GCSE

3400U10-1

MONDAY, 10 JUNE 2024 – 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 _____

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ADDITIONAL MATERIALS

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 5 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.	**9**	
2.	**10**	
3.	**13**	
4.	**9**	
5.	**6**	
6.	**13**	
7.	**8**	
8.	**12**	
Total	**80**	

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TURN OVER

BLOOD VESSEL	FUNCTION
pulmonary vein	transports blood from the body to the heart
aorta	transports blood from the heart to the body
vena cava	transports blood from the heart to the lungs
pulmonary artery	transports blood from the lungs to the heart

Answer ALL questions.

1 IMAGE 1 in the separate diagram booklet shows a section through the heart.

(a) Complete IMAGE 1 by adding the TWO missing labels (A and B) for the chambers of the heart. [2 marks]

(b) There are four main blood vessels connected to the heart.
On the opposite page USE A RULER to DRAW LINES to match up each blood vessel with the correct function. [3 marks]

(c) There are valves in the heart.
UNDERLINE the statement below that describes the function of the valves. [1 mark]

Stop blood from clotting

Push blood through the heart

Prevent the backflow of blood

1 (d) COMPLETE THE FOLLOWING SENTENCES, using the correct words FROM THE LIST BELOW. [3 marks]

pump muscle pulmonary

carbon dioxide coronary

The heart is made of

_____ .

The function of the heart is to

_____ blood around the body.

The heart has its own blood supply provided by the

_____ arteries.

9

2 **IMAGE 2.1 in the separate diagram booklet shows a part of the respiratory system where gas exchange takes place.**

(a) **Name structures X and Y in IMAGE 2.1. CHOOSE WORDS FROM THE LIST BELOW. [2 marks]**

bronchus	**alveolus**
bronchiole	**trachea**

X _____

Y _____

2 (b)(i) **<u>UNDERLINE</u> the correct term from the brackets to complete each of the following sentences: [3 marks]**

I. **The gas that moves from the air into the bloodstream is**

(carbon dioxide / oxygen / nitrogen).

II. **The process that describes how the gas moves from the air into the bloodstream is**

(respiration / osmosis / diffusion / photosynthesis).

III. **The process that releases energy in cells is**

(respiration / osmosis / diffusion / photosynthesis).

2 (b)(ii) **Describe TWO ways that the part of the respiratory system shown in IMAGE 2.1 is adapted for gas exchange. [2 marks]**

1. _____

_____

2. _____

_____

(c) **TABLE 2.2 in the separate diagram booklet shows the percentage of gases in inspired and expired air.**

COMPLETE TABLE 2.2 by adding the missing percentages to the empty boxes from the list below: [3 marks]

0.04 16 78 21 4

10

3 TABLE 3.1 in the separate diagram booklet shows a nutritional information label from a packet of crisps.

(a)(i) COMPLETE THE MISSING VALUE on TABLE 3.1 by calculating the mass of carbohydrate per 25g bag. GIVE YOUR ANSWER TO ONE DECIMAL PLACE. [2 marks]

Space for working:

(ii) State the use of carbohydrate in the body. [1 mark]

_____

_____

(b) A 6-year-old child ate two bags of these crisps.

(i) Calculate the total mass of fat in the crisps that the child consumed. [1 mark]

Total mass of fat = _____ g

3 (b)(ii)

That day, the child consumed more than the guideline daily amount of fat.
State TWO health problems of regularly consuming too much fat. [2 marks]

1. _____

_____

2. _____

_____

3 (c) **A student used the apparatus shown in IMAGE 3.2 in the separate diagram booklet to measure the energy content of the crisps. She measured the temperature of the water before and after burning the crisp.**

(i) **State TWO safety precautions the student should have taken when carrying out the investigation. [2 marks]**

1. _____

_____

_____

2. _____

_____

_____

(ii) **State the piece of apparatus missing from IMAGE 3.2 that is needed for the student to be able to measure temperature. [1 mark]**

_____

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$$\text{Energy released from food per gram (J)} = \frac{\text{mass of water (g)} \times \text{temperature rise (°C)} \times 4.2}{\text{mass of food sample (g)}}$$

3 (d) **The temperature of water was 20 °C before burning the crisp and 41 °C after burning the crisp.**

(i) **Calculate the temperature rise of the water. [1 mark]**

Temperature rise = _____ °C

(ii) **The crisp weighed 0.5 g and the mass of water she used was 20 g.**
Use the equation on the opposite page and your answer from (d)(i) to calculate the energy (J) per gram of the crisps. [2 marks]

Space for working:

Energy released from food per gram = _____ J

3 (d)(iii)

The energy value that the student calculated was much lower than the energy value stated on the packet.
Suggest the reason for this. [1 mark]

_____

_____

_____

13

4 **IMAGE 4.1 in the separate diagram booklet shows the area of Minamata in Japan, which has many fishing villages on the coast.**

- **In the mid-1950s, the villagers in Minamata noticed their cats began to lose their balance and some died.**
- **Soon after, the villagers reported having difficulty hearing, seeing and walking. Some of the villagers died following these symptoms.**
- **Fish caught in Minamata bay were a large part of the diet of cats and humans.**
- **Scientists suspected that the fish being eaten had been poisoned.**
- **By 1959, scientists discovered that the illness was caused by high levels of mercury found in the bodies of villagers.**
- **A large factory in Minamata was dumping mercury into the sea.**
- **Mercury is a heavy metal which accumulates in living tissues.**
- **Mercury is taken up by algae in the sea and then passed along the food chain.**

4 (a)(i) Use the information on page 13 to complete TABLE 4.2 in the separate diagram booklet by writing True or False next to each statement. [3 marks]

(ii) Use the information on page 13 to explain how mercury entered the food chain in Minamata. [2 marks]

4 (b)(i)

IMAGE 4.3 in the separate diagram booklet shows a food chain and the concentration of mercury found inside the tissues of each organism.

Mercury is twice as concentrated in the small fish than in the algae.

Calculate how many times more concentrated the mercury is in the large fish than in the small fish. [2 marks]

Answer = _____ times more concentrated

(ii) Explain why the cats were dying from mercury poisoning. [2 marks]

_____

_____

_____

_____

_____

_____

9

5 **IMAGE 5 in the separate diagram booklet shows the carbon cycle.**

Use IMAGE 5 to DESCRIBE THE CARBON CYCLE.

Your answer should include:

- **the names of the processes represented by the arrows W, X, Y and Z**
- **the names of TWO types of decomposers.**

[6 marks QER]

continue answer on next page

6

6 **Protease and lipase are enzymes that are added to biological washing powders to help break down stains on clothing.**

(a) **Complete the sentences below by stating the TWO types of molecules that the enzymes in the biological washing powders help to break down. [2 marks]**

Protease breaks down _____

Lipase breaks down _____

6 (b) **Students designed an experiment to test the effect of temperature on the activity of these enzymes in biological washing powder. They used the following method:**

- **Stain five pieces of fabric with egg.**
- **Set up five beakers of water at 20 °C, 30 °C, 40 °C, 50 °C and 60 °C.**
- **Add biological washing powder to each beaker.**
- **Add a piece of stained fabric to each beaker and leave for 5 minutes.**
- **Remove the samples of fabric and compare the stain remaining.**

The method and results of the experiment are shown in IMAGE 6.1 in the separate diagram booklet.

continues on next page

6 (b)(i)

Suggest the best temperature to wash clothes using this biological washing powder. Use the results in IMAGE 6.1 to give the reason for your answer. [2 marks]

Temperature _____ °C

Reason

_____

_____

_____

6 (b)(ii) **Use your knowledge of enzymes to explain the result at 60 °C. [3 marks]**

6 (c) **The students repeated the experiment using the same method but using non-biological washing powder which does not contain enzymes. Their results are shown in IMAGE 6.2 in the separate diagram booklet.**

(i) **Describe the results with the non-biological washing powder. [1 mark]**

(ii) **State why they repeated the experiment using non-biological washing powder. [1 mark]**

6 (c)(iii) **Use the results of both experiments to explain the advantage to the environment of adding enzymes to washing powder. [2 marks]**

(d) **Suggest TWO variables which should have been controlled in this method. [2 marks]**

1. _____

2. _____

13

7 **IMAGE 7 in the separate diagram booklet shows a pyramid of numbers in African grassland.**

(a)(i) **State the producer in this pyramid. [1 mark]**

(ii) **<u>UNDERLINE</u> TWO terms from the list below that can be used to describe the zebra. [1 mark]**

Producer

Secondary consumer

Carnivore

Herbivore

Primary consumer

(iii) **Write the FOOD CHAIN that is represented by the pyramid of numbers in IMAGE 7. [1 mark]**

---

7 (a)(iv) State the source of energy for a food chain. [1 mark]

_____

(v) State ONE reason why not all of the energy is passed from one stage of the food chain to the next. [1 mark]

_____

_____

_____

(vi) Suggest why this pyramid of numbers is not pyramid-shaped. [1 mark]

_____

_____

_____

7 (a)(vii)

In the space below DRAW A LABELLED PYRAMID OF BIOMASS for the organisms shown in IMAGE 7. Your pyramid of biomass does not need to be to scale. [2 marks]

8

8 **A tomato fertiliser can be used when growing tomato plants.**

(a) **State THREE nutrients that a tomato fertiliser may contain. [3 marks]**

1. _____

2. _____

3. _____

(b) **Tony grows tomato plants in his greenhouse. He designed an investigation to see if using fertiliser made a difference to the mass of his tomatoes. He grew one tomato plant adding the fertiliser once a week and left one plant without fertiliser. After three months he measured the mass of 10 tomatoes from each plant.**

Identify the independent and dependent variables for the investigation. [2 marks]

Independent variable

_____

Dependent variable

_____

8 (c) **TABLE 8 in the separate diagram booklet shows the results for the experiment.**

(i) **Tony calculated the mean mass of tomatoes grown WITH FERTILISER without including an anomalous result.**

CIRCLE THE ANOMALOUS RESULT IN TABLE 8. [1 mark]

(ii) **Calculate the mean mass of tomatoes grown WITHOUT FERTILISER. WRITE YOUR ANSWER IN TABLE 8 TO THE NEAREST WHOLE NUMBER. [2 marks]**

Space for working:

(iii) **State the conclusion that Tony can make from the results in TABLE 8. [1 mark]**

_____

_____

_____

8 (d)(i) Tony ensured that this investigation was a fair test.
State ONE variable that Tony would have controlled. [1 mark]

_____

(ii) Each tomato plant produced many tomatoes, from which Tony chose ten.

Suggest why this step in Tony's method could have caused inaccuracies in his results, and what he could have done to improve the investigation. [2 marks]

Reason for inaccuracies

_____

_____

_____

Suggestion for improvement

_____

_____

_____

12

END OF PAPER

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

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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 _____

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IMAGE 1

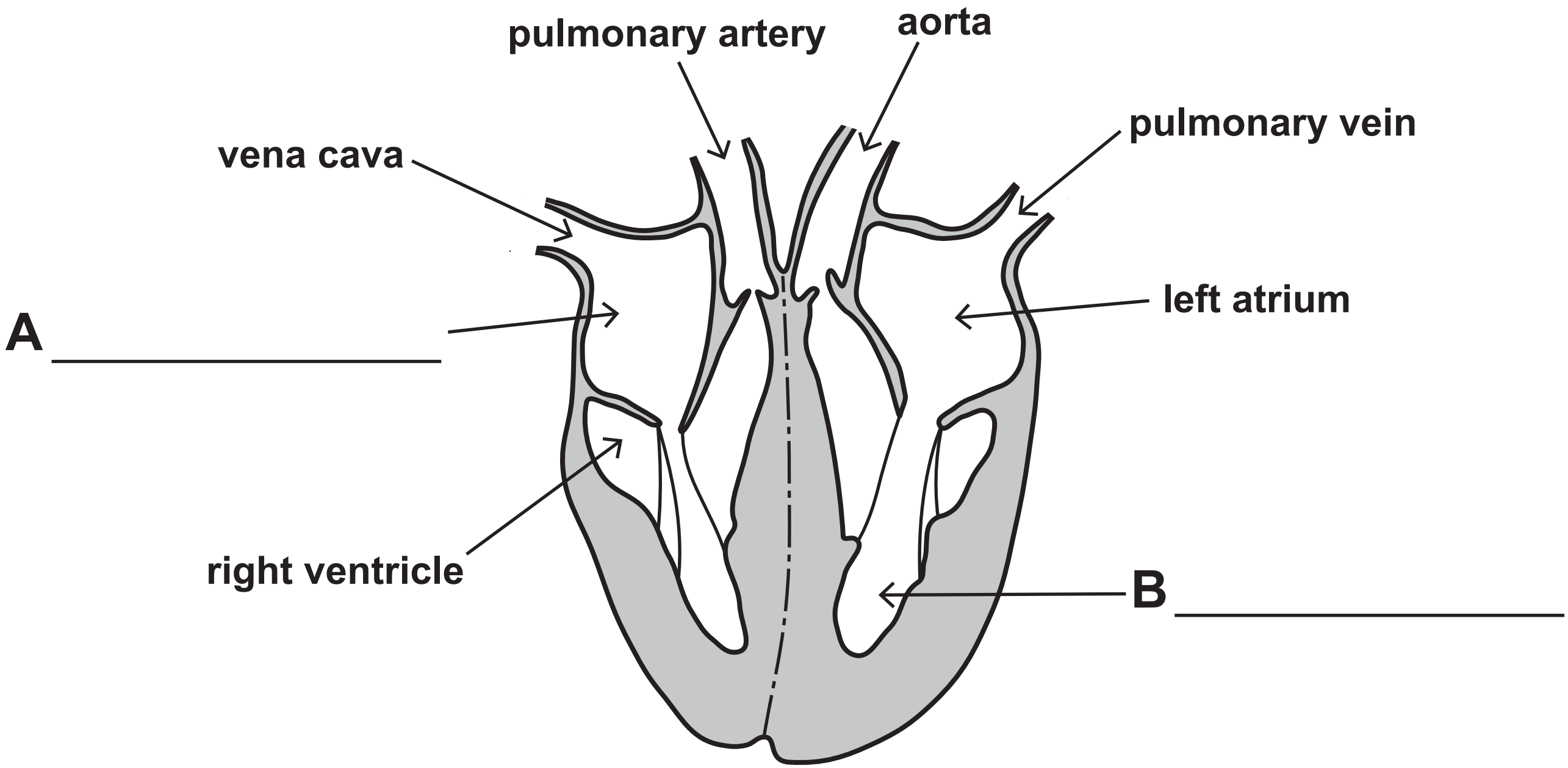

pulmonary artery
aorta
vena cava
pulmonary vein
A
left atrium
right ventricle
B

IMAGE 2.1

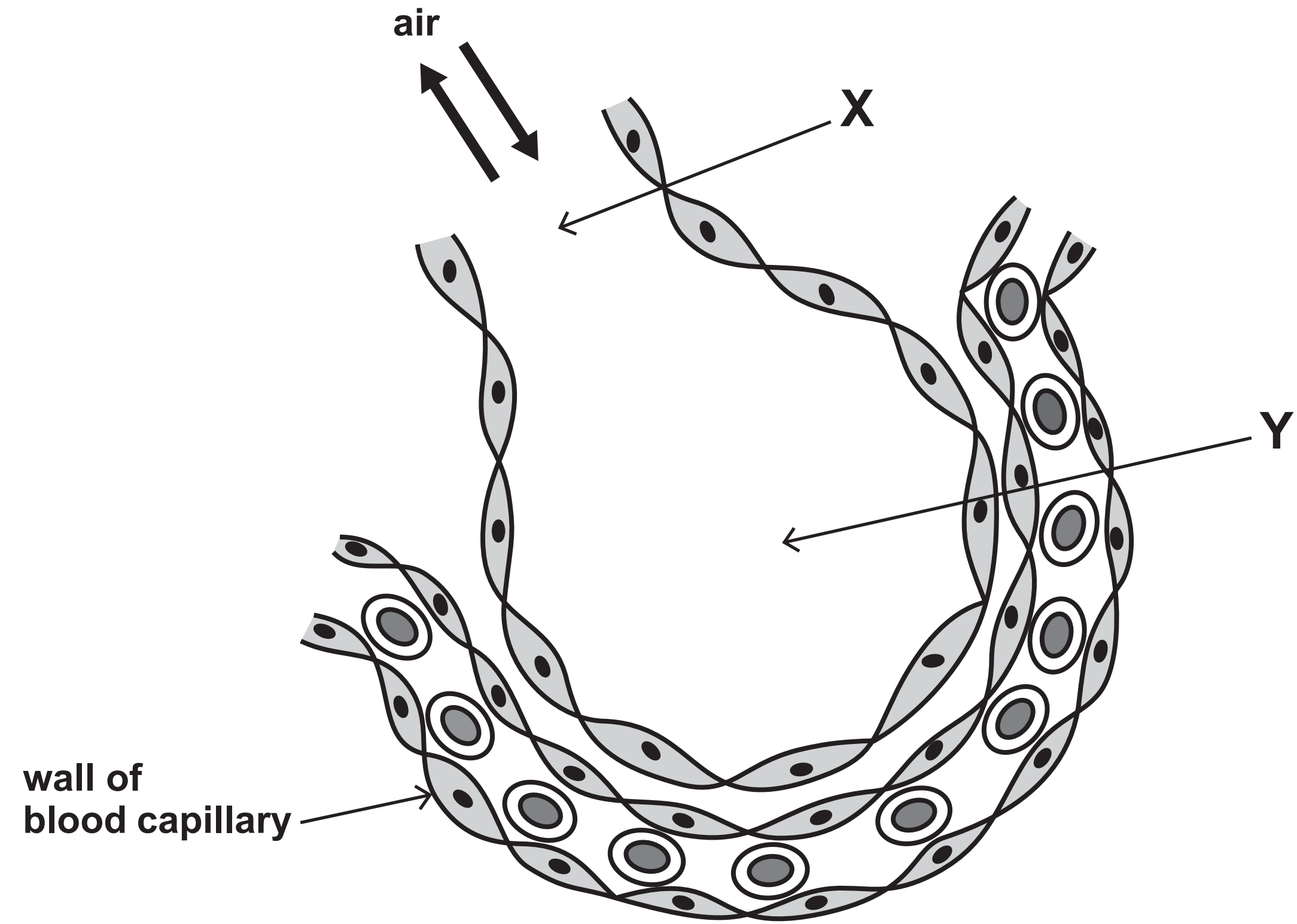


TABLE 2.2

Gas	Inspired air (%)	Expired air (%)
Nitrogen	78	
Oxygen	21	
Carbon dioxide		4

TABLE 3.1

TYPICAL NUTRITIONAL VALUES		
	PER 25g BAG	PER 100g
ENERGY	550 kJ	2200 kJ
PROTEIN	1.6 g	6.5 g
CARBOHYDRATE	_____ g	49.0 g
FAT	8.5 g	34.0 g
FIBRE	1.0 g	4.0 g

IMAGE 3.2

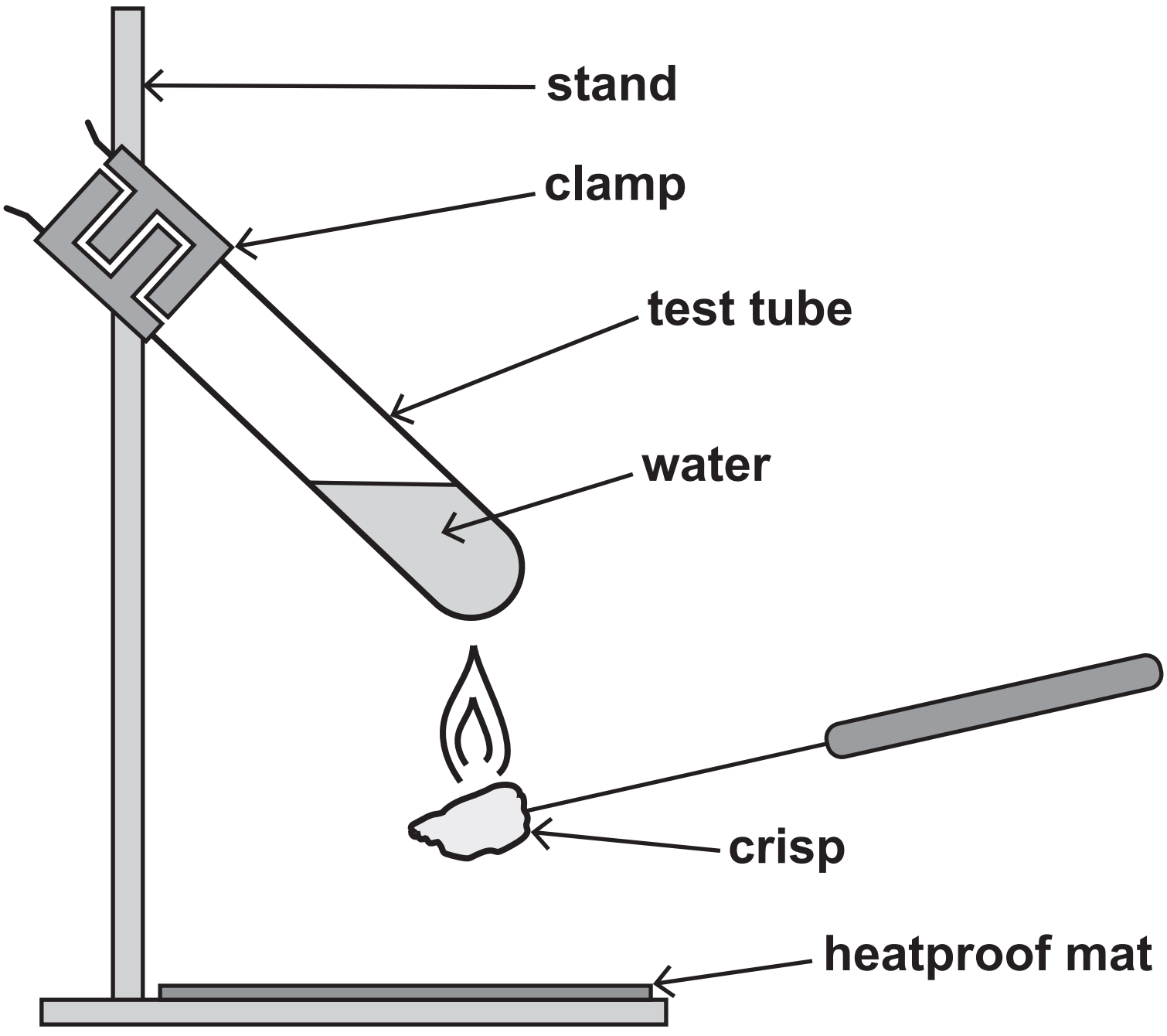


IMAGE 4.1

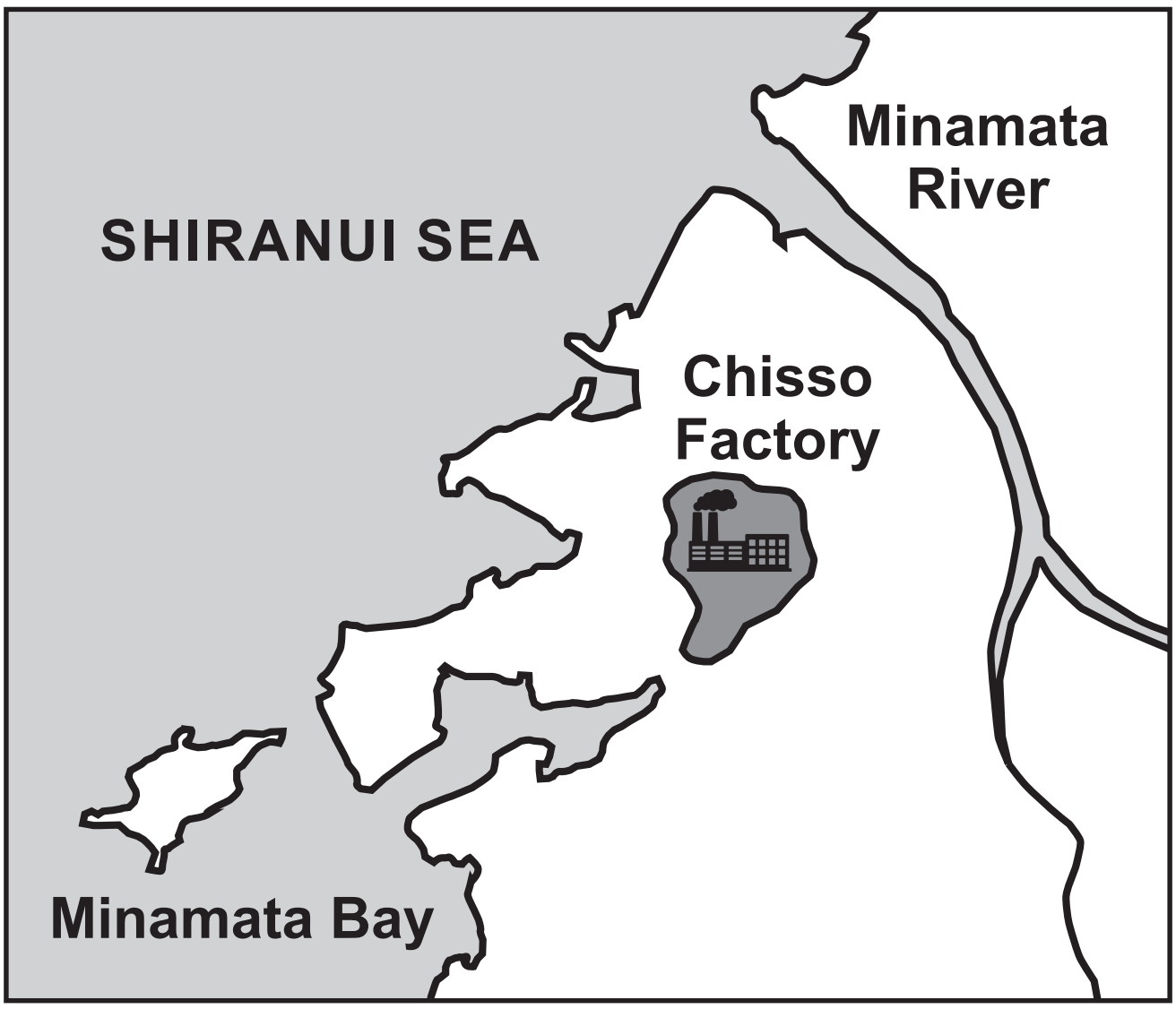


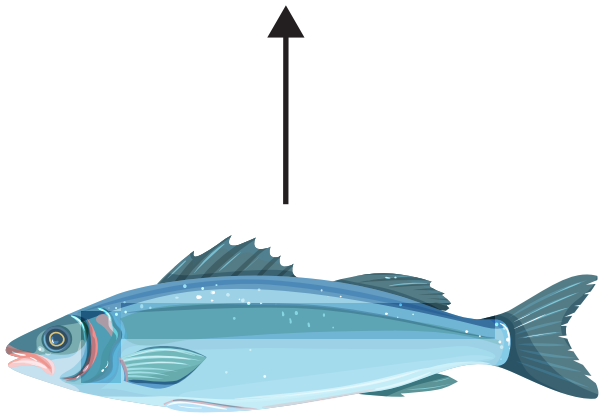
TABLE 4.2

Statement	True or False
The fish that were caught died of mercury poisoning.	_____
Symptoms of the illness included difficulty walking.	_____
Humans and cats had a similar diet.	_____
Cats and humans were dying because of air pollution.	_____

IMAGE 4.3

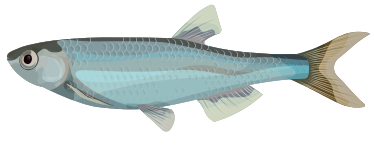
ppb = parts per billion

cat
15 000 ppb



large fish
1200 ppb

small fish
100 ppb



algae
50 ppb

DIAGRAM NOT DRAWN TO SCALE

IMAGE 5

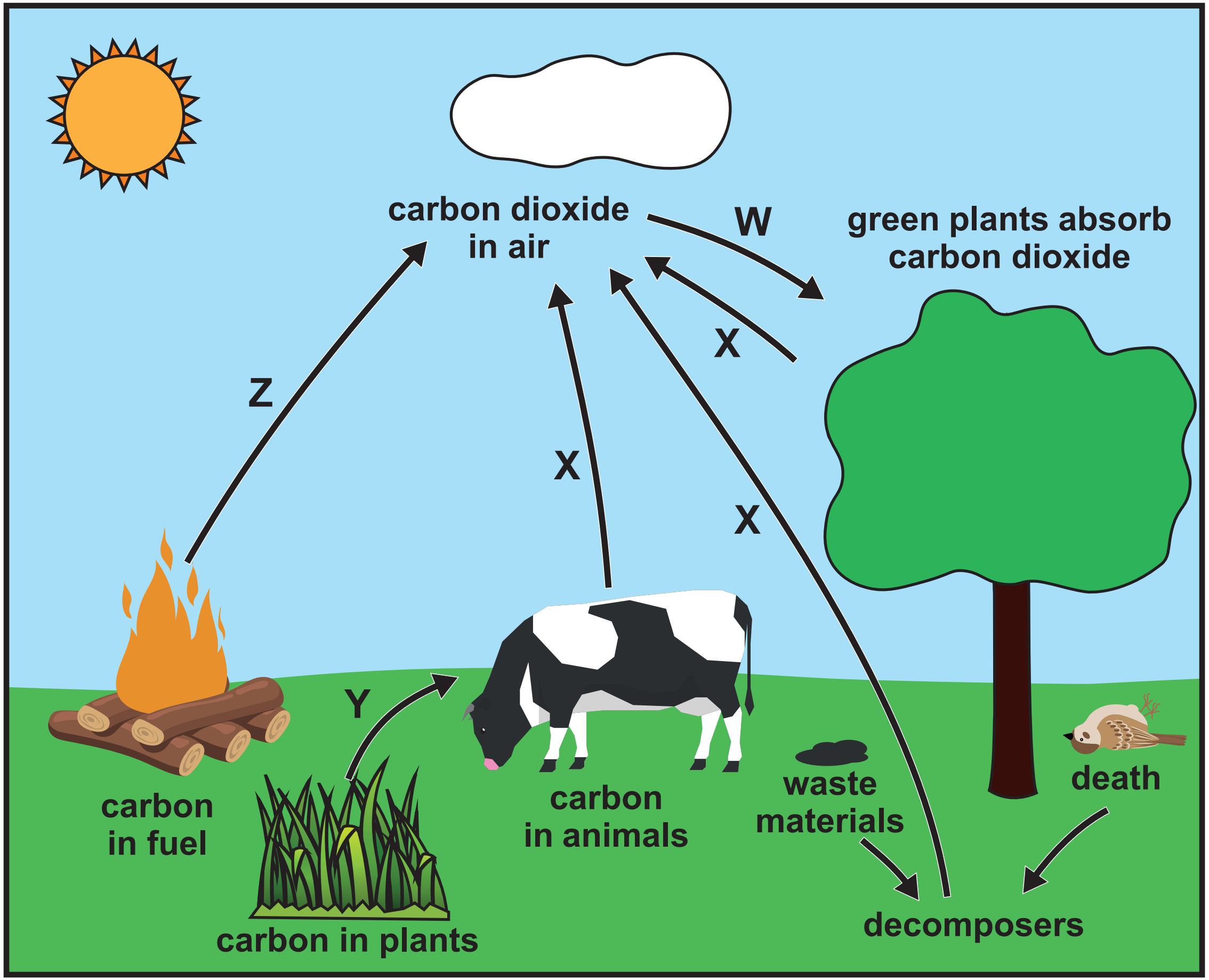

carbon dioxide
in air
W
green plants absorb
carbon dioxide
X
Z
X
X
Y
carbon
in fuel
carbon in plants
carbon
in animals
waste
materials
death
decomposers

IMAGE 6.1

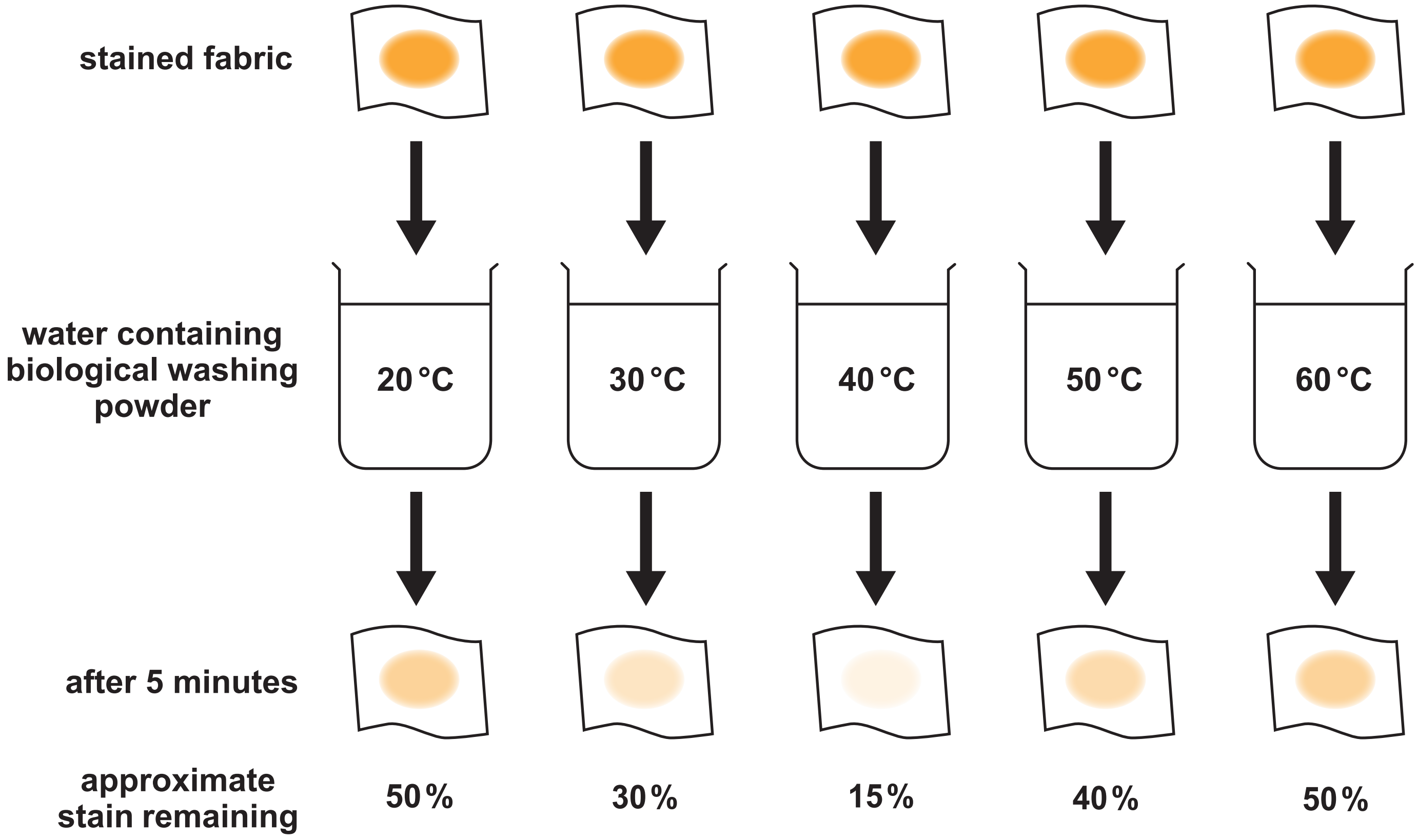

stained fabric
water containing biological washing powder
20 °C
30 °C
40 °C
50 °C
60 °C
after 5 minutes
approximate stain remaining
50 %
30 %
15 %
40 %
50 %

IMAGE 6.2

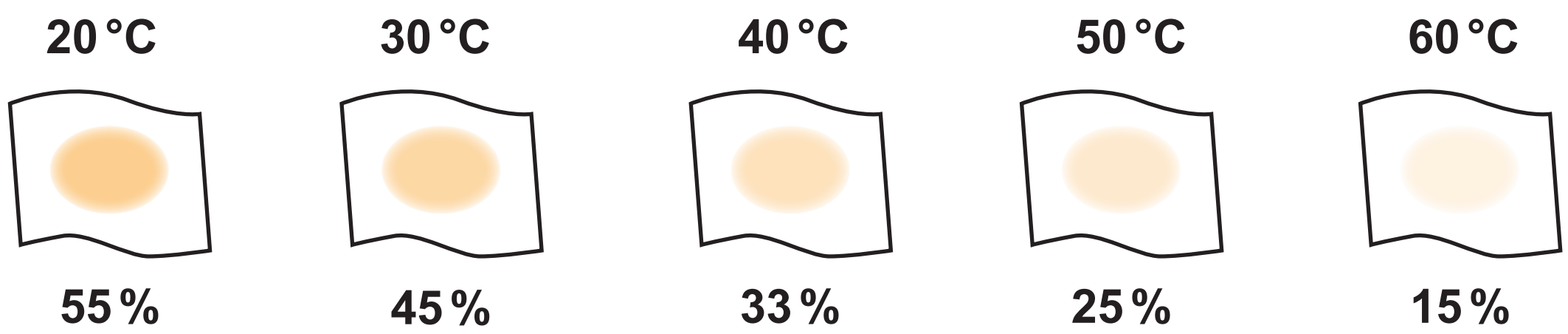


IMAGE 7

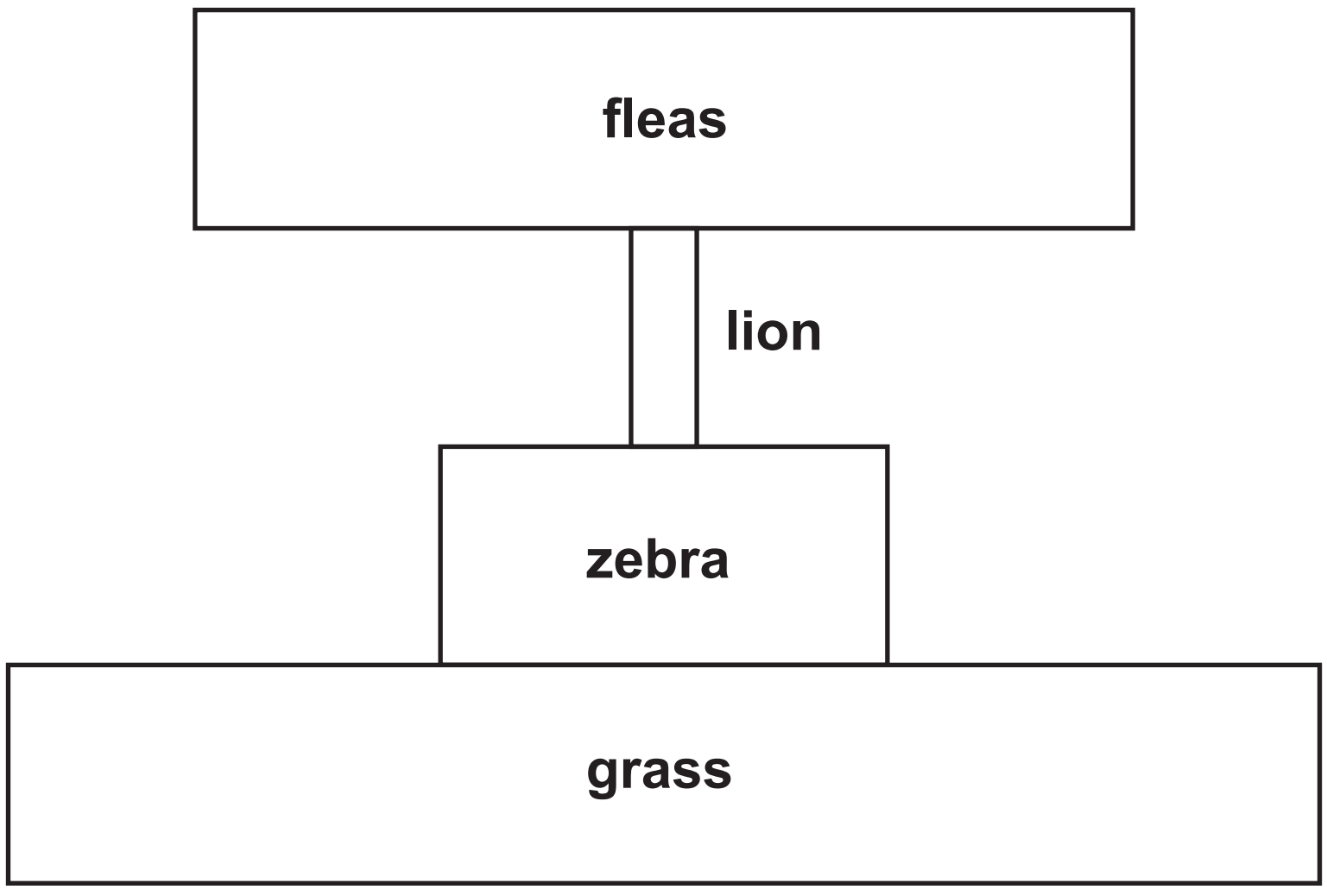


TABLE 8

Treatment of tomato plants	Mass of each tomato (g)										Mean mass of tomatoes (g)
	1	2	3	4	5	6	7	8	9	10	
With fertiliser	36	33	34	46	37	32	33	34	35	37	35
Without fertiliser	28	30	29	32	30	31	27	28	32	29	_____