Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3400U10-1

S24-3400U10-1

MONDAY, 10 JUNE 2024 – 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.	**9**	
2.	**10**	
3.	**13**	
4.	**9**	
5.	**6**	
6.	**13**	
7.	**8**	
8.	**12**	
Total	**80**	

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ADDITIONAL MATERIALS

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(s) 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.

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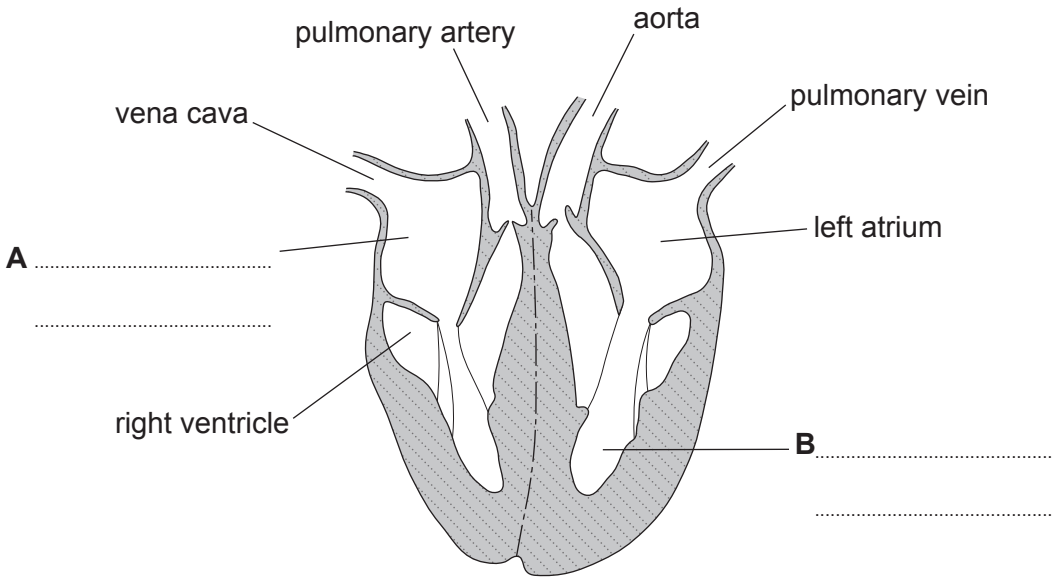
Answer **all** questions.

1. **Image 1** shows a section through the heart.

Image 1



(a) Complete **Image 1** by adding the **two** missing labels (**A** and **B**) for the chambers of the heart. [2]

(b) There are four main blood vessels connected to the heart.
Use a ruler to **draw lines** to match up each blood vessel with the correct function. [3]

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

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

Stop blood from clotting

Push blood through the heart

Prevent the backflow of blood

(d) **Complete the following sentences**, using the correct words **from the list below**. [3]

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.

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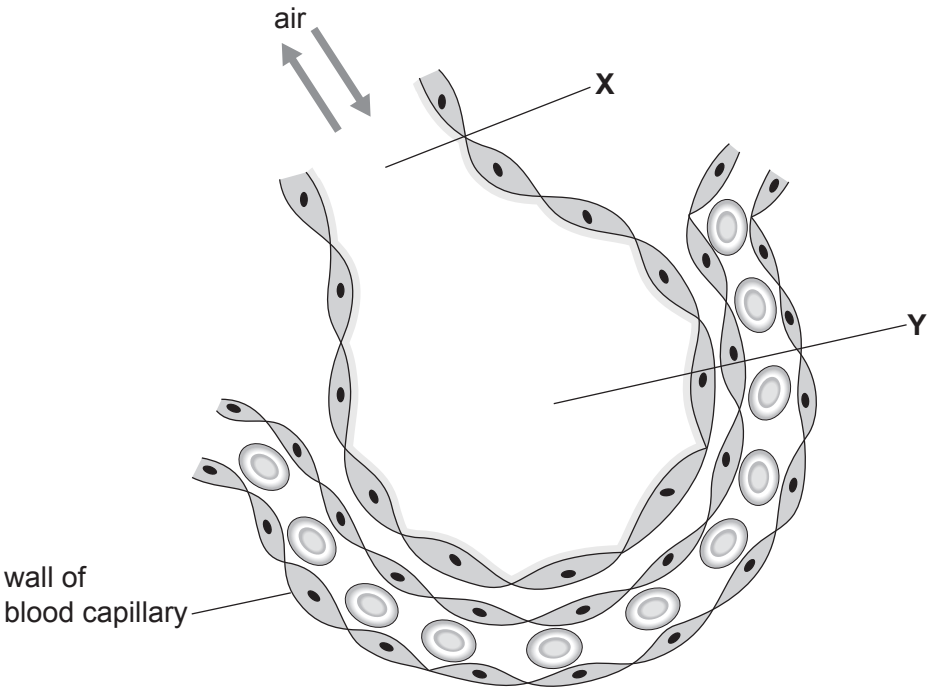
2. **Image 2.1** shows a part of the respiratory system where gas exchange takes place.

Image 2.1



(a) Name structures **X** and **Y** in **Image 2.1. Choose words from the list below.** [2]

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

X .....

Y .....

(b) (i) Underline the correct term from the brackets to complete each of the following sentences: [3]

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).

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

1. .....

2. .....

(c) **Table 2.2** shows the percentage of gases in inspired and expired air.

Table 2.2

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

Complete Table 2.2 by adding the missing percentages to the empty boxes from the list below: [3]

0.04 **16** **78** **21** **4**

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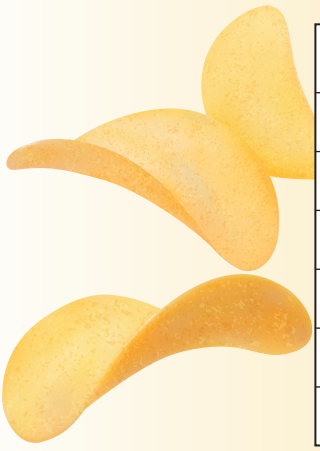
3. **Table 3.1** shows a nutritional information label from a packet of crisps.

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

(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]

Space for working:

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

.....

(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]

Total mass of fat = ... g

(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]

1. .....

2. .....

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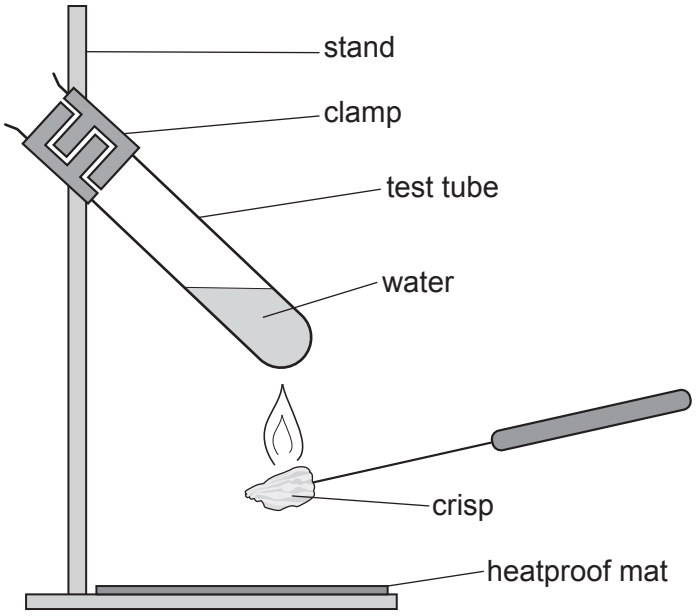
(c) A student used the apparatus shown in **Image 3.2** to measure the energy content of the crisps. She measured the temperature of the water before and after burning the crisp.

Image 3.2



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

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]

.....

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(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]

Temperature rise = ... °C

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

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

Space for working:

Energy released from food per gram = ... J

(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]

.....

.....

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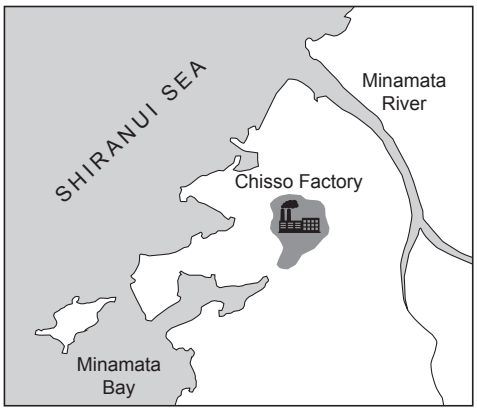
4. **Image 4.1 s**hows the area of Minamata in Japan, which has many fishing villages on the coast.

Image 4.1



- 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.

(a) (i) Use the information above to complete **Table 4.2** by writing True or False next to each statement. [3]

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.	.....

(ii) Use the information above to explain how mercury entered the food chain in Minamata. [2]

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Image 4.3 shows a food chain and the concentration of mercury found inside the tissues of each organism.

Image 4.3

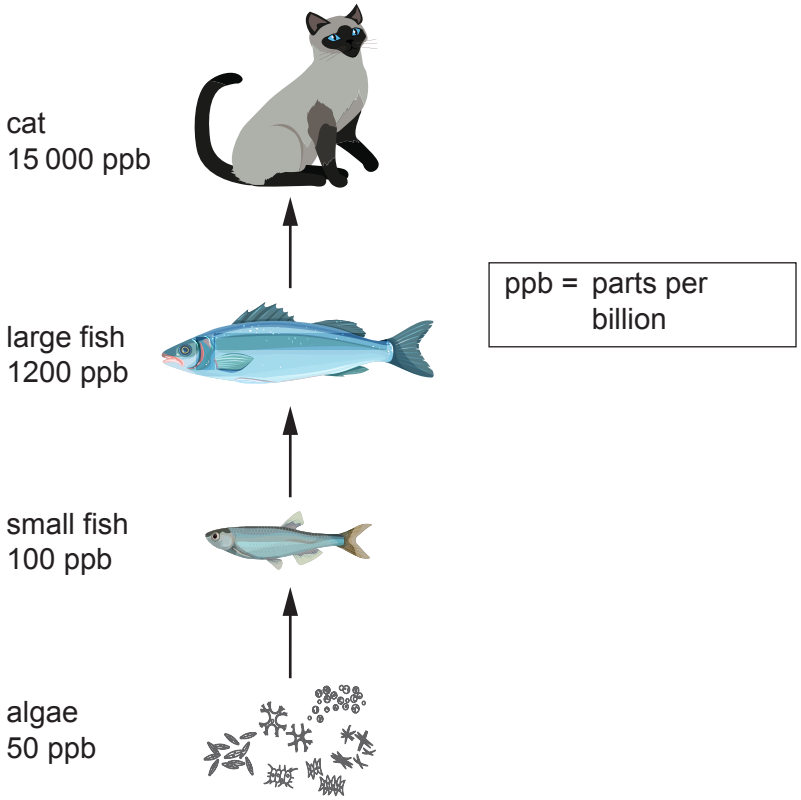

Diagram not drawn to scale

(b) (i) 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]

Answer = ... times more concentrated

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

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Turn over.

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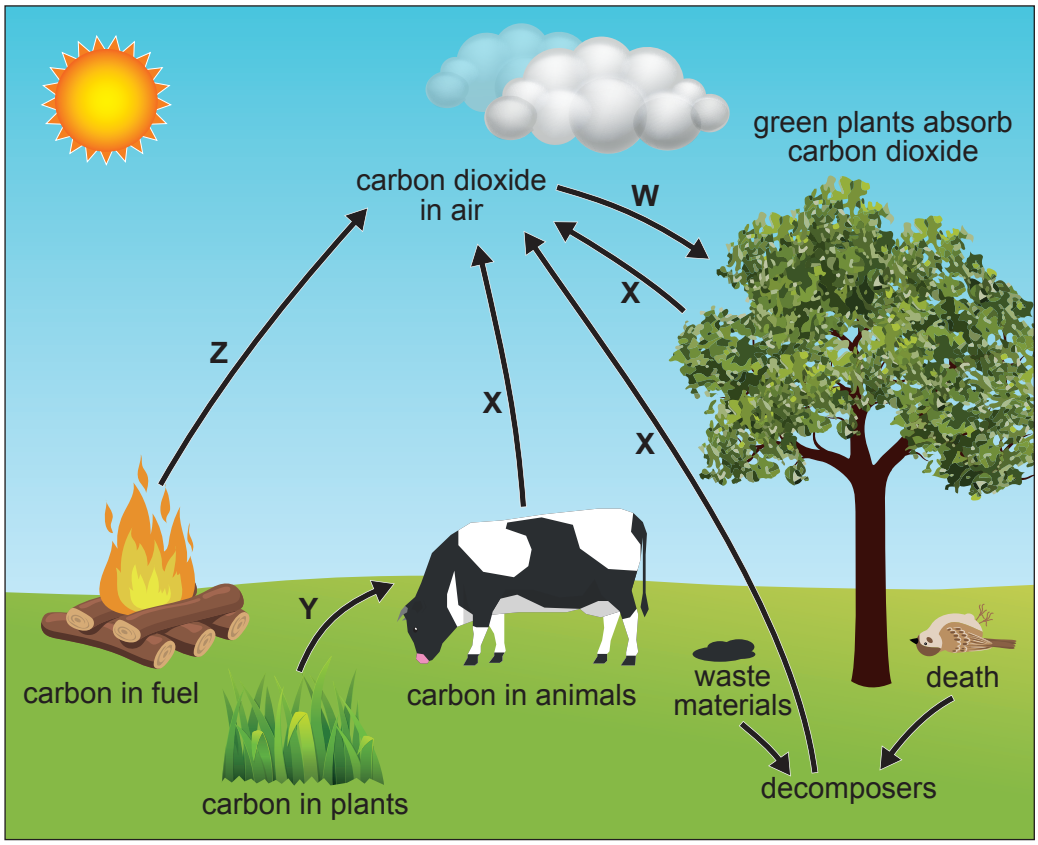
5. **Image 5** shows the carbon cycle.

Image 5



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 QER]

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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]

Protease breaks down ..... .

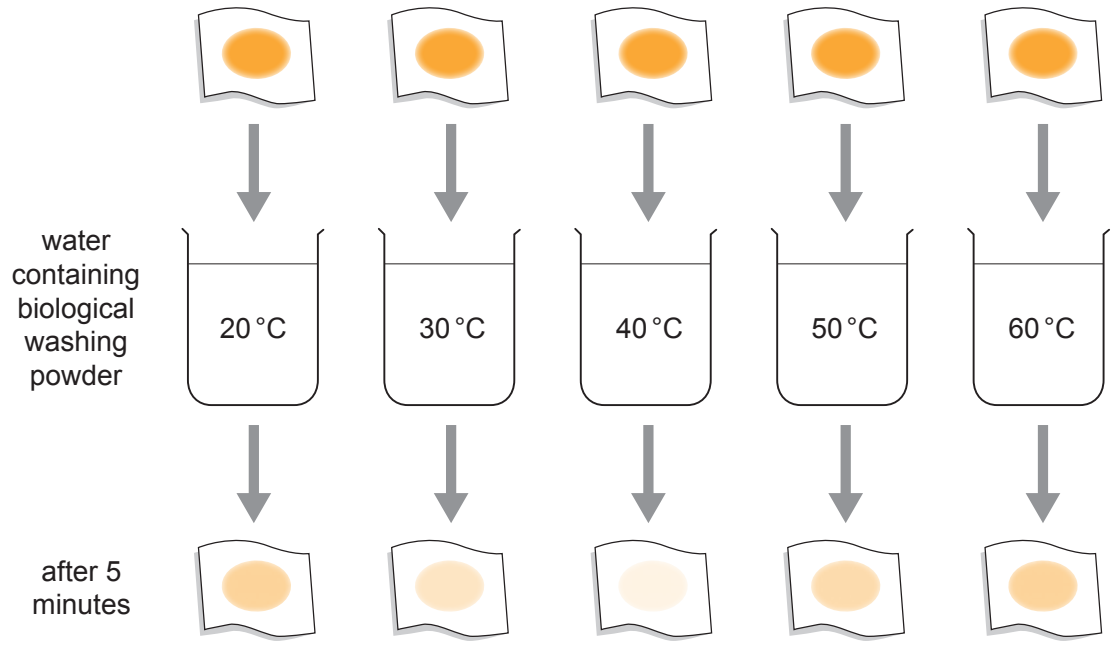
Lipase breaks down ..... .

(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**.

Image 6.1



(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]

Temperature ..... °C

Reason

.....

.....

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

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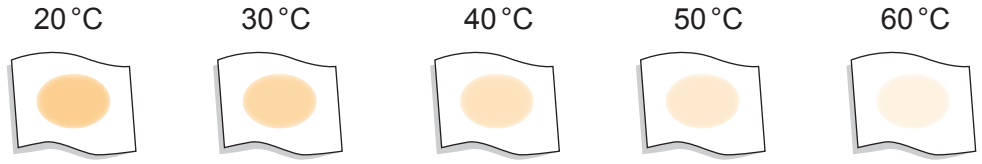
(c) The students repeated the experiment using the same method but using non-biological washing powder which does not contain enzymes. Their results are shown in **Image 6.2**.

Image 6.2



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

.....

.....

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

.....

.....

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

.....

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.....

.....

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

1. .....

2. .....

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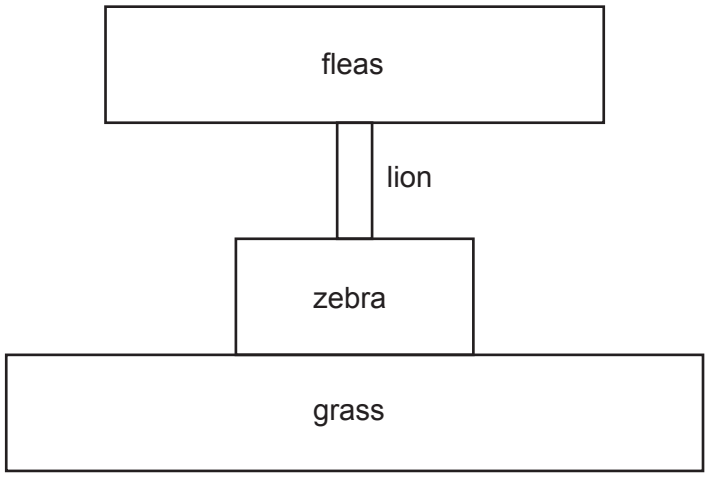
7. **Image 7** shows a pyramid of numbers in African grassland.

Image 7



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

.....

(ii) Underline **two** terms from the list below that can be used to describe the zebra. [1]

Producer

Secondary consumer

Carnivore

Herbivore

Primary consumer

(iii) Write the **food chain** that is represented by the pyramid of numbers in **Image 7**. [1]

.....

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

.....

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

.....

.....

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

.....

.....

(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]

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8. **Image 8.1** shows a fertiliser that is used when growing tomato plants.

Image 8.1

(a) State **three** nutrients that this fertiliser may contain. [3]

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]

Independent variable .....

Dependent variable .....

(c) **Table 8.2** shows the results for the experiment.

Table 8.2

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	.....

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

Circle the anomalous result in Table 8.2. [1]

(ii) Calculate the mean mass of tomatoes grown **without fertiliser**. **Write your answer in Table 8.2 to the nearest whole number.** [2]

Space for working:

(iii) State the conclusion that Tony can make from the results in **Table 8.2**. [1]

.....

.....

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

.....

(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]

Reason for inaccuracies

.....

.....

Suggestion for improvement

.....

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END OF PAPER

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

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