wjec cbac GCSE

3400U10-1

TUESDAY, 13 JUNE 2023 – MORNING

BIOLOGY – Unit 1:

Cells, Organ Systems and Ecosystems
FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

ITEMS INCLUDED WITH QUESTION PAPER

A separate Diagram booklet.

The Diagram Booklet MUST be handed in to the invigilators and sent for marking.

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

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

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**	

Answer ALL questions.

1 (a) IMAGE 1.1 in the separate diagram booklet shows a food web from an area of grassland.

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

1 (a)(ii)

Name the THIRD STAGE (tertiary) consumers shown in the food web in IMAGE 1.1. Give the reason for your choice. [2 marks]

Name

Reason

1 (b) One food chain from the food web is shown in IMAGE 1.2 in the separate diagram booklet. The images are not to scale.

TABLE 1.3 in the separate diagram booklet shows the results of an investigation of the organisms in this food chain in the area of grassland habitat.

(i) COMPLETE TABLE 1.3 by calculating the total biomass for each of the organisms in this food chain. One has been done for you. [2 marks]

Space for working.

1 (b)(ii) Use TABLE 1.3 to complete the pyramid of numbers in IMAGE 1.4 in the separate diagram booklet by WRITING THE NAMES OF THE ORGANISMS in this food chain and the NUMBERS OF EACH. [1 mark]

(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 marks]

2 IMAGE 2.1 in the separate diagram booklet shows a sample of human blood as seen through a light microscope.

(a)(i) The drawing in IMAGE 2.2 in the separate diagram booklet shows the cell membrane of the phagocyte.

I. DRAW the NUCLEUS in the outline of the phagocyte and LABEL IT. [1 mark]

II. LABEL the CYTOPLASM in the outline of the phagocyte. [1 mark]

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

Width x–x = _____ mm

2 (a)(ii)

II. The width of the actual cell is 0.012 mm.

Calculate the magnification of the drawing using the equation below. [1 mark]

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

magnification = ✕ _____

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Part of blood	Function
red blood cell	
white blood cell	
platelets	

2 (b) COMPLETE THE TABLE opposite by selecting functions from those below. [3 marks]

transports hormones

carries oxygen

defends against disease

clots the blood

controls temperature

2 (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 in the separate diagram booklet.

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

A selected

B specialised

C secondary

D sensitive

Answer letter = _____

8

3 (a) IMAGE 3.1 in the separate diagram booklet is a vertical section through the human chest cavity (thorax).

Choose the letter (A – D) from IMAGE 3.1 which shows [2 marks]

(i) a bronchus _____

(ii) an alveolus _____

3 (b) The way in which the respiratory system works during breathing can be demonstrated using the bell-jar model shown in IMAGE 3.2 in the separate diagram booklet.

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

I. the diaphragm

_____

II. the lungs

_____

III. the trachea

_____

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The volume of the thorax

increases / decreases / stays the same.

The pressure in the thorax

increases / decreases / stays the same.

3 (b)(ii)

The rubber sheet can be pulled downwards to demonstrate INSPIRATION (breathing in).

Complete each of the sentences on the opposite page by circling the correct statement to describe the process of INSPIRATION in the human thorax. [2 marks]

3 (b)(iii)

Describe how the ribcage moves during INSPIRATION and why this cannot be demonstrated using the bell jar model. [2 marks]

3 (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 mark]

10

4 IMAGE 4.1 in the separate diagram booklet shows part of the digestive system in a human.

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

_____

(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 mark]

4 (a)(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 marks]

4 (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 in the separate diagram booklet.

(i) I. Calculate the ratio of the means. WRITE YOUR ANSWER IN TABLE 4.2. [1 mark]

II. Complete GRAPH 4.3 by PLOTTING THE RESULTS for trial 4 and trial 5 from TABLE 4.2. [3 marks]

4 (b)(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 marks]

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

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

5 Sea anemones are animals which are often found in rock pools along the seashore. IMAGE 5.1 in the separate diagram booklet shows a 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.

(Turn over)

5 continued

IMAGE 5.2 in the separate diagram booklet shows a rock pool at the end of a warm day and a fact file of the conditions required for sea anemones to survive.

TABLE 5.3 in the separate diagram booklet shows how the sea water temperature affects its oxygen concentration.

Use the information to answer the following questions.

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

5 (a)(ii) Calculate the mean change in oxygen concentration PER DEGREE when the temperature rises from 10 ºC to 30 ºC. [2 marks]

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

5 (b) The statements in TABLE 5.4 in the separate diagram booklet refer to conditions in a rock pool at the end of a warm, sunny day when the sea water temperature was 24 ºC. Write TRUE or FALSE for each statement. [4 marks]

7

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

6 (b) Gelatine is a protein which is liquid above 25ºC. The gelatine protein sets when it cools down and becomes fully solid at 15ºC. The gelatine protein does not set if it is broken down by an enzyme. IMAGE 6.1 in the separate diagram booklet shows a packet of gelatine.

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 in the separate diagram booklet.

They placed all the tubes in a refrigerator at 5 ºC for some time. They then observed the tubes. Their results are shown in TABLE 6.3 in the separate diagram booklet.

6 (b)(i)

Use the information about gelatine and TABLE 6.3 to answer the following questions.

I. Identify ALL the fruits which contain protease. [1 mark]

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

6 (b)(ii)

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

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

6 (b) (ii)

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

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

_____ °C

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

_____

_____

9

7 The increasing level of carbon dioxide in the air is causing global warming. IMAGE 7.1 in the separate diagram booklet shows one effect of global warming.

IMAGE 7.2 in the separate diagram booklet shows part of the carbon cycle.

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 marks QER]

continue answer on next page

(Turn over)

(Turn over)

34

6

(Turn over)

8 Part of a plant root is shown in IMAGE 8.1 in the separate diagram booklet.

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

8 (b) IMAGE 8.2 in the separate diagram booklet represents a section through the leaf of a plant.

(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 marks]

(ii) I. Name cells X shown in IMAGE 8.2. [1 mark]

---

8 (b)(ii)

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

Stoma

Cuticle

8 (c) Megan and Rhys investigated the loss of water from a leafy shoot. They used the apparatus shown in **IMAGE 8.3** in the separate diagram booklet.

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 mark]

8 (c)(ii) State ONE way in which Megan and Rhys could ensure that they carried out a fair test. [1 mark]

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

8 (c)(iv)

The results of their investigation are summarised in GRAPH 8.4 in the separate diagram booklet.

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

8 (c)(iv)

II. SKETCH A LINE ON GRAPH 8.4 to suggest the result you would expect if the HUMIDITY of the air was increased. [1 mark]

12

9 **IMAGE 9.1 in the separate diagram booklet shows chickens in two different farming systems.**

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.

(Turn over)

9(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 marks]

Increase in mass = _____ kg / family / year

9 (a) (continued)

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 in the separate diagram booklet.

(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 mark]

Difference = _____ g

9 (b)(i) Use the information on page 42 in this question paper to suggest ONE advantage to farmers of farming chickens intensively. [1 mark]

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

9 (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 marks]

8

END OF PAPER

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

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FOUNDATION TIER

1 hour 45 minutes plus your additional time allowance

DIAGRAM BOOKLET
This Diagram Booklet MUST be handed in to the invigilators and sent for marking.

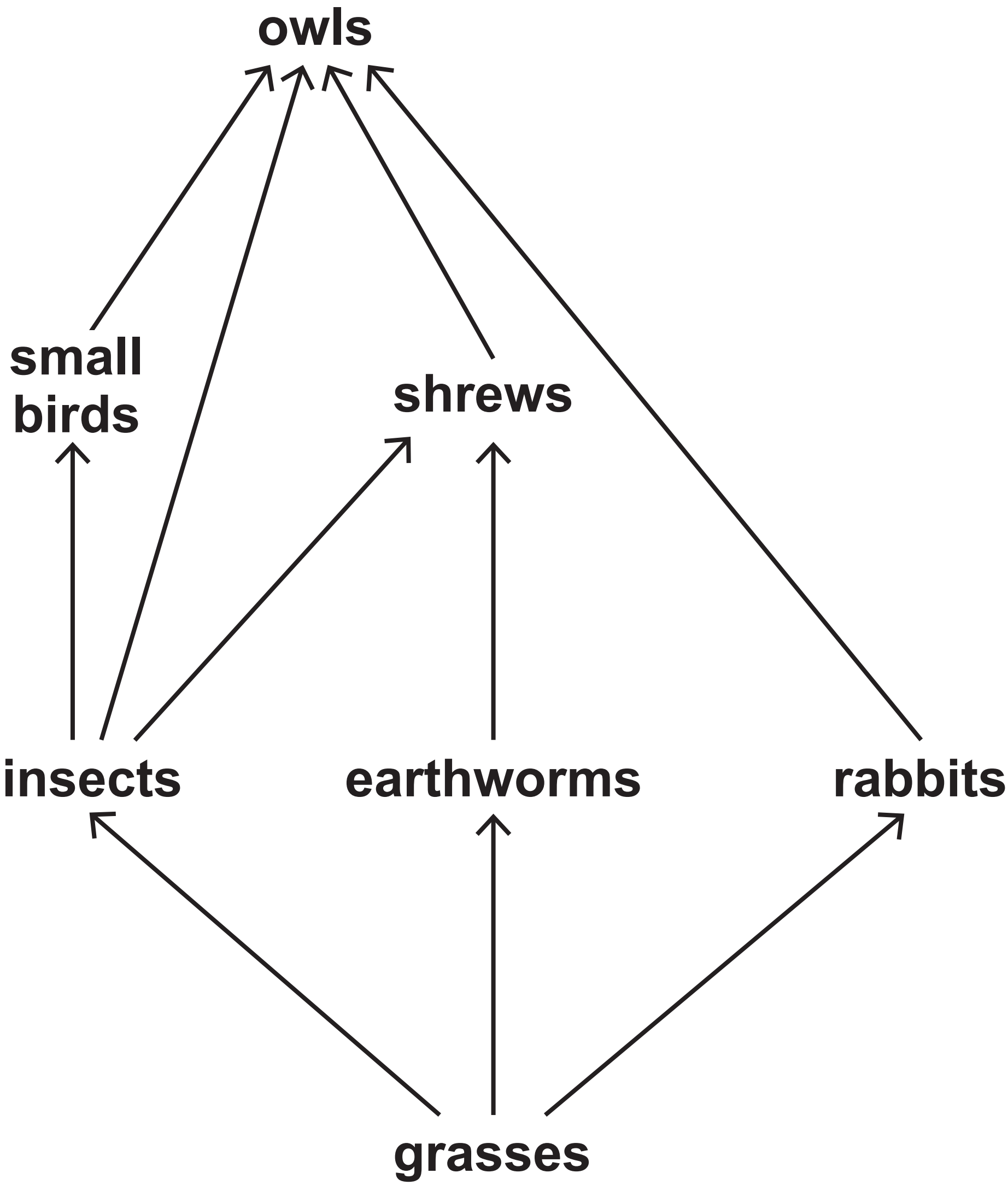
Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

IMAGE 1.1


owls
small birds
shrews
insects
earthworms
rabbits
grasses

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TURN OVER

IMAGE 1.2

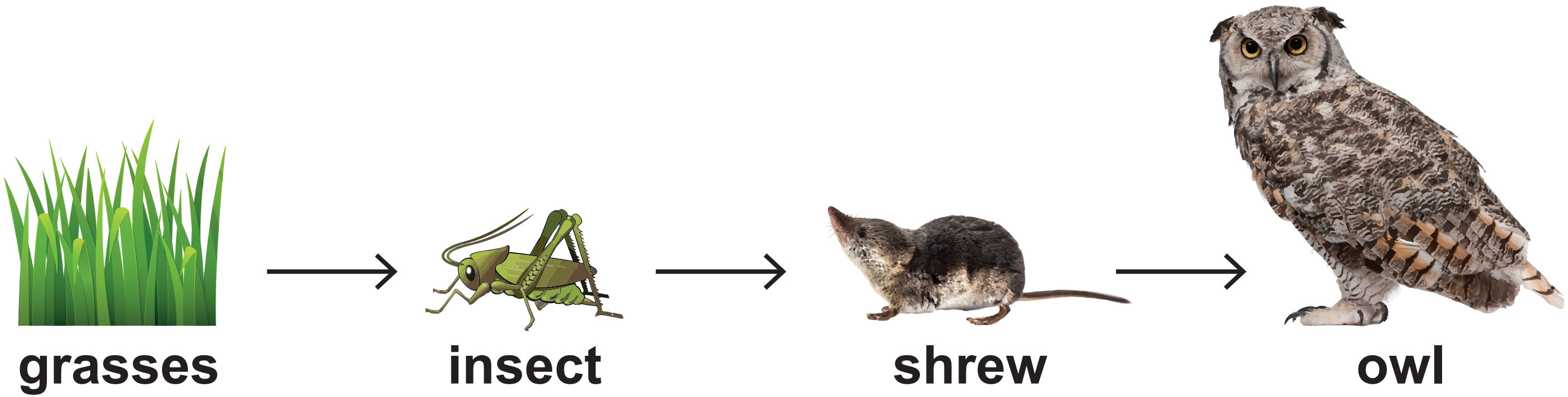

TABLE 1.3

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	_____

IMAGE 1.4

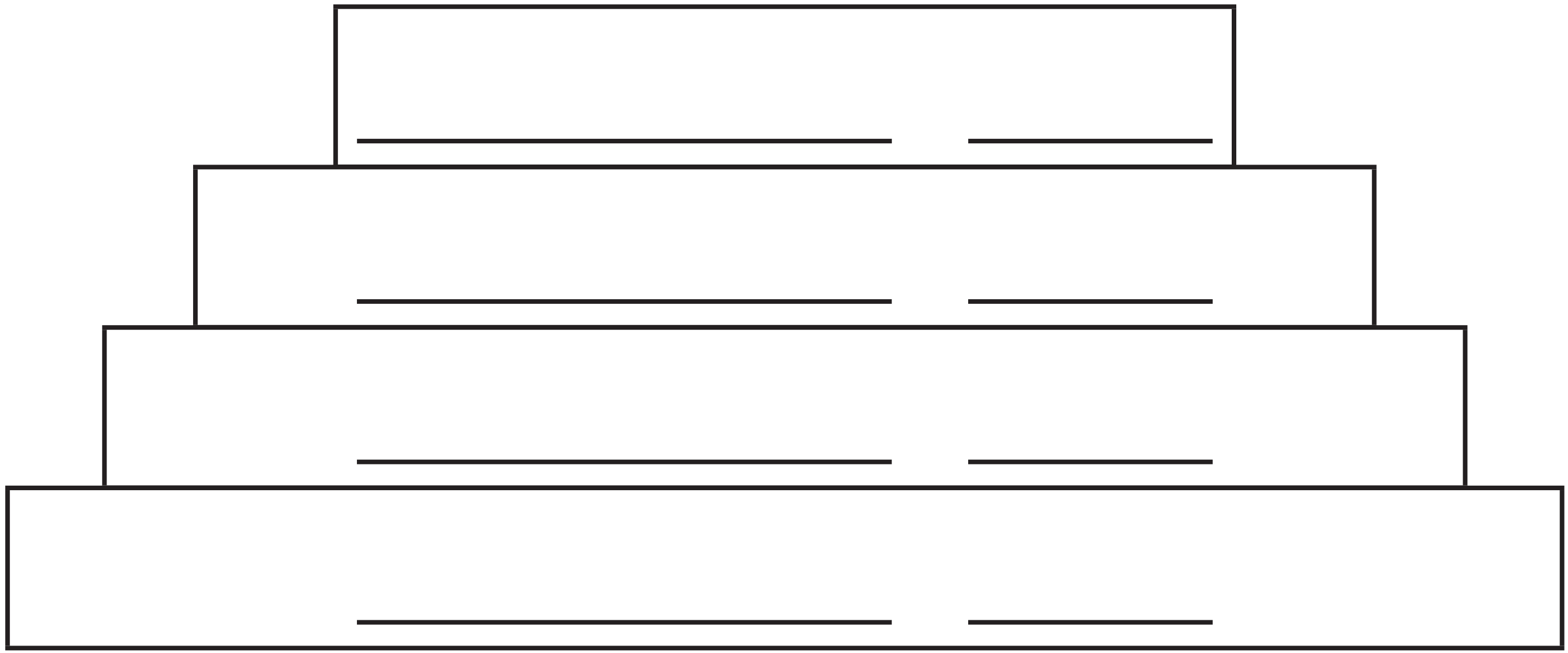

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IMAGE 2.1

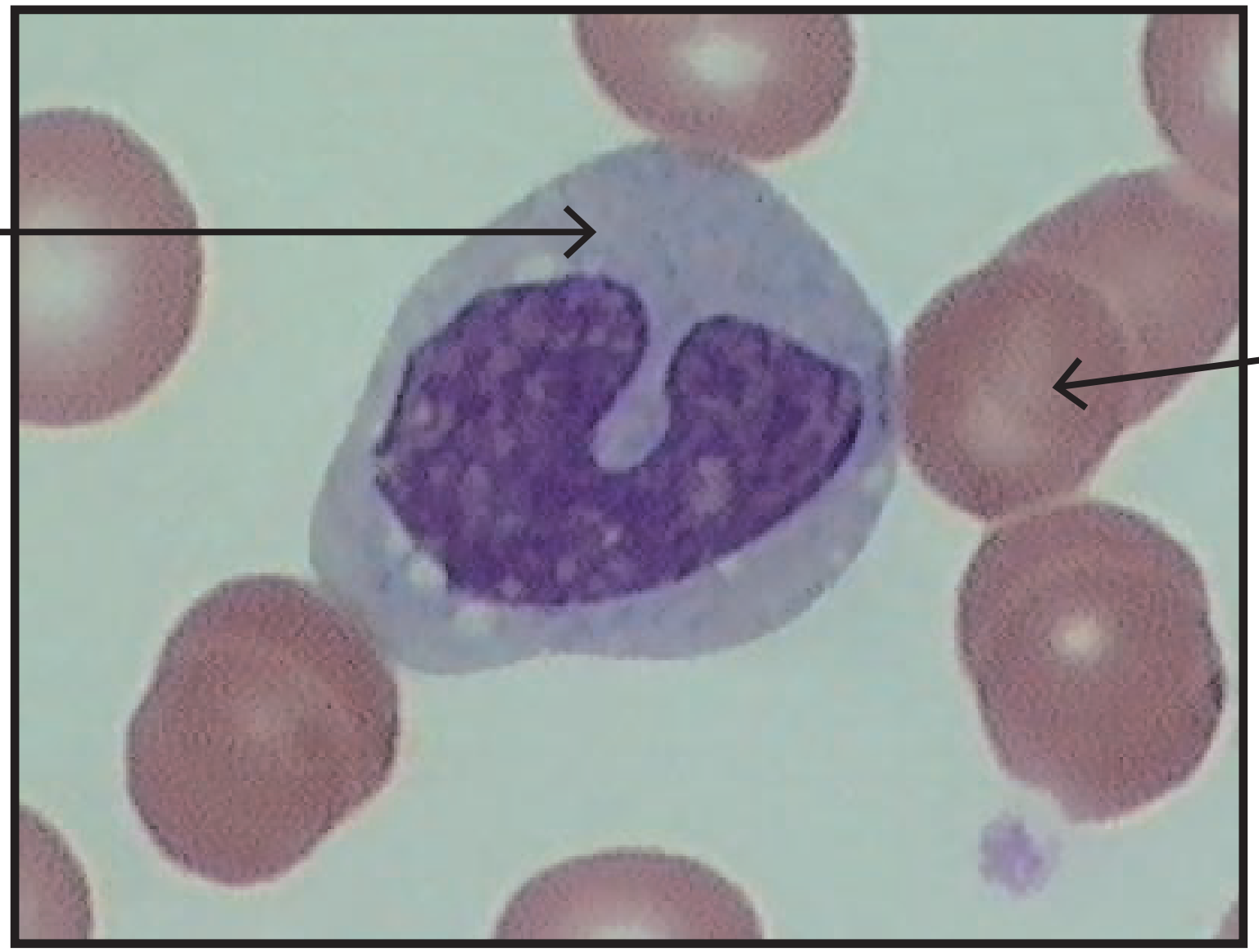


IMAGE 2.2

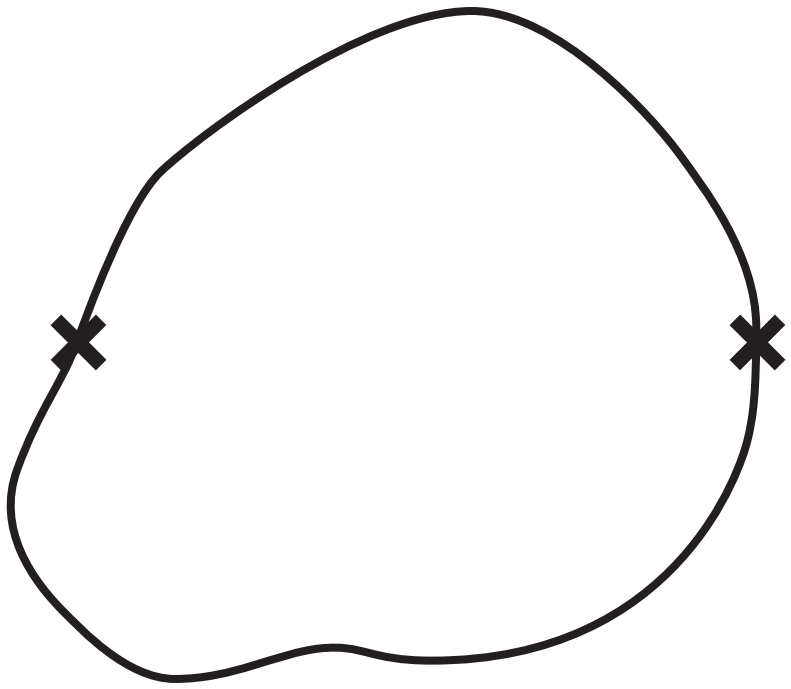
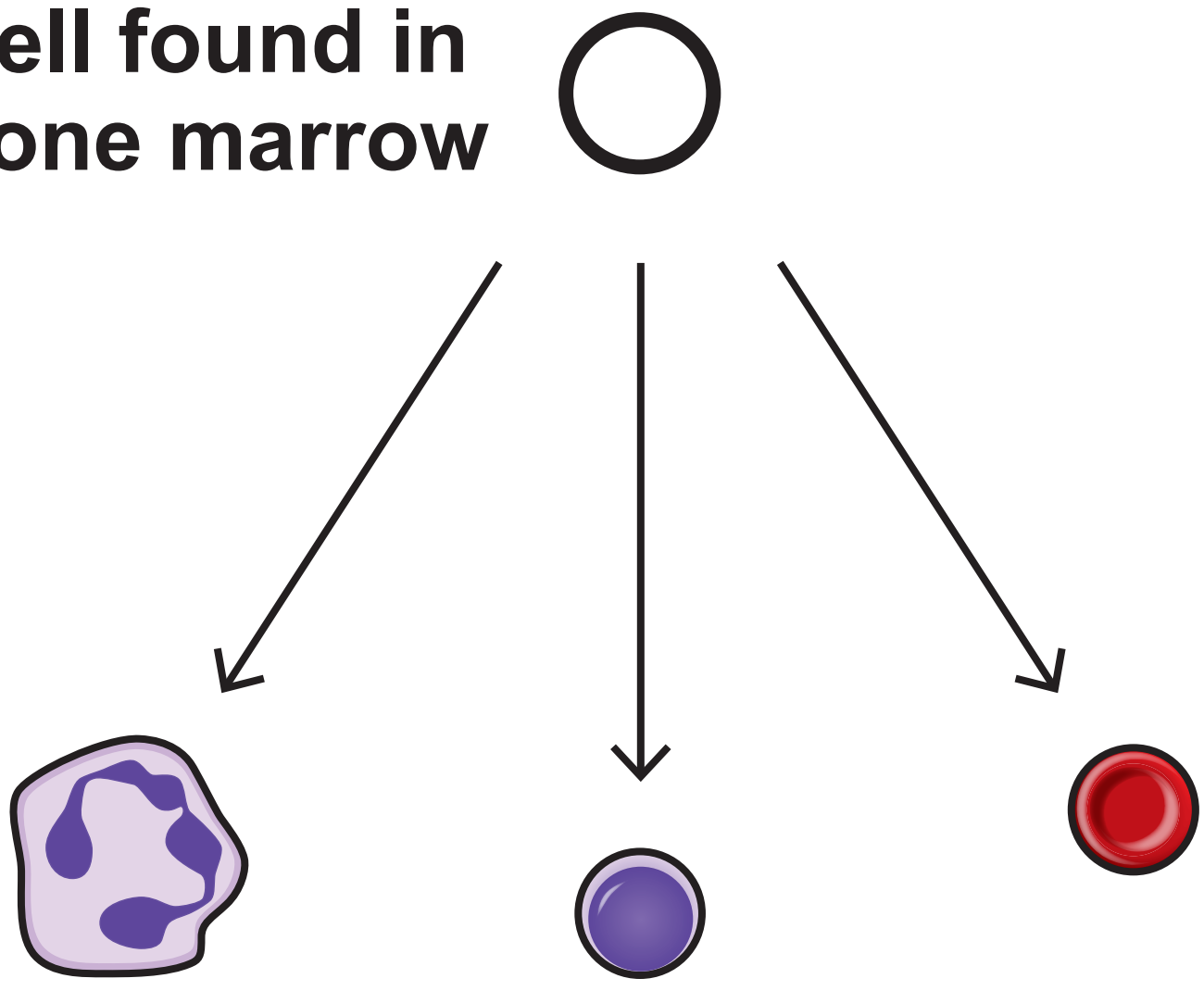


IMAGE 2.3

Cell found in bone marrow



Many types of blood cells

IMAGE 3.1

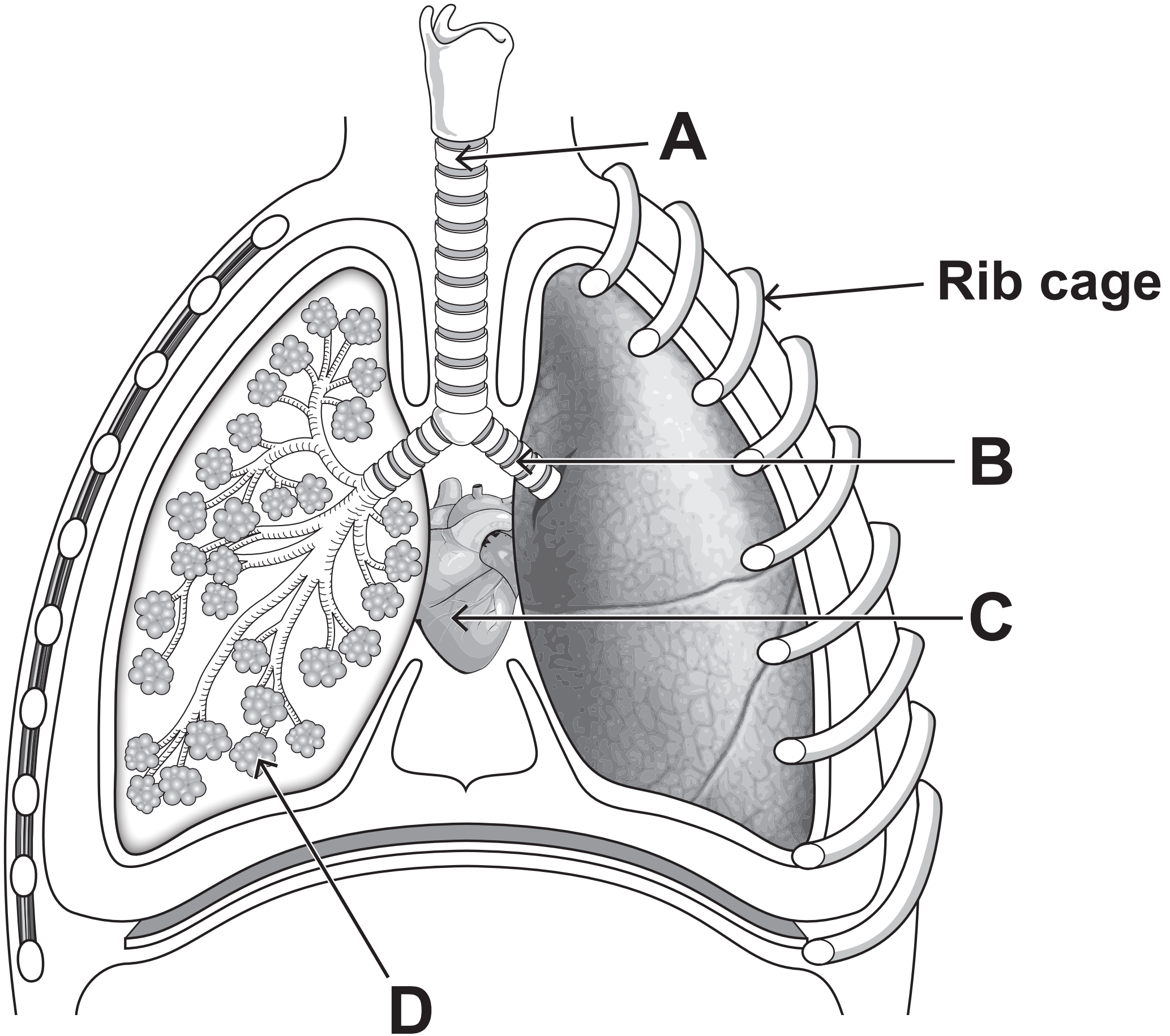


IMAGE 3.2

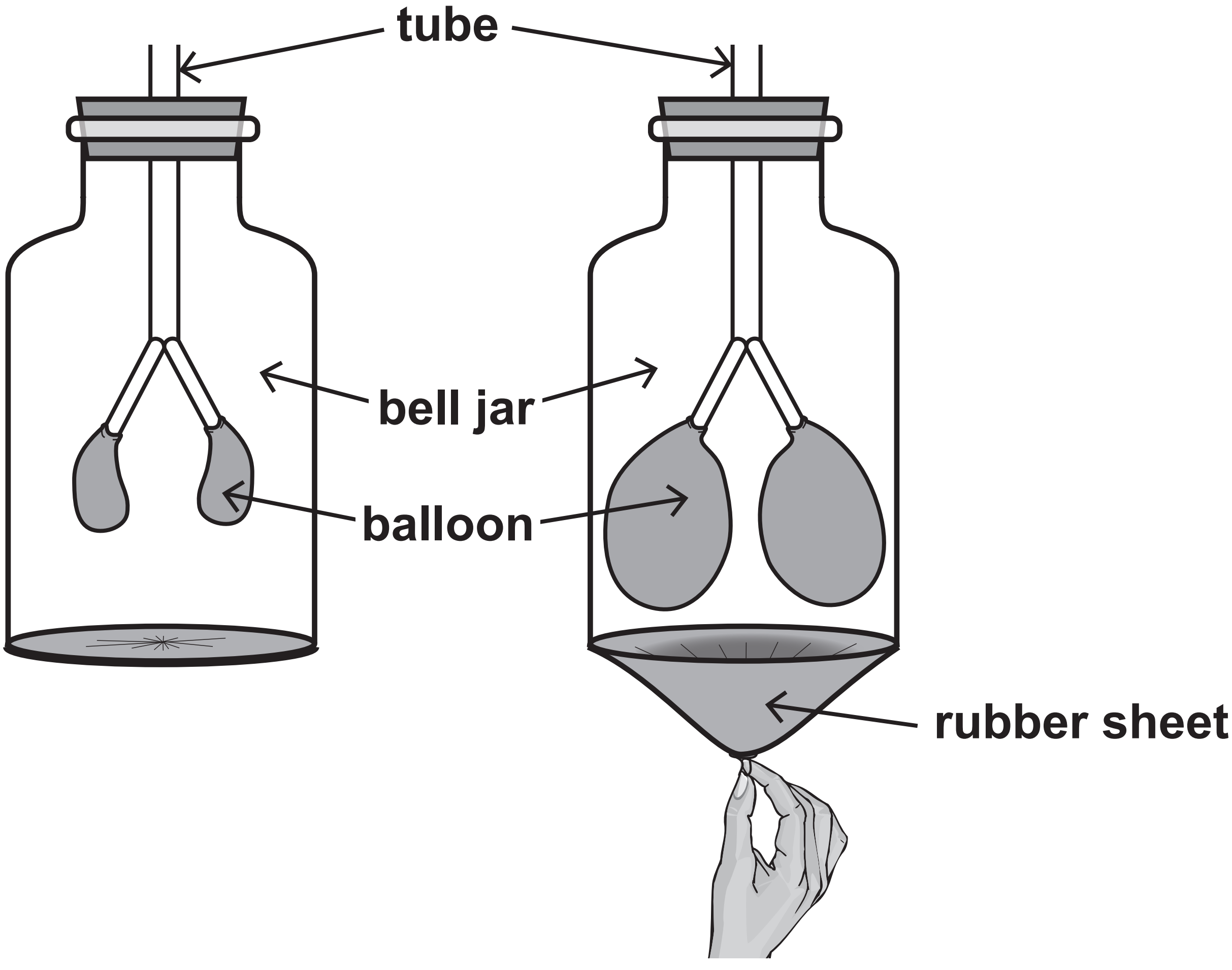


IMAGE 4.1

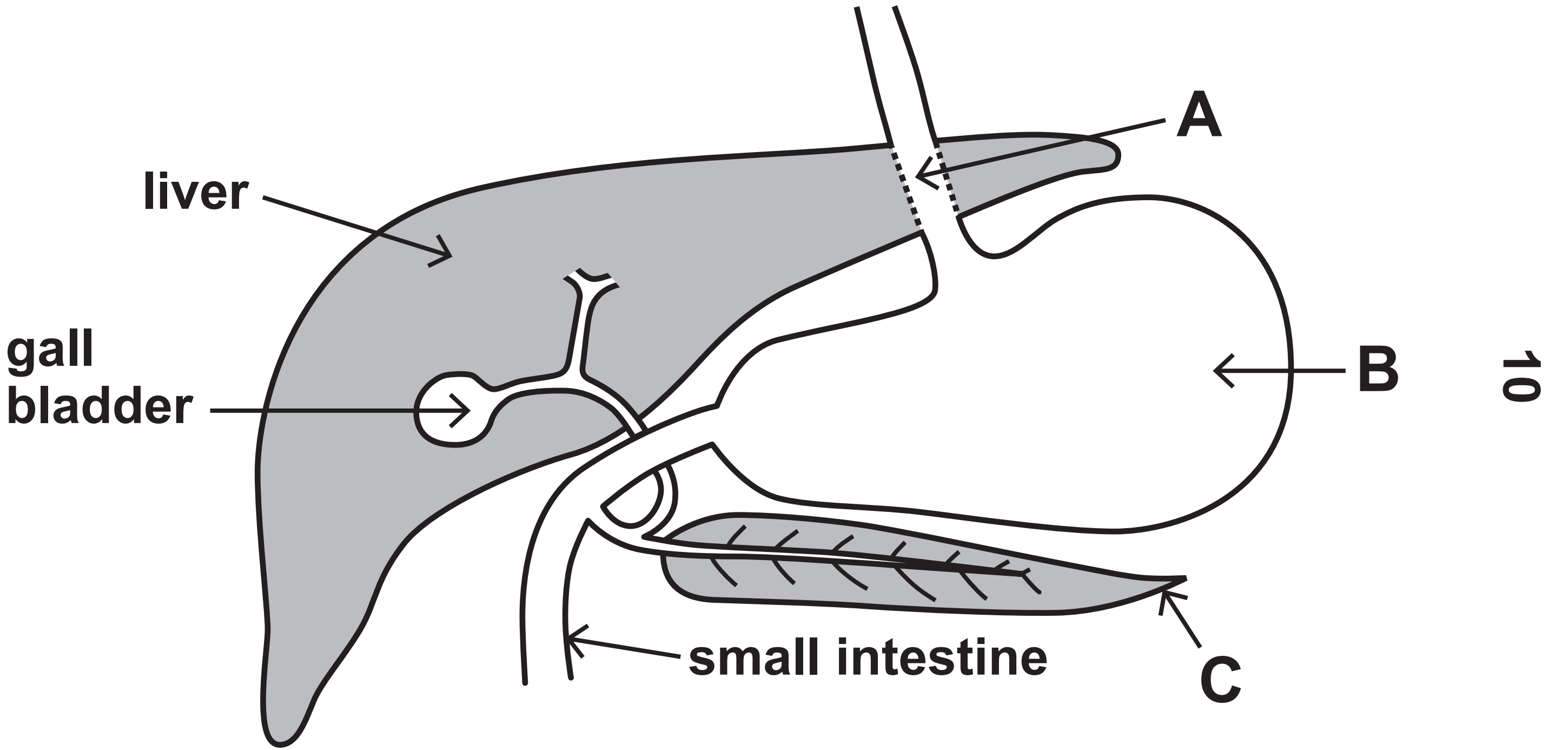


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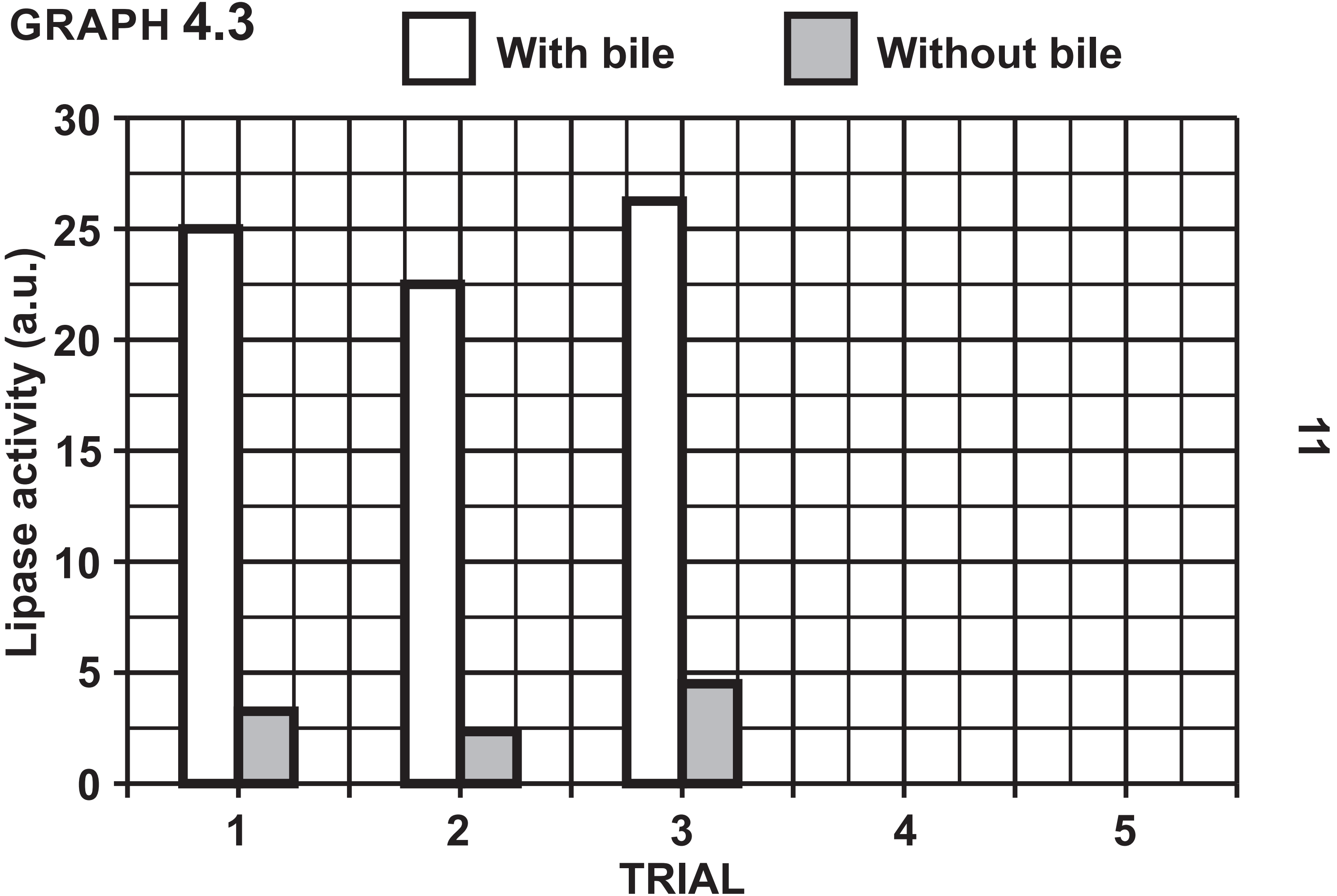
TABLE 4.2

		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 = _____ : _____		

GRAPH 4.3


With bile
Without bile
30
25
20
15
10
5
0
Lipase activity (a.u.)
1
2
3
4
5
TRIAL

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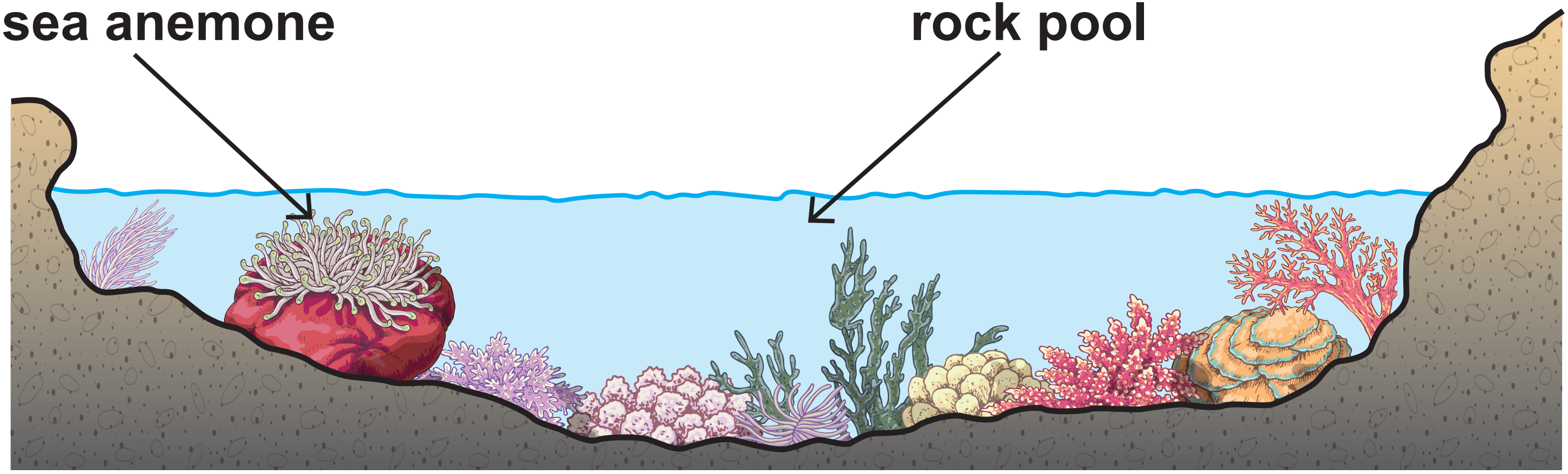
TURN OVER

IMAGE 5.1

IMAGE 5.2



FACT FILE –
CONDITIONS REQUIRED FOR SEA ANEMONES TO SURVIVE.

Oxygen concentration (mg / dm3)	Above 9.9
pH	Between 8.1 and 9.7

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TURN OVER

TABLE 5.3

Sea water temperature (°C)	Oxygen concentration (mg/dm3)
0	14.5
10	11.2
20	9.4
30	7.6
40	4.5

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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IMAGE 6.1

IMAGE 6.2

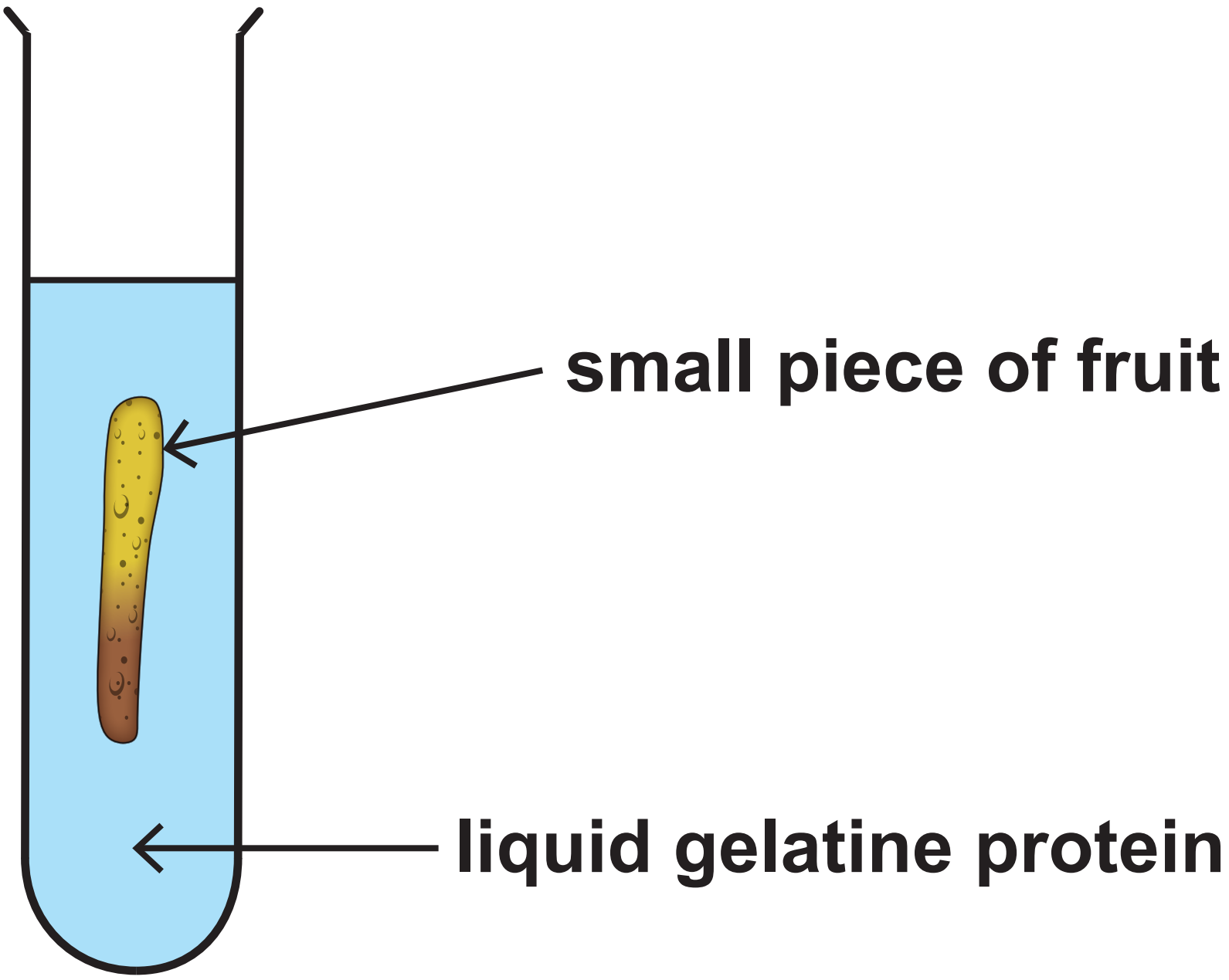

TABLE 6.3

		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

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IMAGE 7.1

Polar bear’s habitat damaged by global warming

IMAGE 7.2

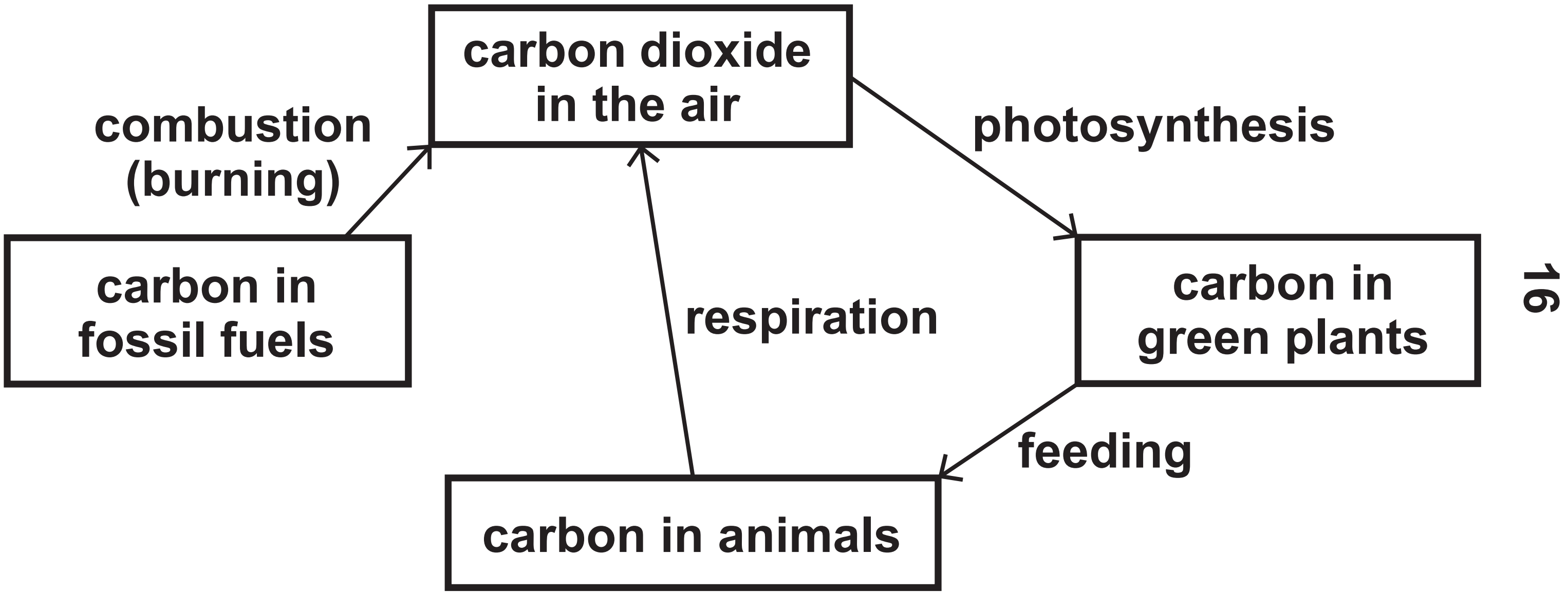
carbon dioxide in the air
combustion (burning)
photosynthesis
carbon in fossil fuels
respiration
carbon in green plants
feeding
carbon in animals

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IMAGE 8.1

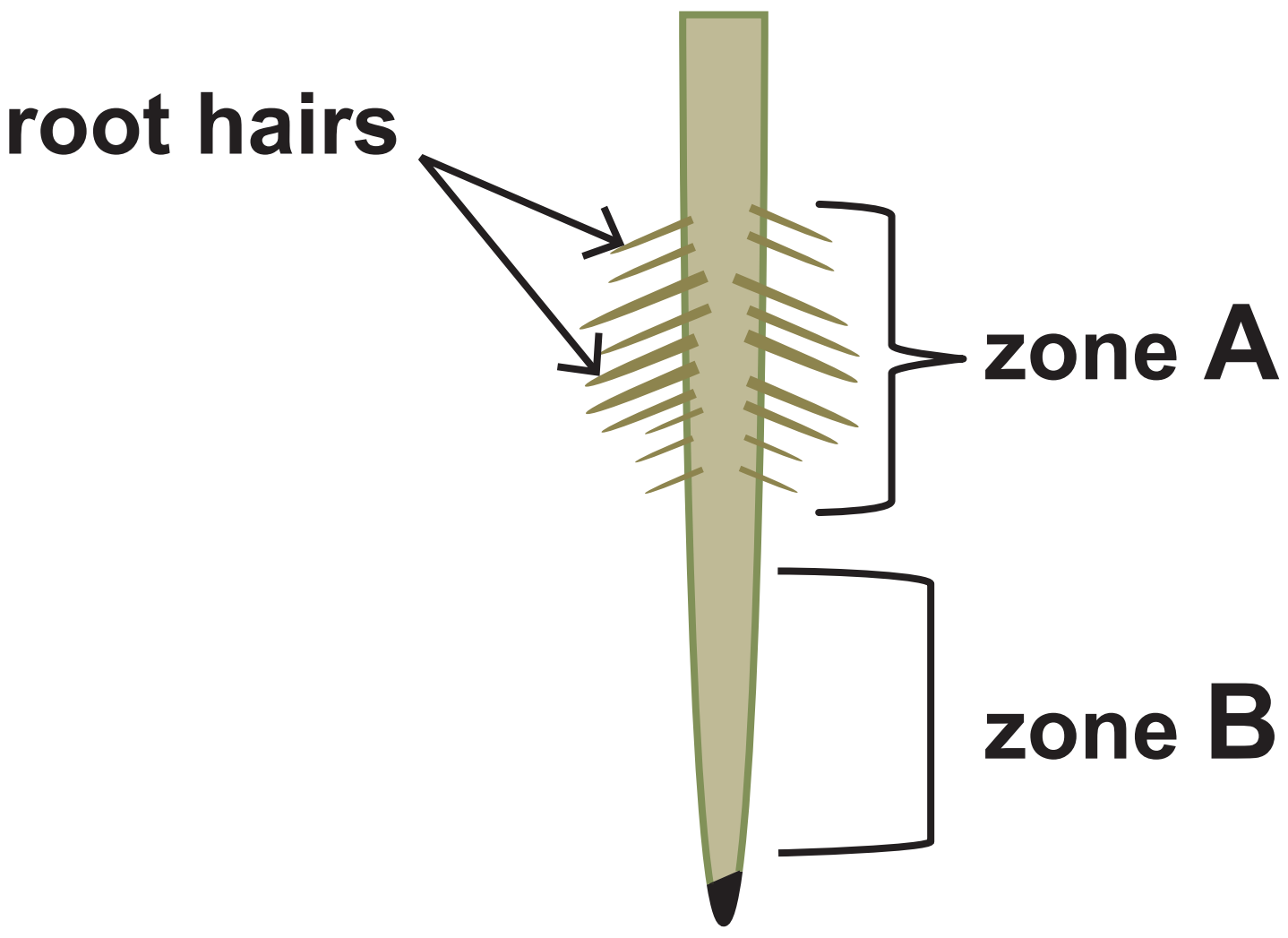


IMAGE 8.2

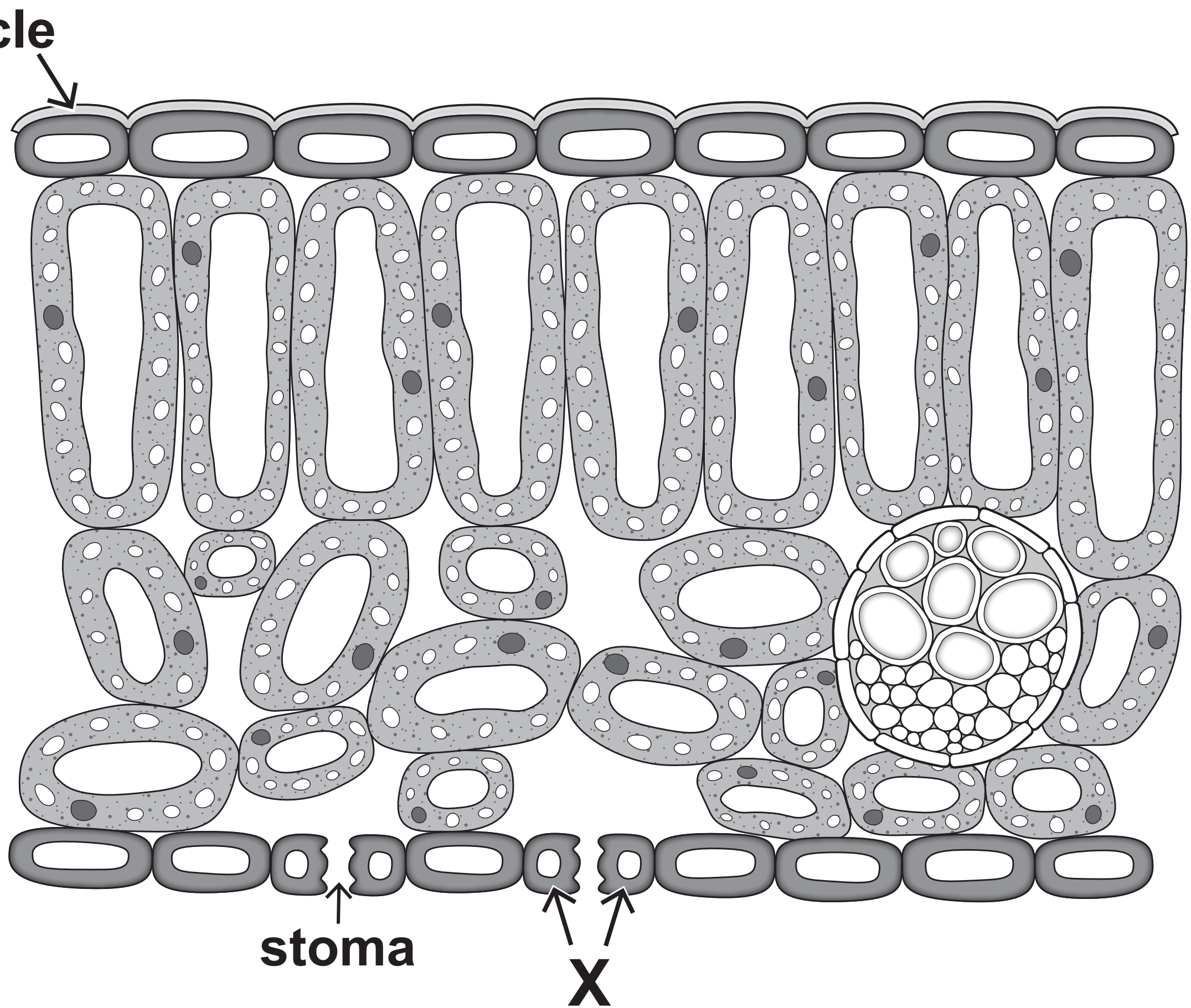
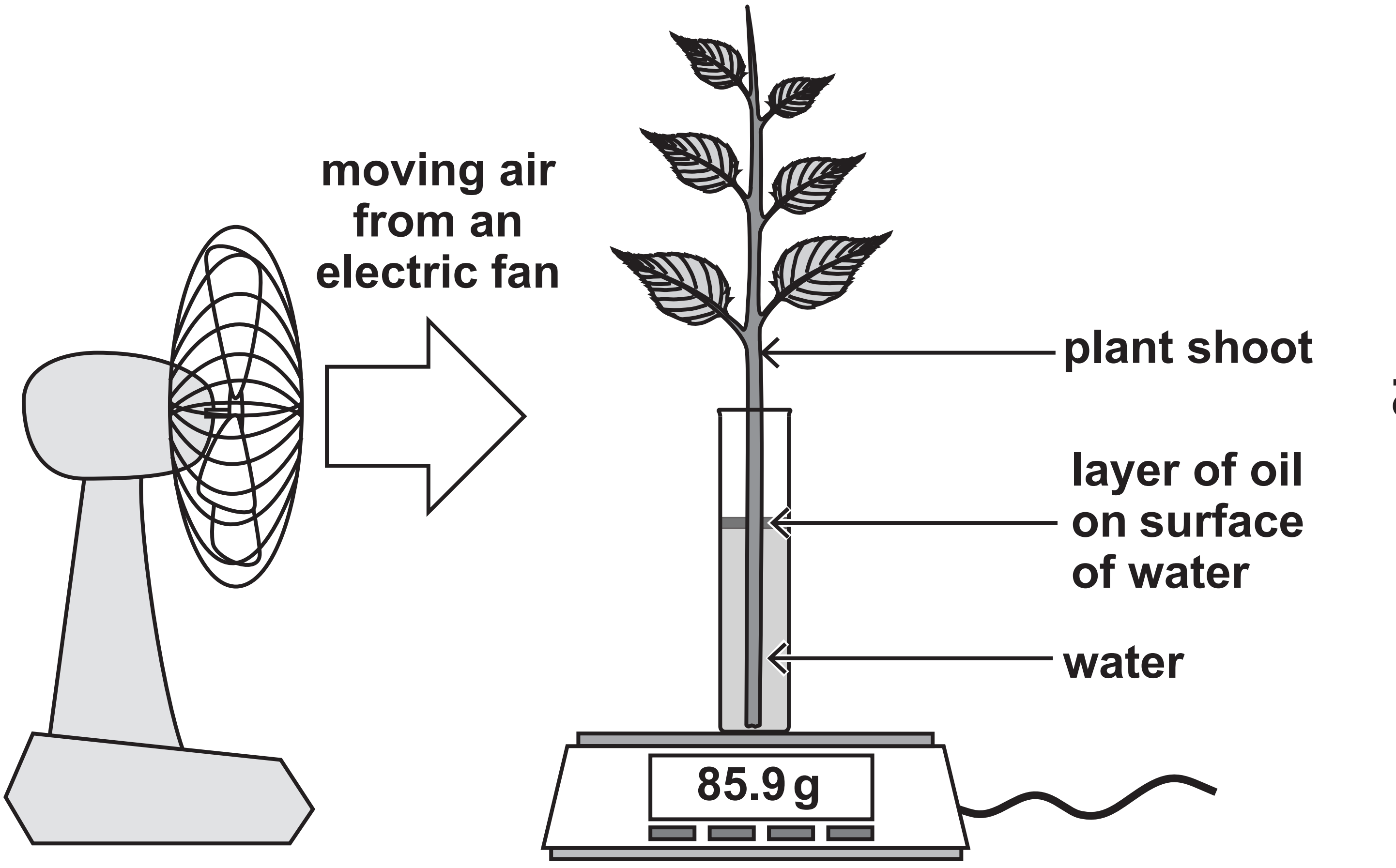


IMAGE 8.3


moving air from an electric fan
plant shoot
layer of oil on surface of water
water
85.9 g

GRAPH 8.4

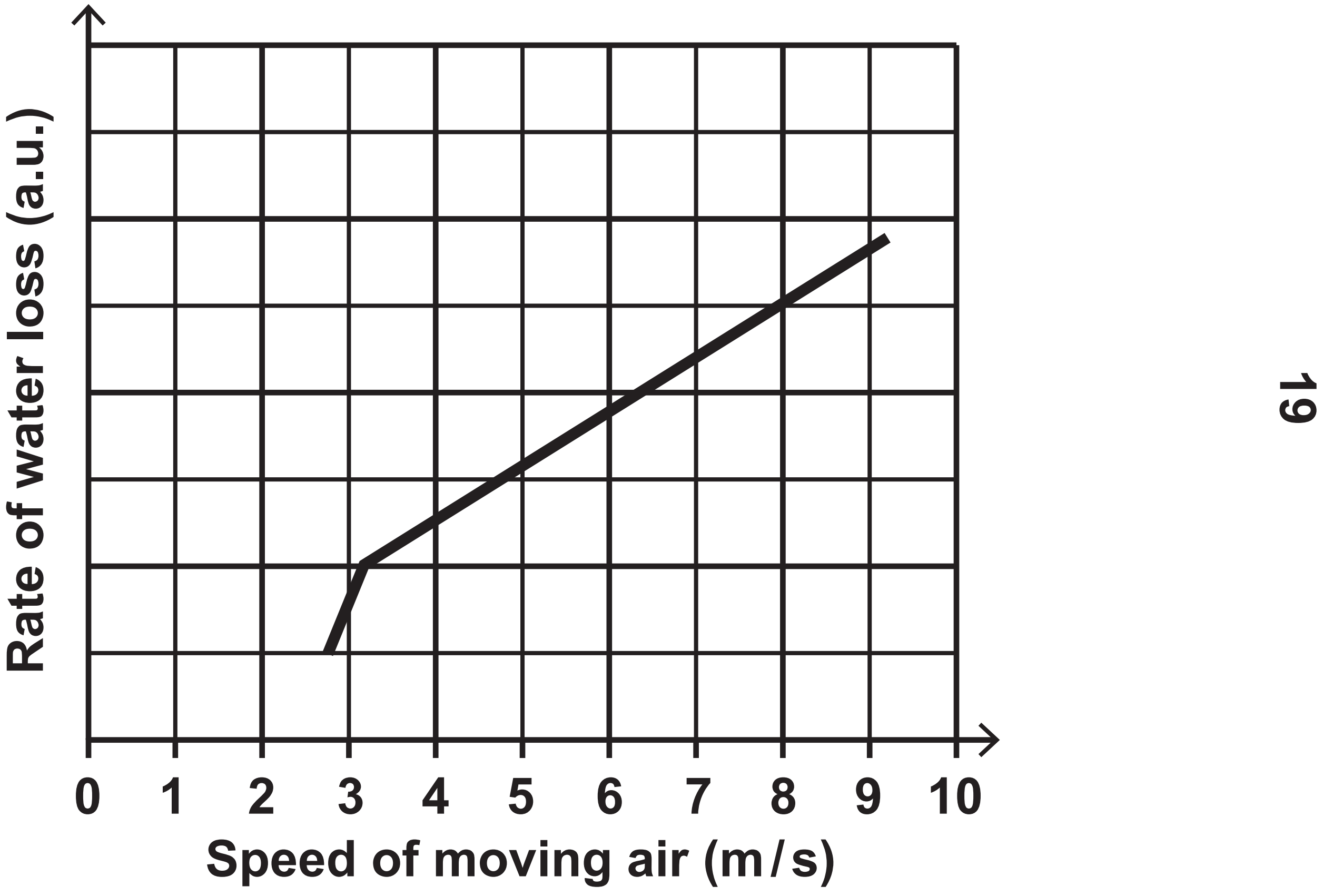


IMAGE 9.1

Free-range farm

Intensive farm

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GRAPH 9.2

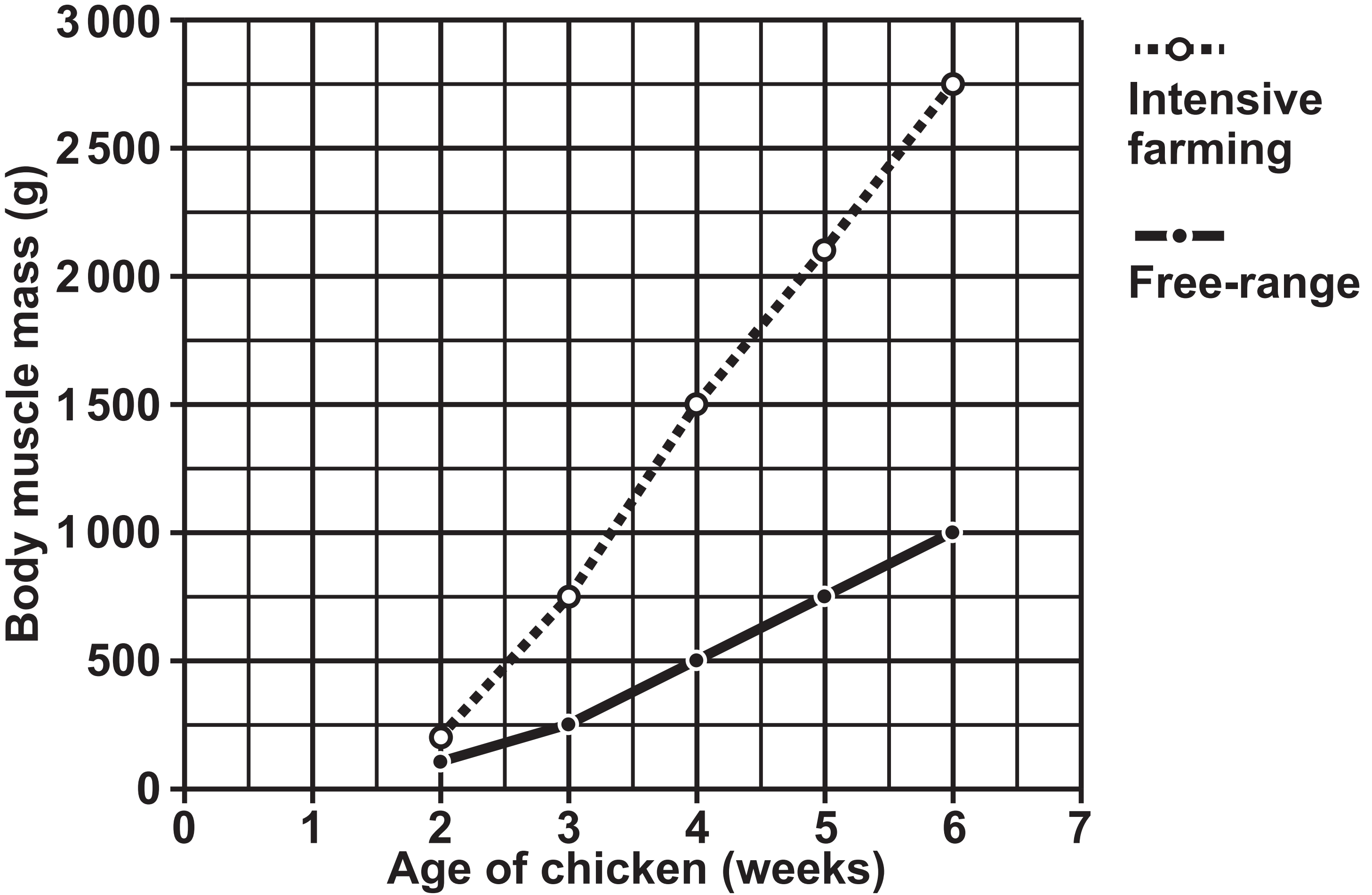
3 000
2 500
2 000
1 500
1 000
500
0
Body muscle mass (g)
0
1
2
3
4
5
6
7
Age of chicken (weeks)
Intensive farming
Free-range

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/cm3)	1.29	0.79
Presence of broken bones (%)	2.5	37
Length of leg bones (mm)	73	118