Surname	Centre Number	Candidate Number
First name(s)		0

wjec cbac

GCSE

S23-3400U10-1

3400U10-1

TUESDAY, 13 JUNE 2023 – MORNING

BIOLOGY – Unit 1:
Cells, Organ Systems and Ecosystems
FOUNDATION TIER

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**8**	
3.	**10**	
4.	**12**	
5.	**7**	
6.	**9**	
7.	**6**	
8.	**12**	
9.	**8**	
Total	**80**	

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

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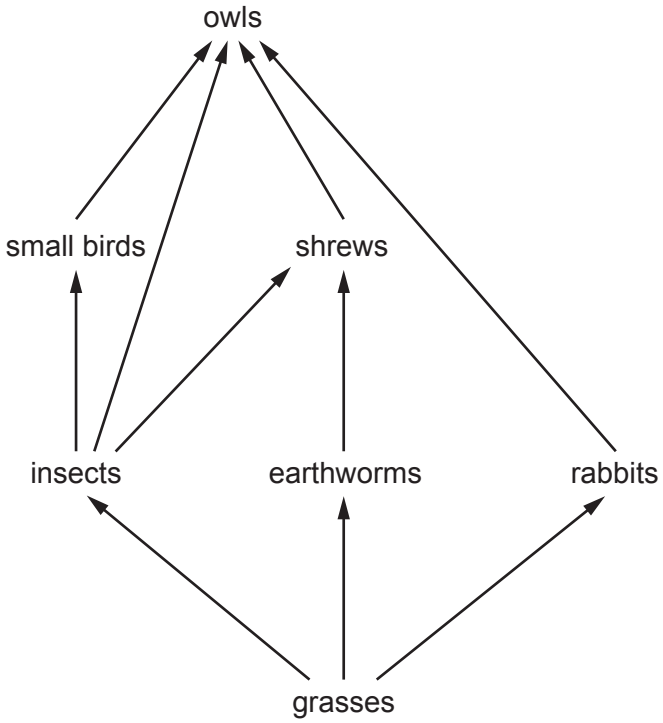
Answer **all** questions.

1. (a) **Image 1.1** shows a food web from an area of grassland.

Image 1.1



(i) Use **Image 1.1** to state the organisms which are present in the highest numbers. [1]

.....

(ii) Name the **third stage** (tertiary) consumers shown in the food web in **Image 1.1**. Give the reason for your choice. [2]

Name .....

Reason .....

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(b) One food chain from the food web is shown below. The images are not to scale.

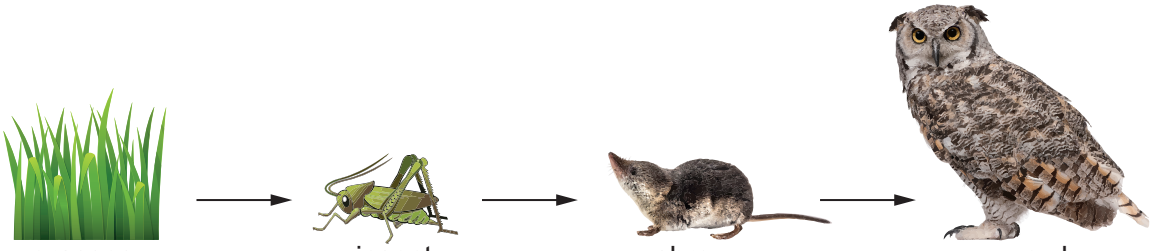


Table 1.2 shows the results of an investigation of the organisms in this food chain in the area of grassland habitat.

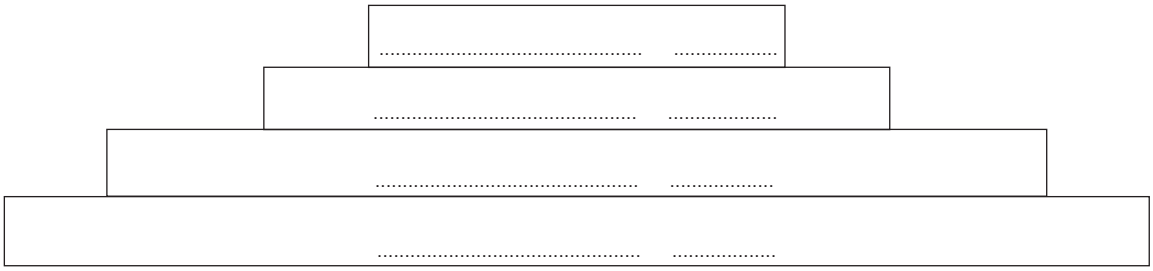
Table 1.2

Organism	Number of individuals counted	Mass of one individual (g)	Total biomass (g)
shrew	90	10	.....
owl	1	350	.....
grasses	10 000	2	20 000
insect	3 000	4	.....

(i) **Complete Table 1.2** by calculating the total biomass for each of the organisms in this food chain. One has been done for you. [2]
Space for working.

(ii) Use **Table 1.2** to complete the pyramid of numbers in **Image 1.3** by **writing the names of the organisms** in this food chain and the **numbers of each**. [1]

Image 1.3



(iii) State **one** way in which energy can be lost from a food chain and explain how this loss of energy is shown in the pyramid. [2]

.....

.....

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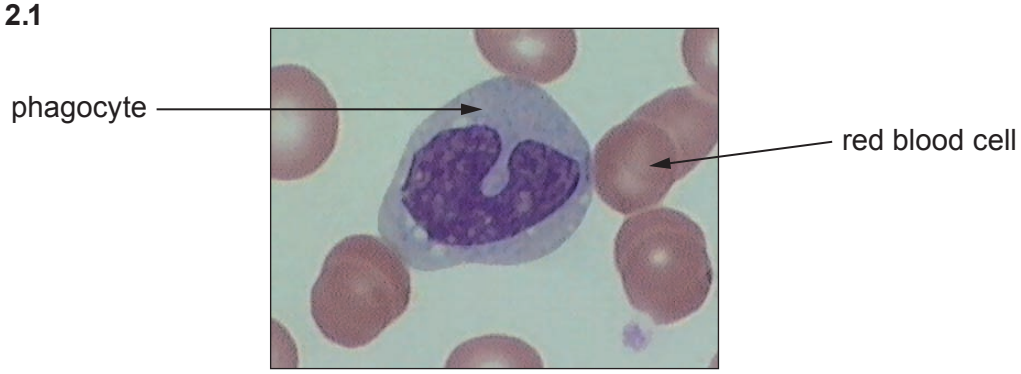
2. **Image 2.1** shows a sample of human blood as seen through a light microscope.

Image 2.1

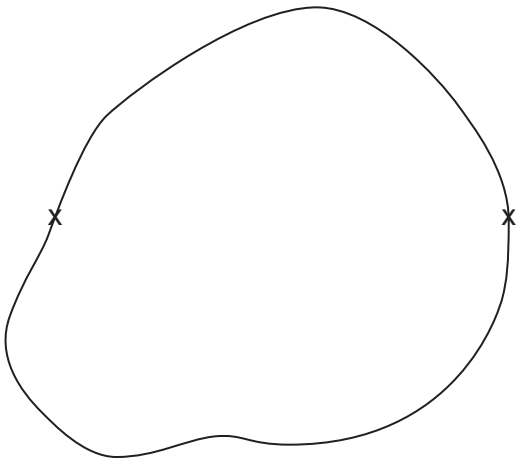


(a) (i) The drawing in **Image 2.2** shows the cell membrane of the phagocyte.

I. **Draw** the **nucleus** in the outline of the phagocyte and **label it**. [1]

II. **Label** the **cytoplasm** in the outline of the phagocyte. [1]

Image 2.2



(ii) I. Measure the width x–x **in mm** on the drawing. [1]

Width x–x = ... mm

II. The width of the actual cell is 0.012 mm.
Calculate the magnification of the drawing using the equation below. [1]

$$\text{magnification} = \frac{\text{width x–x on drawing}}{\text{width of the actual cell}}$$

magnification = × .....

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(b) **Complete the table** by selecting functions from those below. [3]

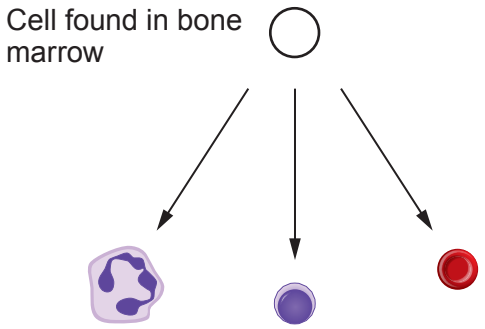
transports hormones carries oxygen defends against disease

clots the blood controls temperature

Part of blood	Function
red blood cell	.....
white blood cell	.....
platelets	.....

(c) There are many types of blood cell, each with a particular function. They all come from one type of cell found in bone marrow through the process of differentiation. This is shown in **Image 2.3**.

Image 2.3



Many types of blood cells

Choose the letter **A-D** to give the term used for the various types of blood cells. [1]

A selected

B specialised

C secondary

D sensitive

Answer letter = ...

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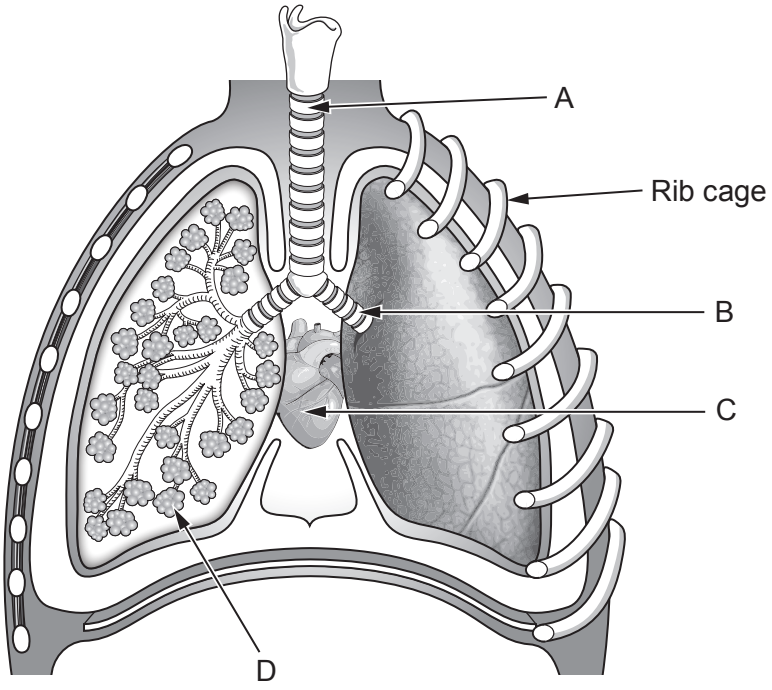
3. (a) **Image 3.1** is a vertical section through the human chest cavity (thorax).

Image 3.1



Choose the letter (**A–D**) from **Image 3.1** which shows [2]

(i) a bronchus .....

(ii) an alveolus .....

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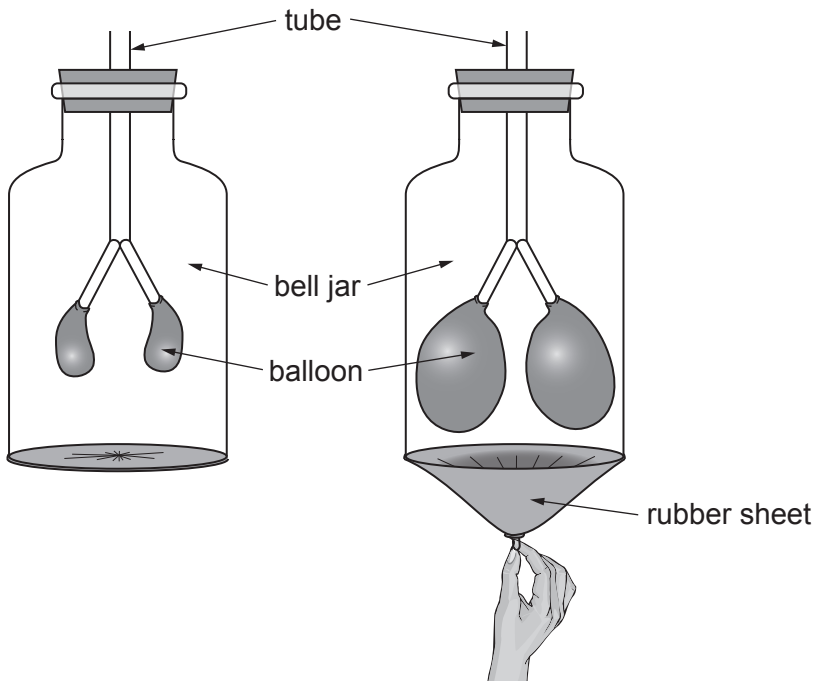
(b) The way in which the respiratory system works during breathing can be demonstrated using the bell-jar model shown in **Image 3.2**.

Image 3.2



(i) State the part of the model shown in **Image 3.2** which represents: [3]

I. the diaphragm .....

II. the lungs .....

III. the trachea .....

(ii) The rubber sheet can be pulled downwards to demonstrate **inspiration** (breathing in).

Complete each of the sentences below by circling the correct statement to describe the process of **inspiration** in the human thorax. [2]

The volume of the thorax **increases** / **decreases** / **stays the same**.

The pressure in the thorax **increases** / **decreases** / **stays the same**.

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(iii) Describe how the ribcage moves during **inspiration** and why this cannot be demonstrated using the bell jar model. [2]

.....

.....

.....

.....

(c) Human muscle cells usually carry out aerobic respiration. During strenuous exercise, however, anaerobic respiration occurs.

State the harmful chemical substance produced by anaerobic respiration in human muscle cells. [1]

.....

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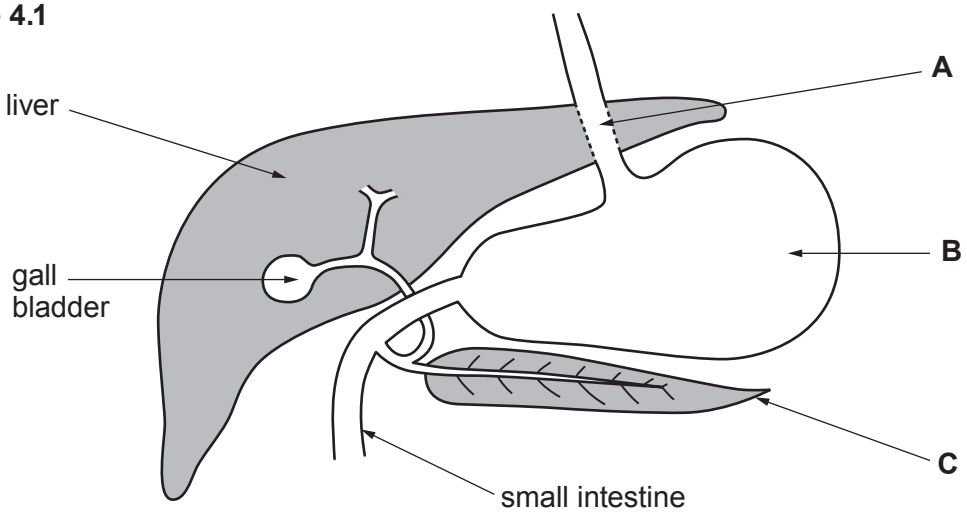
4. **Image 4.1** shows part of the digestive system in a human.

Image 4.1



(a) (i) State the letter (**A-C**) which shows the pancreas. [1]

.....

(ii) The pancreas produces lipase.

Complete the sentence below using one of the terms given.

glucose glycerol amino acids

Lipase breaks down fat into fatty acids and ..... . [1]

(iii) The breakdown of fat by lipase is assisted by bile.
Using **Image 4.1** describe the pathway taken by bile as it passes from the **liver**, where it is produced, to where it enters the **small intestine**. [2]

.....

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(b) In an investigation, the effect of lipase on the breakdown of fat was measured with and without using bile.
Five trials were carried out and the results are shown in **Table 4.2** and **Graph 4.3**.

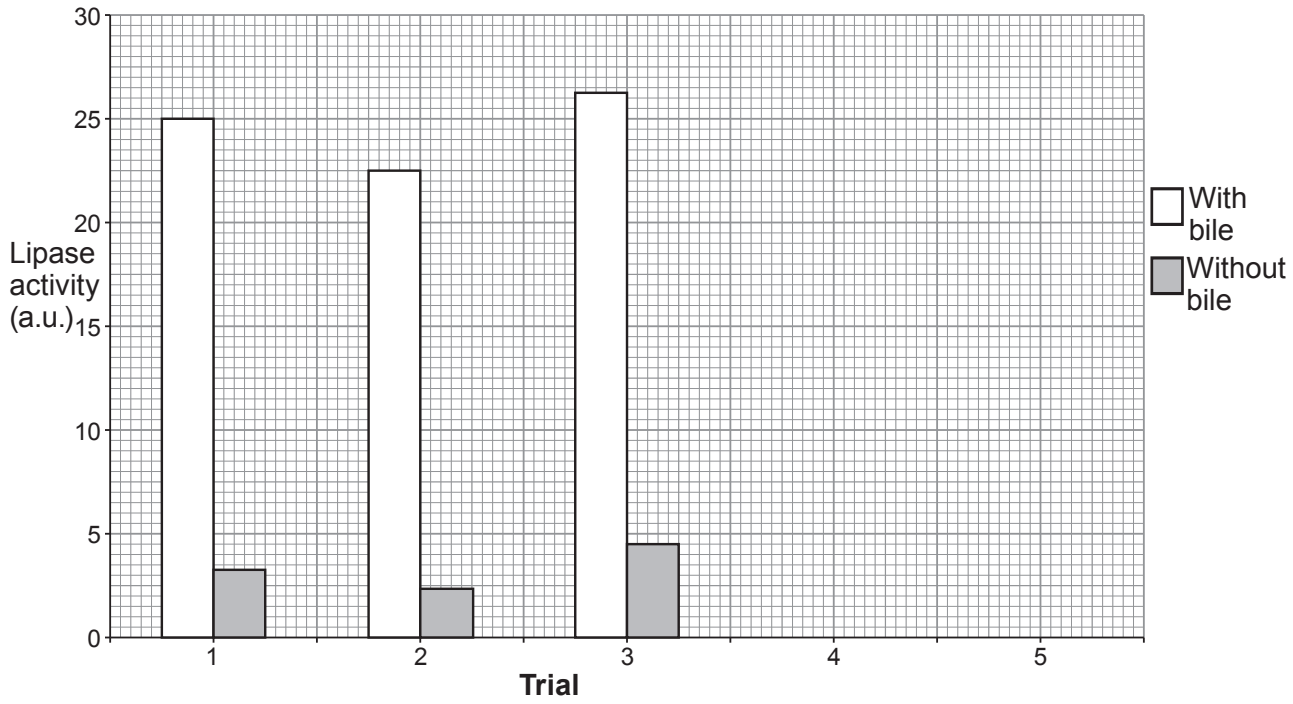
Table 4.2

		Lipase activity (a.u.)	
		With bile	Without bile
Trial	1	24.9	3.1
	2	22.6	2.3
	3	26.2	4.4
	4	22.6	1.7
	5	23.7	3.5
	Mean	24.0	3.0
	Ratio of means = ... :		

(i) I. Calculate the ratio of the means. **Write your answer in Table 4.2**. [1]

II. Complete **Graph 4.3** by **plotting the results** for trial **4** and trial **5** from **Table 4.2**. [3]

Graph 4.3



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(ii) From these results, describe the effect of bile on the activity of lipase and give **one** piece of evidence to support your answer. [2]

.....

.....

.....

.....

(iii) Each trial started at pH 7. State how the pH would change during the trial. [1]

.....

(iv) State the purpose of measuring the activity of lipase without bile in each of the trials. [1]

.....

.....

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5. Sea anemones are animals which are often found in rock pools along the seashore. **Image 5.1** shows a sea anemone.

Image 5.1

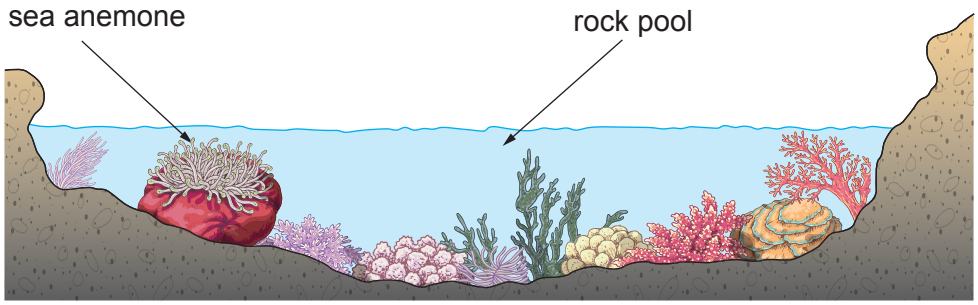
sea anemone

On warm sunny days:

- the water temperature in rock pools increases.
- evaporation occurs, so the concentration of salts in the water increases.
- the water becomes acidic (pH lower than 7).
- concentration of salt in sea water is HIGHER than anemone cells.
- concentration of water in sea water is LOWER than anemone cells.

Image 5.2 shows a rock pool at the end of a warm day.

Image 5.2



Fact file – Conditions required for sea anemones to survive.

Oxygen concentration (mg/dm^3)	Above 9.9
pH	Between 8.1 and 9.7

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Table 5.3 shows how the sea water temperature affects its oxygen concentration.

Table 5.3

Sea water temperature (°C)	Oxygen concentration (mg/dm^3)
0	14.5
10	11.2
20	9.4
30	7.6
40	4.5

Use the information to answer the following questions.

(a) (i) State how the oxygen concentration of sea water changes when the temperature increases. [1]

.....

(ii) Calculate the mean change in oxygen concentration **per degree** when the temperature rises from 10 °C to 30 °C. [2]

Mean change in oxygen concentration per degree = ... mg/dm^3

(b) The statements in **Table 5.4** refer to conditions in a rock pool at the end of a warm, sunny day when the sea water temperature was 24 °C. Write **true** or **false** for each statement. [4]

Table 5.4

Statements	True or False
Water vapour has been lost from the rock pool.	
The sea anemone has lost salt by diffusion.	
There is enough oxygen in the water for the sea anemone to survive.	
The pH of the water is suitable for the sea anemone.	
Water will pass out of the sea anemone by osmosis.	

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6. (a) Enzymes are described as biological catalysts. State the function of enzymes in cells. [1]

.....

.....

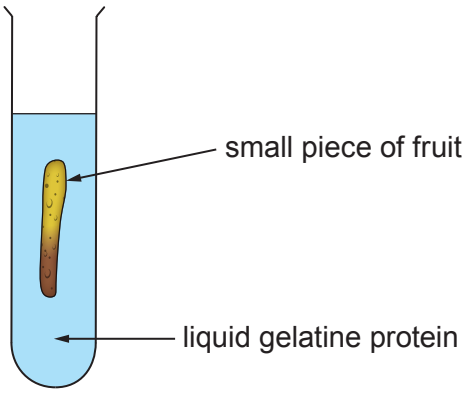
(b) Gelatine is a protein which is liquid above 25 °C. The gelatine protein sets when it cools down and becomes fully solid at 15 °C. The gelatine protein does not set if it is broken down by an enzyme. **Image 6.1** shows a packet of gelatine.

Image 6.1

Many fruits have protease enzymes which break down proteins.

In an investigation some students used the gelatine protein to identify which fruits contain proteases.
They set up five test tubes, one of which is shown in **Image 6.2**.

Image 6.2



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They placed all the tubes in a refrigerator at 5 °C for some time. They then observed the tubes. Their results are shown in **Table 6.3**.

Table 6.3

		Gelatine protein (liquid or solid)	
Tube number	Fruit	At start	At end
1	fresh figs	liquid	liquid
2	fresh strawberry	liquid	solid
3	fresh kiwi fruit	liquid	liquid
4	boiled peaches	liquid	solid
5	fresh pineapple	liquid	liquid

(i) Use the information about gelatine and **Table 6.3** to answer the following questions.

I. Identify **all** the fruits which contain protease. [1]

.....

II. Explain why you reached this conclusion. [2]

.....

.....

(ii) The students' teacher commented that the result for peaches was not valid.

I. Explain the reason for this comment. [2]

.....

.....

.....

.....

II. State how they could obtain a valid result for peaches. [1]

.....

.....

(iii) Suggest a temperature at which gelatine should be kept before pouring it into the test tubes. [1]

..... °C

(iv) State **one** variable, other than temperature, which the students should have controlled to ensure fair testing. [1]

.....

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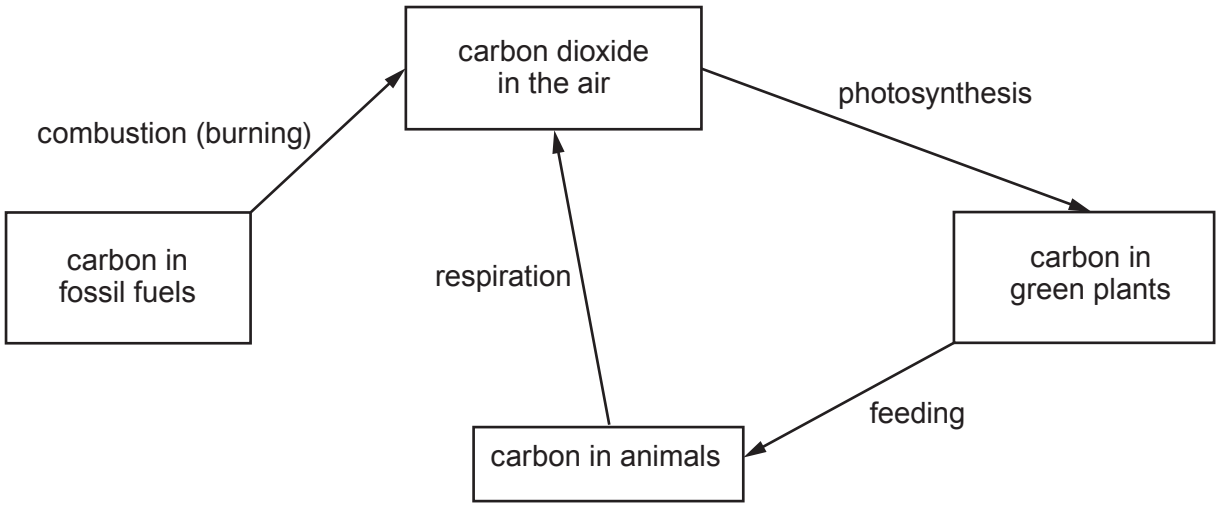
7. The increasing level of carbon dioxide in the air is causing global warming. **Image 7.1** shows one effect of global warming

Image 7.1

Polar bear's habitat damaged by global warming.

Image 7.2 shows part of the carbon cycle.

Image 7.2



Explain how the processes of photosynthesis, respiration and combustion each affect global warming. Suggest how humans could try to reduce the levels of carbon dioxide in the air.

[6 QER]

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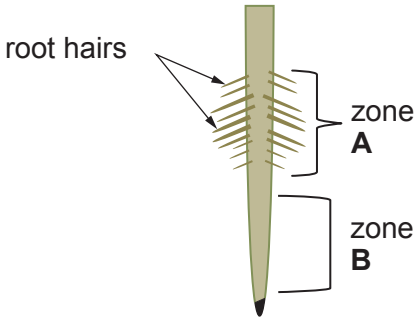
8. Part of a plant root is shown in **Image 8.1**.

Image 8.1



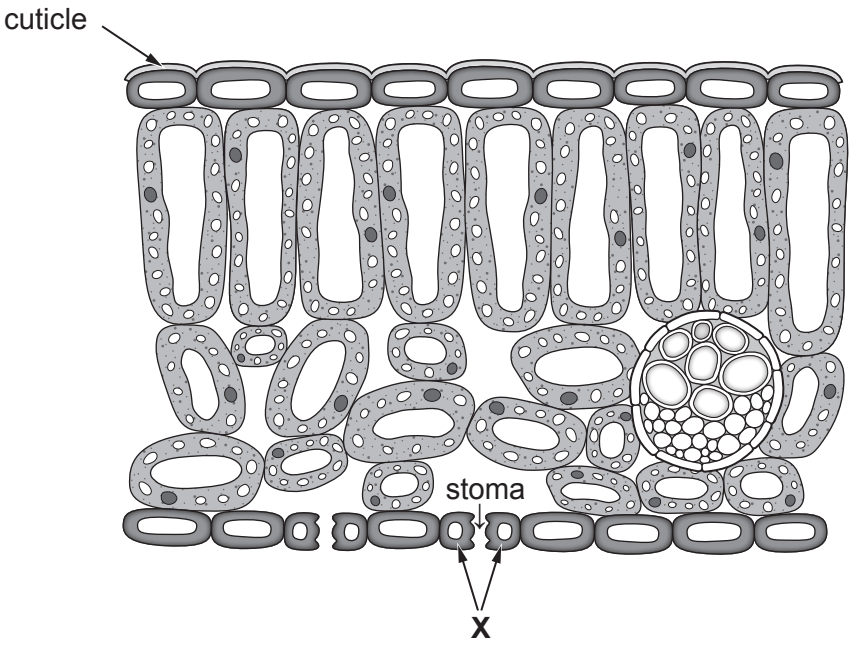
(a) Explain why water uptake in zone **A** is greater than in zone **B**. [1]

.....

.....

(b) **Image 8.2** represents a section through the leaf of a plant.

Image 8.2



(i) On **Image 8.2**, **draw an arrow** to show the tissue which transports water to all parts of the plant. **Label the arrow with the name of the tissue**. [2]

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(ii) I. Name cells **X** shown in **Image 8.2**. [1]

.....

II. State how the stoma and cuticle are involved in the control of water loss from a leaf. [2]

Stoma

.....

.....

Cuticle

.....

.....

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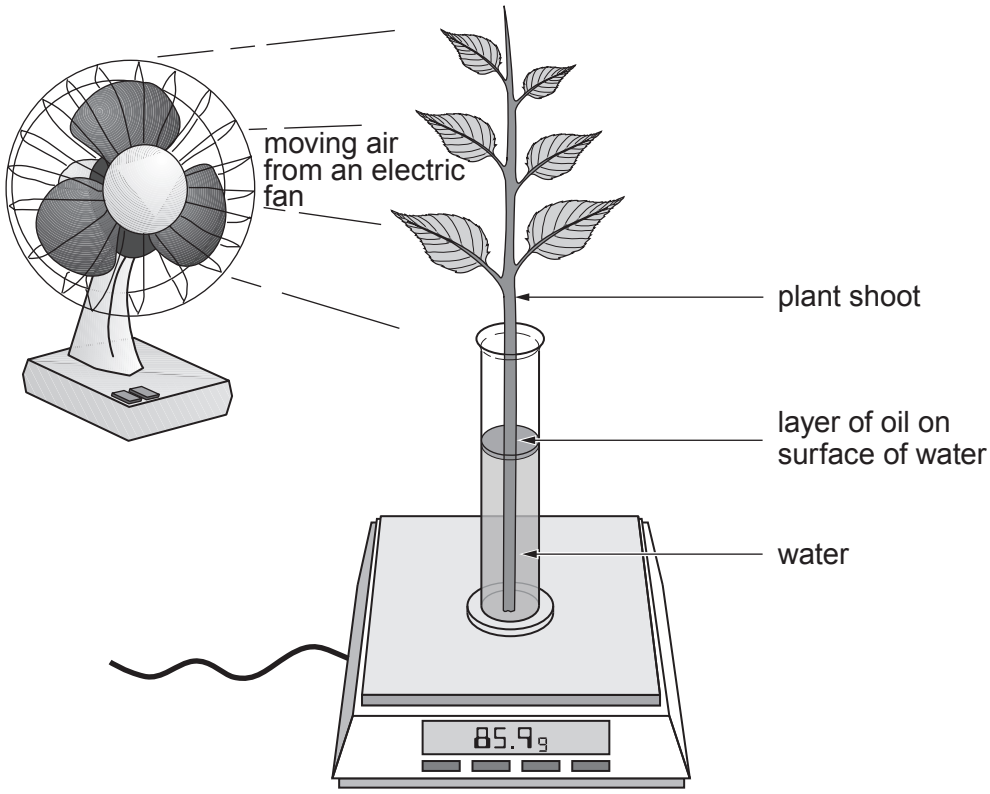
(c) Megan and Rhys investigated the loss of water from a leafy shoot. They used the apparatus shown in **Image 8.3**.

Image 8.3



They recorded the loss of mass after directing moving air, at different speeds, onto the shoot.

(i) State the scientific term for the evaporation of water from the leaves of a plant. [1]

.....

(ii) State **one** way in which Megan and Rhys could ensure that they carried out a fair test. [1]

.....

.....

(iii) State why it was important that the layer of oil was added. [1]

.....

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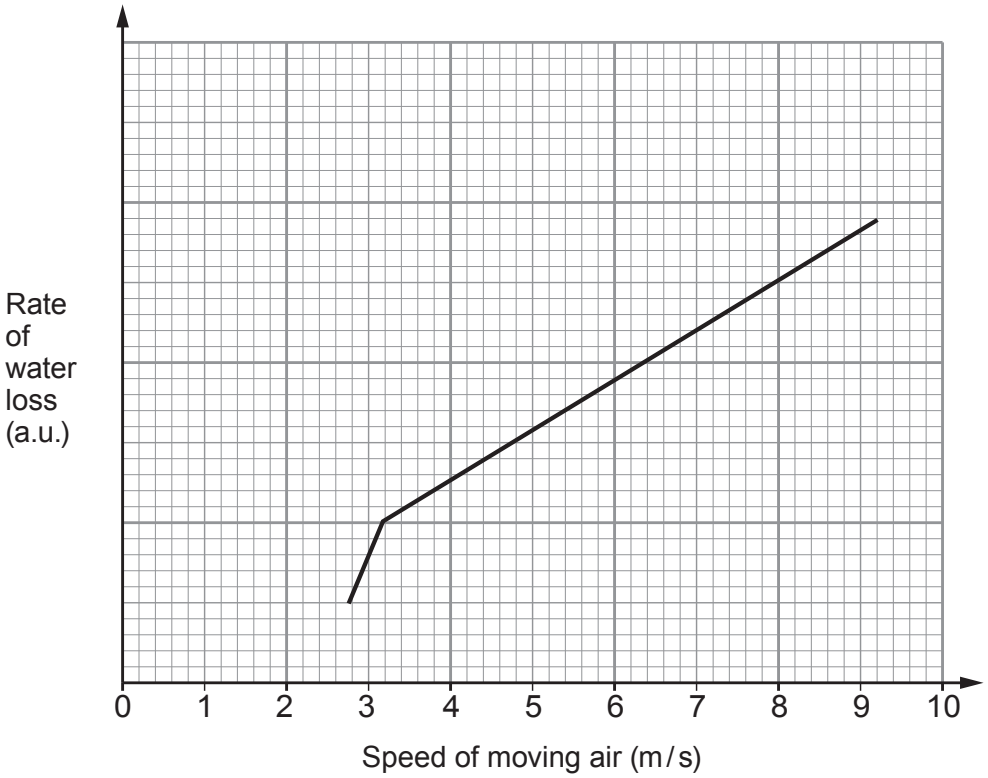
(iv) The results of their investigation are summarised in **Graph 8.4**.

Graph 8.4



I. Describe the effect of increasing the speed of moving air on the rate of water loss. [2]

.....

.....

.....

.....

II. **Sketch a line on Graph 8.4** to suggest the result you would expect if the **humidity** of the air was increased. [1]

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9. **Image 9.1** shows chickens in two different farming systems.

Image 9.1

Free-range farm Intensive farm

In 1950 chicken was an expensive food and most adults in the UK, on average, ate only 1100 g each year. By 2000 they ate 25 kg per year as intensive farming had made chicken much cheaper.

In intensive farming, large numbers of chickens are reared indoors. Environmental conditions and food supply are constantly controlled. The chickens grow faster than free-range chickens and use less energy as their movement is restricted.

The farmer can monitor the chickens more easily than on a free-range farm. Much less land is used and labour costs are lower but larger amounts of concentrated waste are produced.

(a) (i) Use the information given to calculate the increase in mass in the annual consumption of chicken for a **family of four adults** in the UK between 1950 and 2000. [2]

Increase in mass = ... kg / family / year

During an investigation, the growth of chickens from different farm systems was compared. The results are shown in **Graph 9.2** and **Tables 9.3** and **9.4**.

Graph 9.2

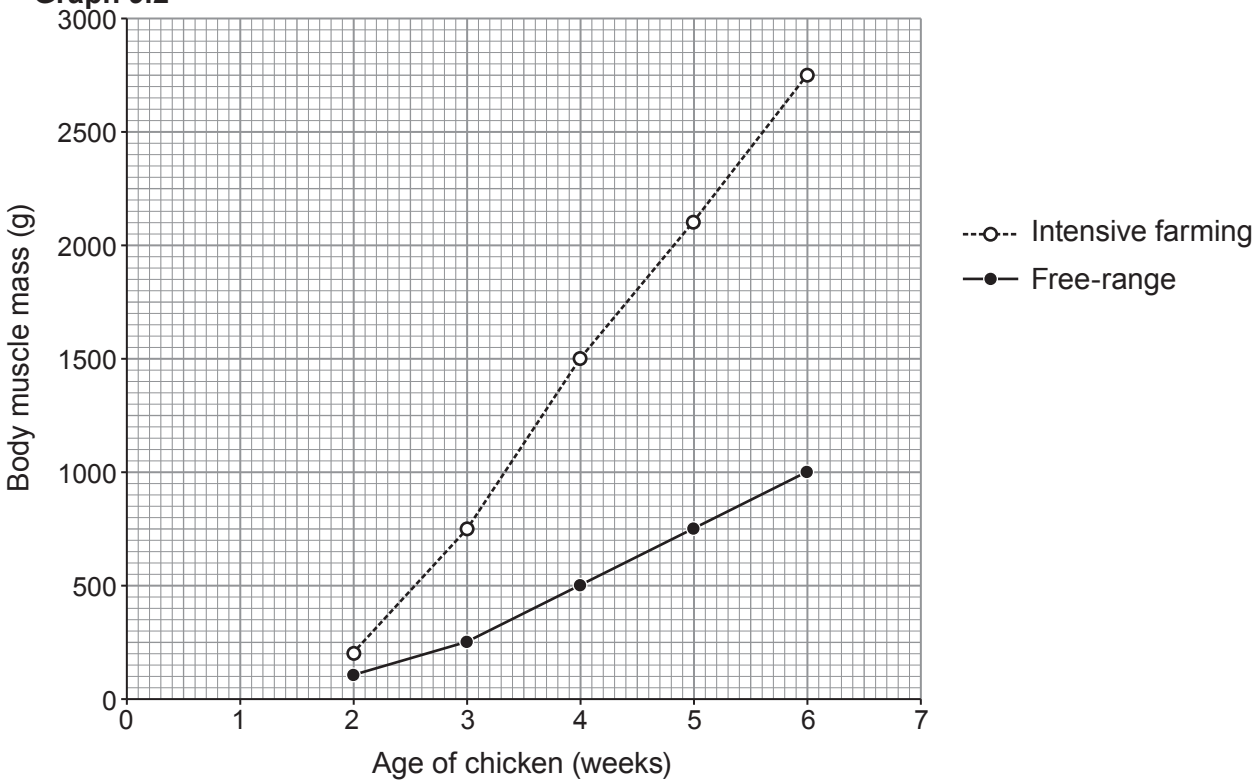

Table 9.3

Organ mass in chickens at six weeks

Organ	Mass (g)	
	Free-range	Intensively farmed
Heart	6.5	4.8
Lungs	4.0	3.5
Liver	20.0	15.0

Table 9.4

Bone quality in chickens at six weeks

	Free-range	Intensively farmed
Bone density (g/cm^3)	1.29	0.79
Presence of broken bones (%)	2.5	37
Length of leg bones (mm)	73	118

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(ii) Use **Graph 9.2** to calculate the difference in the body muscle mass at 5 weeks between intensively farmed chicken and a free–range chicken. [1]

Difference = ... g

(b) (i) Use the information on page 23 to suggest **one** advantage to farmers of farming chickens intensively. [1]

.....

.....

(ii) State **one** feature of intensive farming which is an environmental disadvantage. [1]

.....

(c) Some groups of people have ethical objections to intensive farming because of animal welfare concerns.

Using the information in **Tables 9.3** and **9.4**, state **three** features of intensive farming which support this point of view. [3]

.....

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.....

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

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