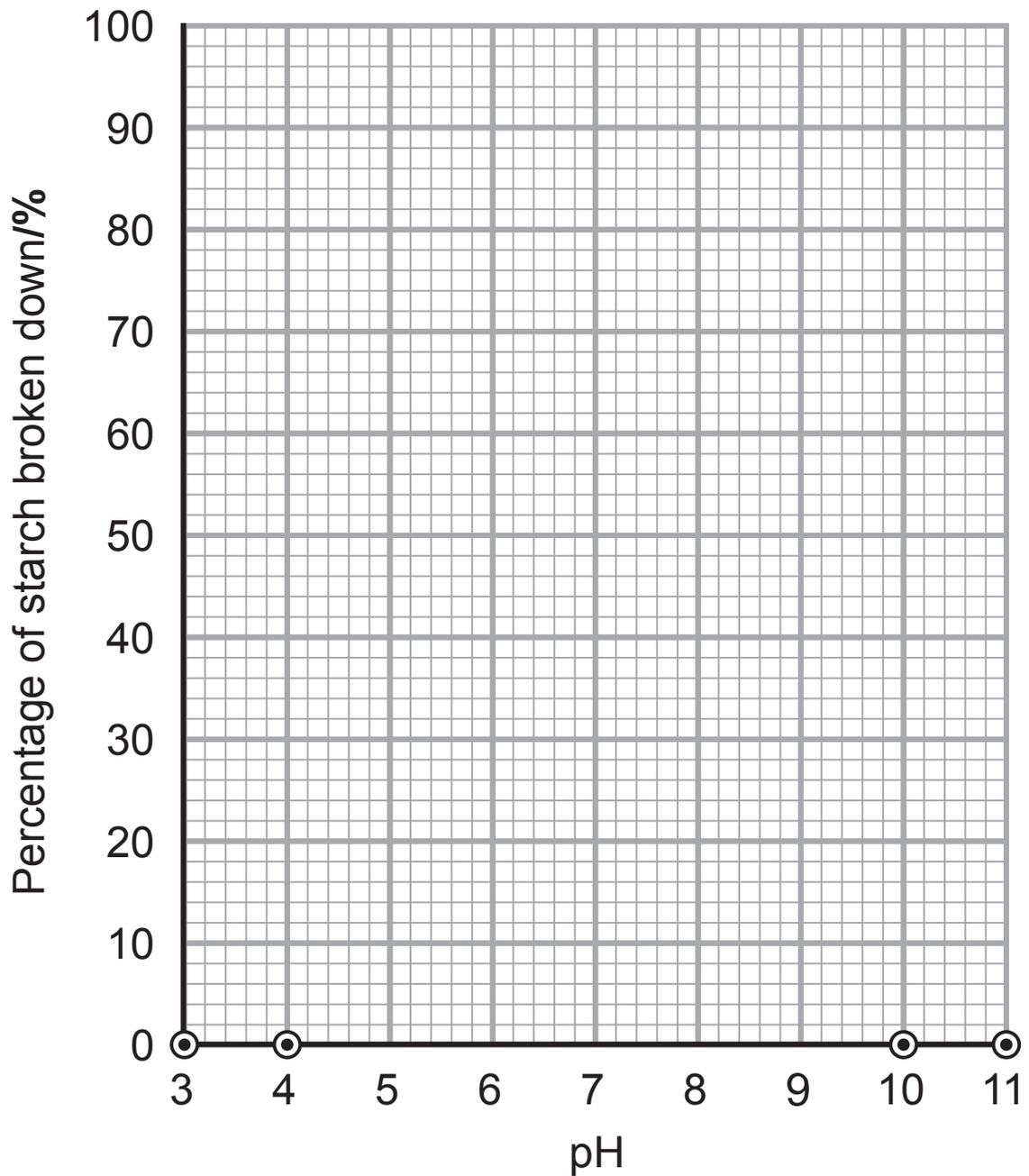
pH	Percentage of starch broken down/%
3	0
4	0
5	10
6	64
7	96
8	68
9	12
10	0
11	0

(i) Plot a line graph on the grid opposite, using the data in the table above.

Four plots have been done for you. [3 marks]

(ii) What is the best pH for amylase to break down starch? [1 mark]

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(iii) Use **data** from the graph to describe the trend shown. [2 marks]

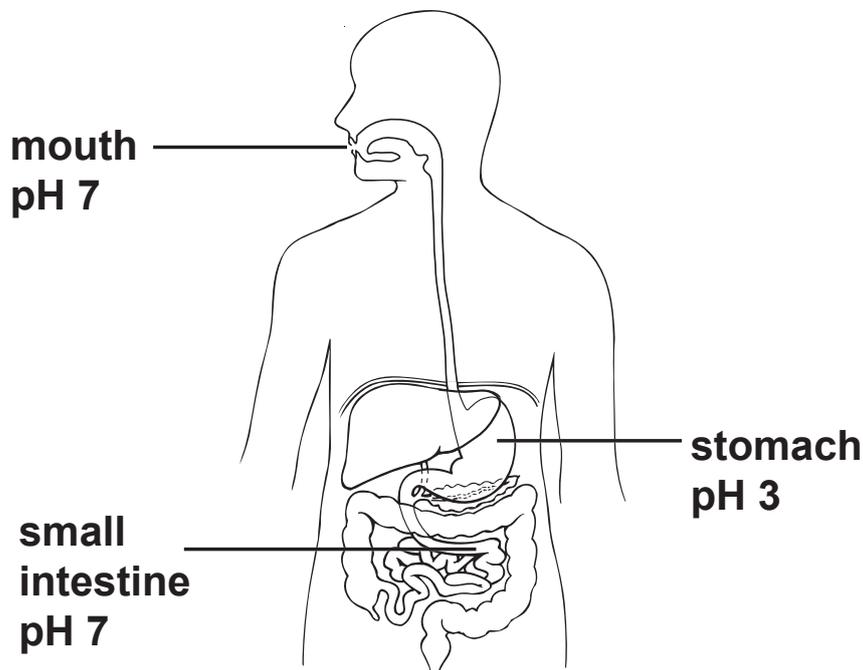
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- (d) The diagram shows part of the human digestive system. The pH of some parts is shown. Food stays only a very short time in the mouth.



Use the graph on page 11, the diagram above and your knowledge of enzymes to:

- Describe the activity of amylase in the
  - mouth
  - stomach
  - small intestine
- Explain why it is important that amylase is made in the small intestine as well as in the mouth.



4 (a) The photograph shows an oak tree.



Read the following passage.

Scientists in North America are concerned that mature oak trees are not being replaced by oak seedlings but by seedlings of other types of trees.

Line

1

3

One reason suggested for this is competition from the seedlings of other types of trees. These seedlings are better adapted than the oak seedlings to grow in the shady conditions on the forest floor.

5

7

Another suggestion is that oak seedling roots are eaten by voles, which are small animals living in the forest.

9

Any decrease in the size of oak forests will cause a problem for the timber industry, which uses the oak wood. It will also affect biodiversity, as a large wildlife population lives in oak forests.

11

(i) Read lines 1–7 of the passage.

Use **only** the information in the passage to suggest what the oak seedlings and seedlings of other types of tree are competing for. [1 mark]

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(ii) Read lines 8–9 of the passage.

What trophic level are the voles feeding at? [1 mark]

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(iii) Read lines 10–13 of the passage.

Name **one** economic problem and **one** environmental problem which would result from the oak seedlings not growing into oak trees. [2 marks]

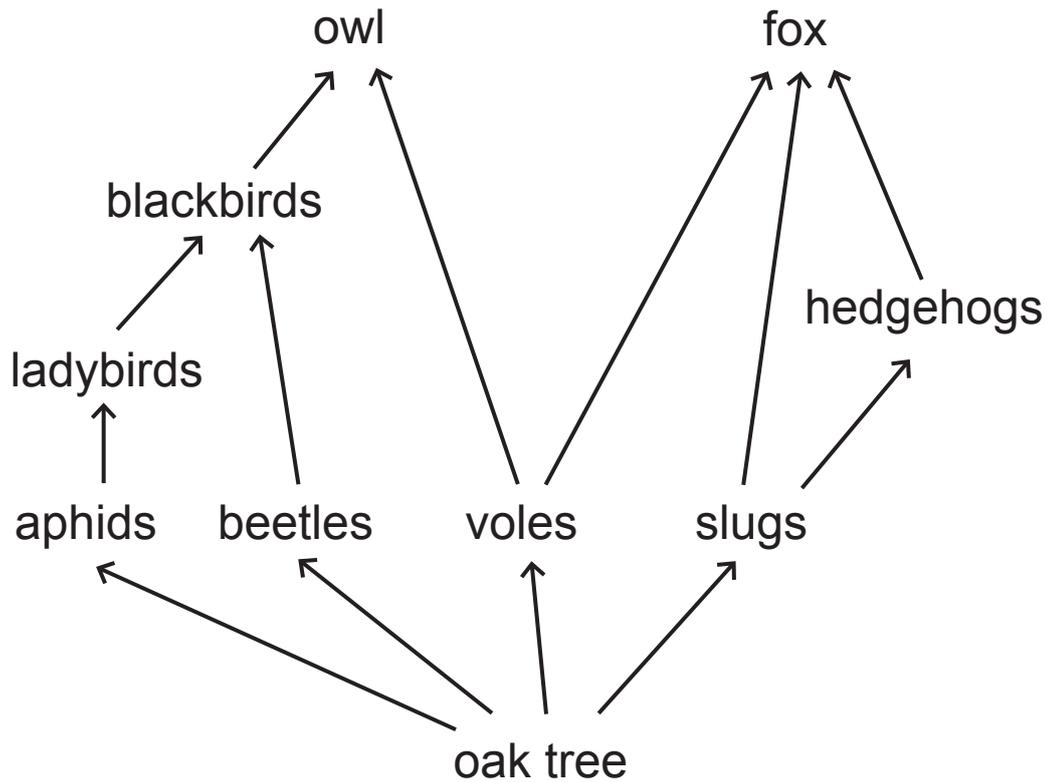
Economic \_\_\_\_\_

\_\_\_\_\_

Environmental \_\_\_\_\_

\_\_\_\_\_

(b) The diagram shows part of a food web in a forest.



(i) Use the food web to draw and label a pyramid of **numbers** for the **only** food chain that has five trophic levels. [3 marks]

(ii) More energy is available to the fox if it eats slugs rather than hedgehogs.

Explain why. [2 marks]

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(c) Owls eat many types of small mammal.

A number of hours after feeding, the owl expels a pellet from its mouth containing all the indigestible parts of its prey, e.g. bones, fur and teeth.

The photographs show owl pellets.



Owl pellets lying on the forest floor



An owl pellet pulled apart to show indigestible body parts of prey

In one evening's hunting, an owl eats three voles.

Each vole has a mass of 30 grams.

Each gram of vole eaten contains 8 kJ of energy.

(i) Calculate the amount of energy in the **three** voles. Show your working. [2 marks]

\_\_\_\_\_ kJ

- (ii) 25% of the energy in the owl's meal is expelled in the pellet.  
Calculate how much energy is in this pellet.

Show your working. [2 marks]

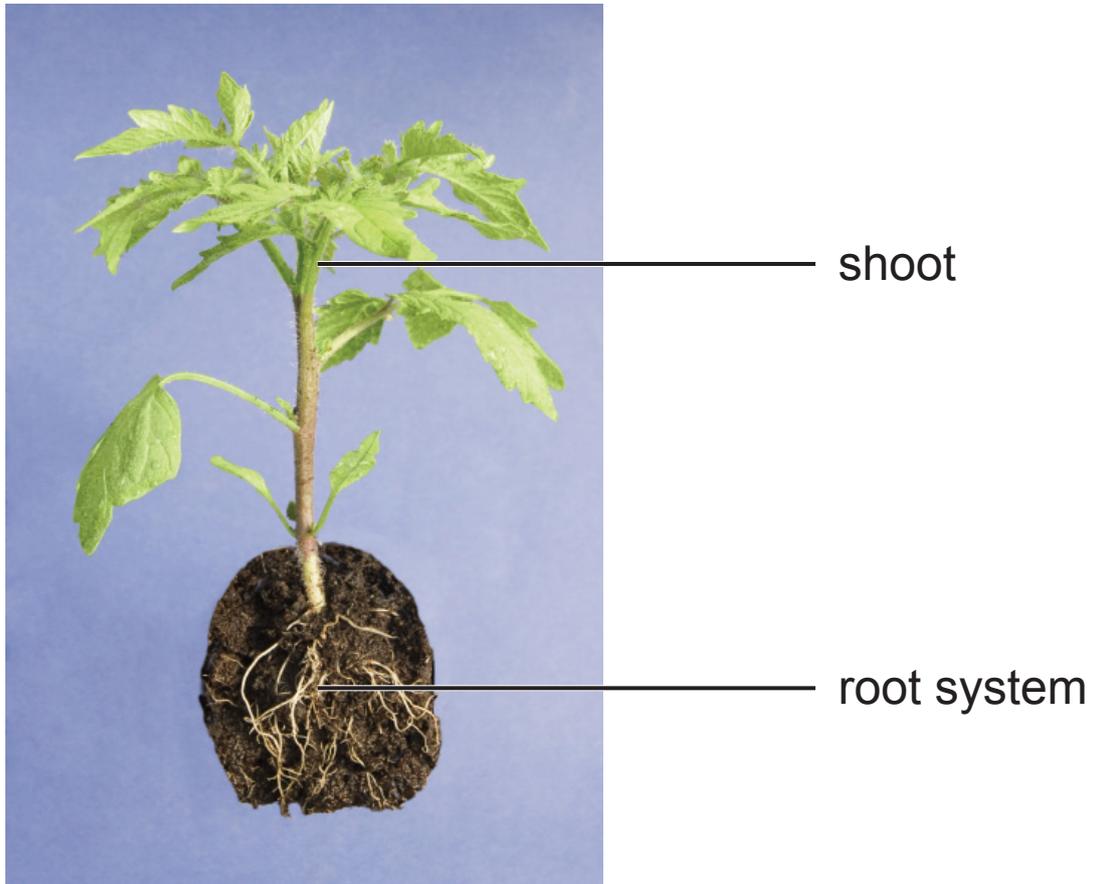
\_\_\_\_\_ kJ

- (iii) Name **one** way, other than indigestible body parts, that energy can be lost between trophic levels in a food chain. [1 mark]

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- 5 (a) A market gardener grows tomato plants in a glasshouse. He is able to control the conditions inside the glasshouse to obtain the best rate of photosynthesis.

The photograph shows a tomato plant.



The market gardener adds fertiliser to increase mineral levels in the soil. The tomato plants absorb the minerals and this improves growth.

- (i) Name the cells in plants which increase the surface area for absorption of minerals. [1 mark]

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- (ii) Name and describe the process which is used by plants to absorb minerals from the soil. [3 marks]

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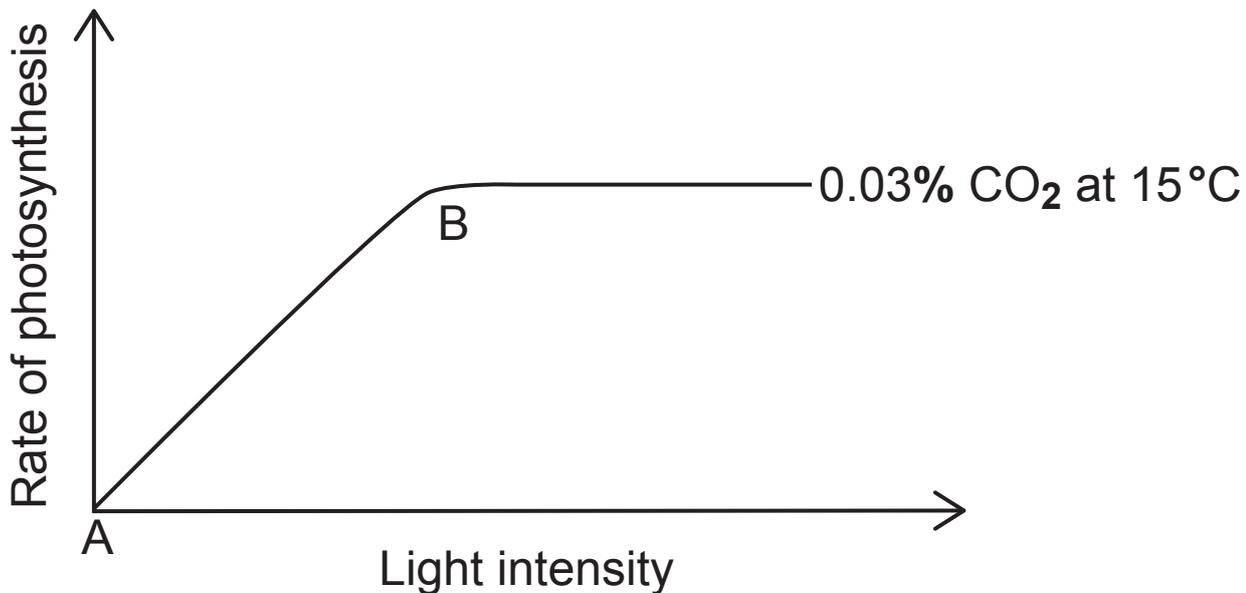
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- (b) The rate of photosynthesis in a plant can be limited by environmental factors.

The graph shows the effect of increasing light intensity on the rate of photosynthesis in **0.03%** carbon dioxide ( $\text{CO}_2$ ) at  $15^\circ\text{C}$ .



- (i) Name the environmental factor that is limiting the rate of photosynthesis between points A–B. [1 mark]

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- (ii) Sketch a line on the graph to show the rate of photosynthesis in the same plant in **0.13%**  $\text{CO}_2$  at  $15^\circ\text{C}$ . [2 marks]

- (c) Geothermal energy is used in Iceland to heat water underground.

This water can be piped into glasshouses. Some market gardeners in Iceland use this hot water to heat their glasshouses.

Geothermal energy is non-polluting.

The photograph shows some of these glasshouses in Iceland.



(i) Suggest **one** economic benefit to market gardeners in Iceland who use geothermal energy to heat their glasshouses. [1 mark]

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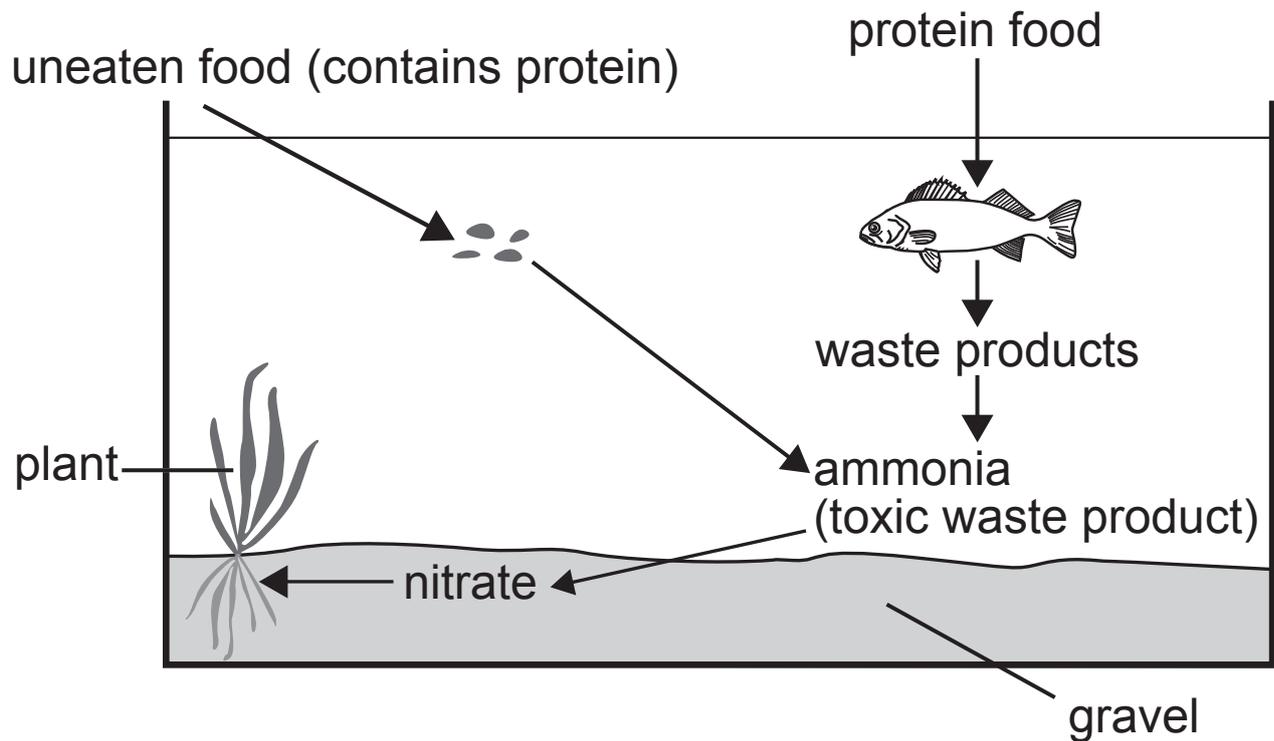
(ii) Suggest how using this form of heating in glasshouses helps Iceland meet international treaty requirements on pollution. [2 marks]

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- 6 The diagram shows part of the nitrogen cycle taking place in a fish tank.



- (a) Name the type of bacteria that converts ammonia into nitrate. [1 mark]

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- (b) Fish food contains protein.

When fish are given too much of this food some of it will remain uneaten in the tank.

Use the diagram to explain how this may lead to the death of fish in the tank. [2 marks]

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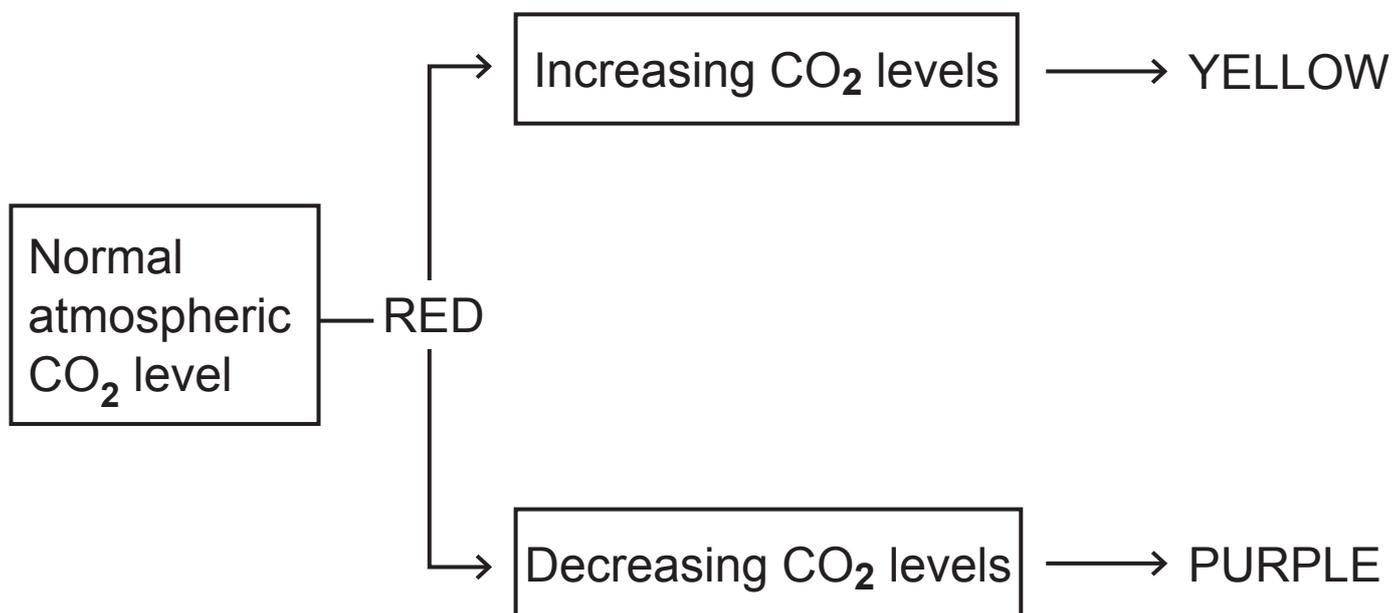


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7 Hydrogencarbonate indicator changes colour as carbon dioxide (CO<sub>2</sub>) levels change.

These colour changes are shown in the diagram below.



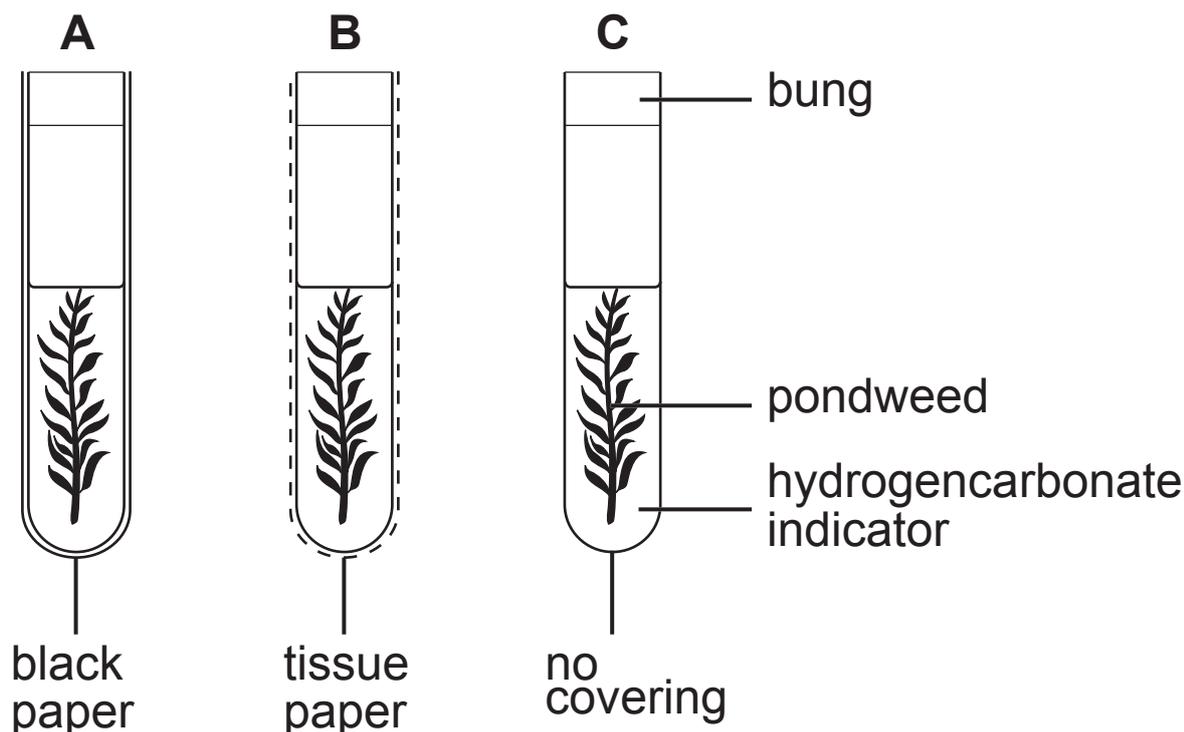
A student investigated gas exchange in pondweed in different light conditions.

Three test tubes were set up, each containing the same amount of pondweed and the same volume of hydrogencarbonate indicator.

The test tubes were set up to give different light conditions.

The three test tubes were left for 6 hours. The colour of the hydrogencarbonate indicator was recorded at the start of the investigation and after 6 hours.

The diagram below shows how the test tubes were set up.



The table below shows the results of the investigation.

Test tube	Test tube covering	Colour of hydrogencarbonate indicator at start	Colour of hydrogencarbonate indicator after 6 hours
<b>A</b>	Black paper	red	yellow
<b>B</b>	Tissue paper	red	red
<b>C</b>	None	red	purple

Explain the colour changes in the hydrogencarbonate indicator after 6 hours, in **each** of the test tubes.









**SOURCES**

Question 3d, Diagram of the digestive system, © CCEA

Question 4a, Photograph of an oak tree, © Cheryl Davis/iStock/Thinkstock

Question 4c (i), Photograph of regurgitated owl pellet, © Edward Kinsman/Science Photo Library

Question 4c (ii), Photograph of barn owl pellet, © Dr Morley Read/Science Photo Library

Question 5a, Photograph of tomato plant, © Sheila Terry/Science Photo Library

Question 5c, Photograph of glasshouses in Iceland, © Martin Bond/Science photo Library

Question 6, Diagram showing part of the nitrogen cycle taking place in a fish tank, © CCEA

Question 6c, Photograph showing a river affected eutrophication, © Robert Brook/Science photo Library

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Question Number	Marks
1	
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<b>Total Marks</b>	
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