



Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

BIOLOGY

F

Foundation Tier

Paper 1F

8461/1F

Tuesday 13 May 2025

Afternoon

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



MATERIALS

For this paper you must have:

- a ruler
- a scientific calculator.

INSTRUCTIONS

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Answer ALL questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.



INFORMATION

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

DO NOT TURN OVER UNTIL TOLD TO DO SO



Answer ALL questions in the spaces provided.

0 1

This question is about cells.

0 1 . 1

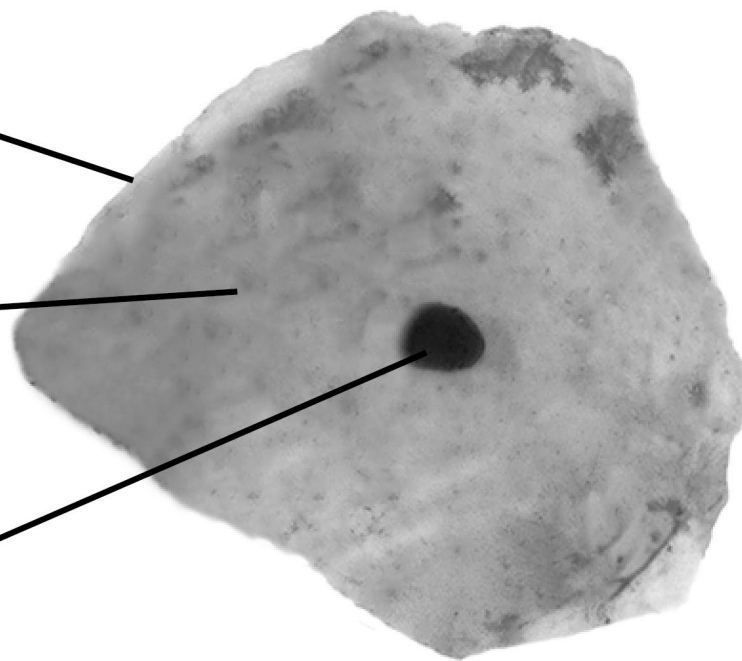
FIGURE 1 shows an animal cell seen through a microscope.

FIGURE 1

Cell
membrane

Part X

Nucleus



What is part X in FIGURE 1? [1 mark]

Tick (✓) ONE box.

☐

Cytoplasm

☐

Mitochondrion

☐

Vacuole

0	1	.	2
---	---	---	---

Name ONE structure found in the nucleus. [1 mark]

0	1	.	3
---	---	---	---

Name ONE cell part that is found in a plant cell but is NOT found in an animal cell. [1 mark]

[Turn over]



0	1	.	4
---	---	---	---

Root hair cells are found in plants.

Which substance do root hair cells absorb from the soil?
[1 mark]

Tick (✓) ONE box.

☐

Glucose

☐

Protein

☐

Water

0	1	.	5
---	---	---	---

A sperm cell is a specialised cell.

What is the function of a sperm cell? [1 mark]



01.6

Draw ONE line from each specialised cell to the type of organism where the specialised cell is found. [2 marks]

SPECIALISED CELL

TYPE OF ORGANISM

Nerve cell

Xylem cell

Animals

Bacteria

Fungi

Plants

[Turn over]



0	1	.	7
---	---	---	---

The cell membrane controls which substances move into and out of cells.

Which TWO processes move substances into and out of cells? [2 marks]

Tick (✓) TWO boxes.

☐

Active transport

☐

Diffusion

☐

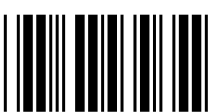
Mitosis

☐

Mutation

☐

Respiration



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[Turn over]





01.8

TABLE 1, on the opposite page, shows substances that are exchanged between the blood and muscle cells.

Complete TABLE 1 to show the direction of movement of each substance. [3 marks]

Tick (✓) ONE box in each row.



1 1

TABLE 1

SUBSTANCE	DIRECTION OF MOVEMENT OF SUBSTANCE			
	ONLY from blood to muscle cells	ONLY from muscle cells to blood	From blood to muscle cells AND from muscle cells to blood	
Carbon dioxide				
Oxygen				
Water				

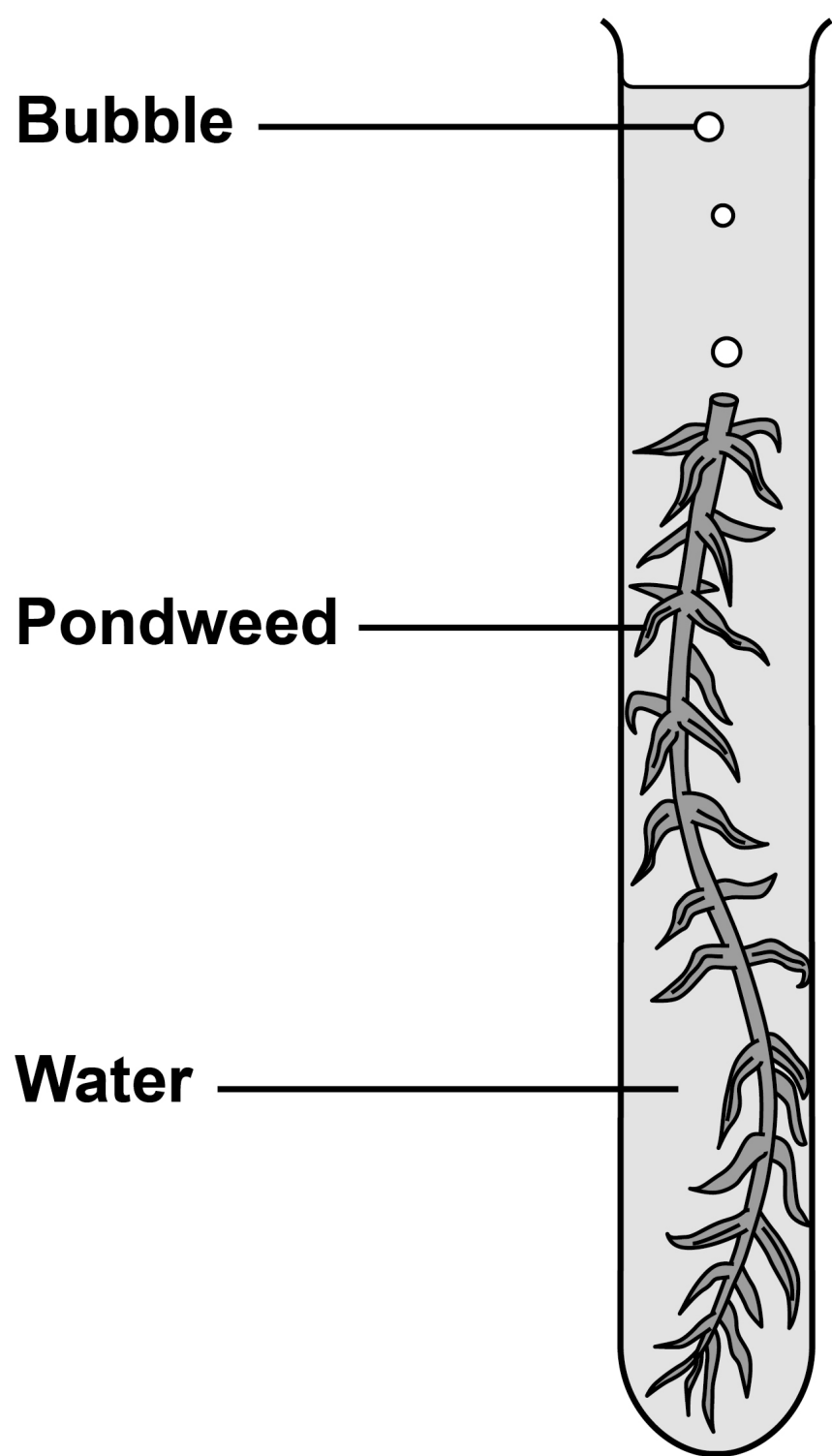
[Turn over]

02

A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

FIGURE 2 shows how the student set up the apparatus.

FIGURE 2



This is the method used.

- 1. Prepare six tubes of pondweed as shown in FIGURE 2.**
- 2. Place one tube into each of six water baths set at different temperatures.**
- 3. Wait two minutes.**
- 4. Measure the time taken for each piece of pondweed to release 10 bubbles.**

0 2 . 1

What is the independent variable in the investigation?
[1 mark]

Tick (✓) ONE box.

☐

Length of pondweed

☐

Temperature of pondweed

☐

Volume of water

[Turn over]



TABLE 2 shows the results.

TABLE 2

TEMPERATURE IN °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77



0	2	.	2
---	---	---	---

Complete the sentences.

Choose answers from the list. [2 marks]

- cellulose
- chlorophyll
- nitrogen
- oxygen
- water

Photosynthesis by the pondweed releases bubbles of

_____.

The green substance needed for photosynthesis is

called _____.

[Turn over]



0	2	.	3
---	---	---	---

Describe the effect of increasing temperature on the time taken for the pondweed to release 10 bubbles. [2 marks]



BLANK PAGE

[Turn over]



REPEAT OF TABLE 2

TEMPERATURE IN °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77

0 2 . 4

Calculate the rate of photosynthesis at 50 °C.

Use the equation:

rate of photosynthesis in bubbles per second =

$$\frac{10}{\text{time taken to release 10 bubbles in seconds}}$$



Use TABLE 2.

Give your answer to 1 decimal place. [3 marks]

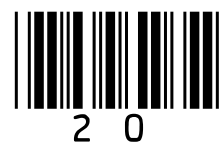
Rate of photosynthesis (1 decimal place) =
_____ bubbles per second

[Turn over]



REPEAT OF TABLE 2

TEMPERATURE IN °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77



0	2	.	5
---	---	---	---

Which temperature had the fastest rate of photosynthesis?
[1 mark]

Tick (✓) ONE box.

☐

20 °C

☐

30 °C

☐

40 °C

☐

50 °C

[Turn over]



REPEAT OF TABLE 2

TEMPERATURE IN °C	Time taken for pondweed to release 10 bubbles in seconds
10	84
20	43
30	27
40	25
50	33
60	77



0	2	.	6
---	---	---	---

The student repeated the investigation at 80 °C.

What would be the time taken for the pondweed to release 10 bubbles at 80 °C? [1 mark]

Tick (✓) ONE box.

☐

Less than 77 seconds

☐

Exactly 77 seconds

☐

More than 77 seconds

[Turn over]



0	2	.	7
---	---	---	---

Which TWO factors could affect the rate of photosynthesis in this investigation? [2 marks]

Tick (✓) TWO boxes.

☐

Concentration of carbon dioxide

☐

Light intensity

☐

Size of boiling tube

☐

Size of bubbles

☐

Type of stopwatch

12



0	3
---	---

Blood contains different types of cell.

0	3	.	1
---	---	---	---

Complete the sentences.

Choose answers from the list. [2 marks]

- antibiotics
- antitoxins
- painkillers
- pathogens

White blood cells defend the body against

_____.

**Some white blood cells release chemicals that
neutralise toxins. These chemicals are called**

_____.

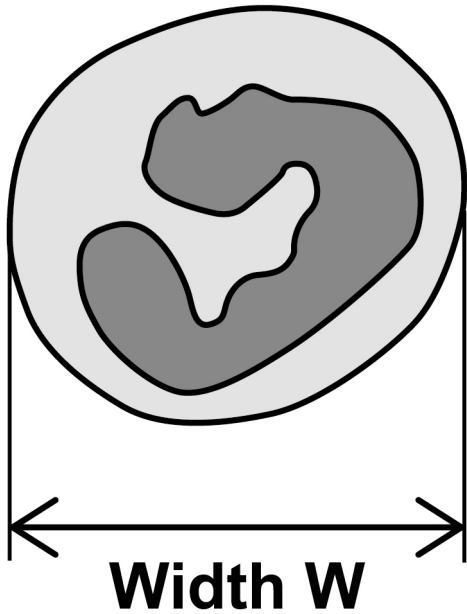
[Turn over]



0	3	.	2
---	---	---	---

FIGURE 3 shows a white blood cell.

FIGURE 3



The image of the white blood cell in **FIGURE 3** is magnified 4000 times.

Calculate the real width of the white blood cell. [4 marks]

Complete the following steps.

Measure width W in millimetres (mm).

Width W = _____ mm

Convert your measurement to micrometres (μm).

1 millimetre (mm) = 1000 micrometres (μm).

Width W in micrometres = _____ μm

Calculate the real width of the white blood cell.

Use the equation:

$$\text{real width} = \frac{\text{width W } (\mu\text{m})}{\text{magnification}}$$

Real width = _____ μm

[Turn over]



TABLE 3 shows information about different types of blood vessel.

TABLE 3

BLOOD VESSEL	Width of blood vessel in micrometres (µm)	Pressure of blood travelling through the blood vessel
Artery	10 000	High
Capillary	10	Low
Vein	20 000	Very low

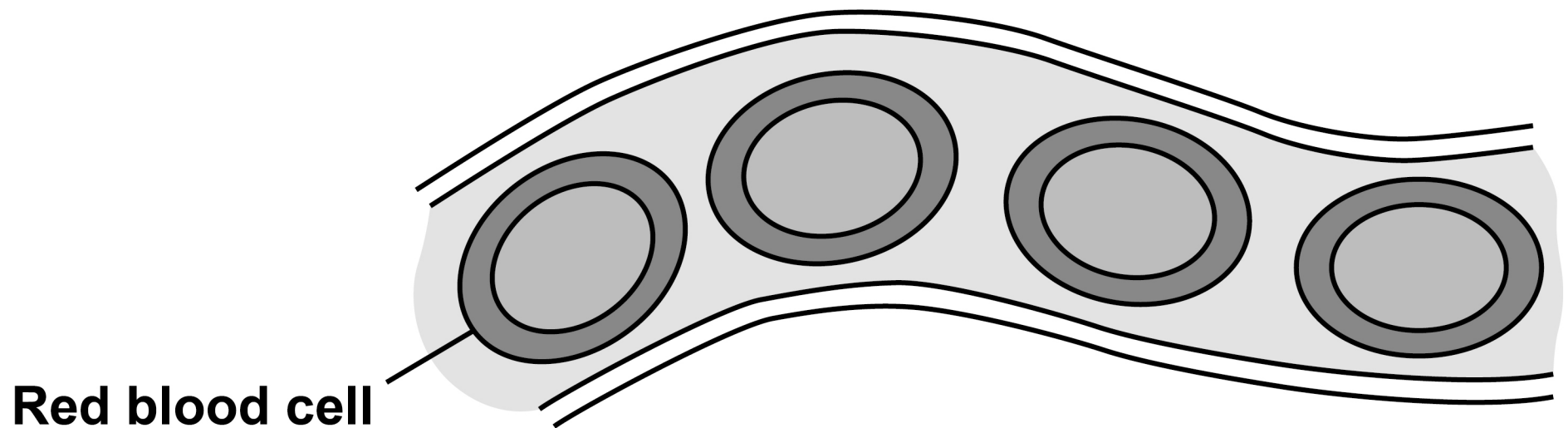


0	3	.	3
---	---	---	---

The width of a red blood cell is $8\text{ }\mu\text{m}$.

FIGURE 4 shows red blood cells in one type of blood vessel.

FIGURE 4



Which type of blood vessel is shown in FIGURE 4?

Use TABLE 3. [1 mark]

Tick (✓) ONE box.

☐

Artery

☐

Capillary

☐

Vein

[Turn over]



REPEAT OF TABLE 3

BLOOD VESSEL	Width of blood vessel in micrometres (µm)	Pressure of blood travelling through the blood vessel
Artery	10 000	High
Capillary	10	Low
Vein	20 000	Very low

03.4

Explain why arteries need to have thick walls.

Use TABLE 3. [2 marks]

Coronary arteries in the heart can become narrowed.

03.5

What happens inside coronary arteries to cause them to become narrowed? [1 mark]

03.6

Explain why narrowed coronary arteries can be dangerous. [2 marks]

[Turn over]



03.7

Treatments are available for some cardiovascular diseases.

Draw ONE line from each cardiovascular disease to a treatment for the disease. [3 marks]

CARDIOVASCULAR DISEASE

TREATMENT

A blocked coronary artery

Heart failure

High blood cholesterol

Antibiotics

Heart transplant

Statins

Stent



0	3	.	8
---	---	---	---

Why is coronary heart disease described as a ‘non-communicable disease’? [1 mark]

[Turn over]

16



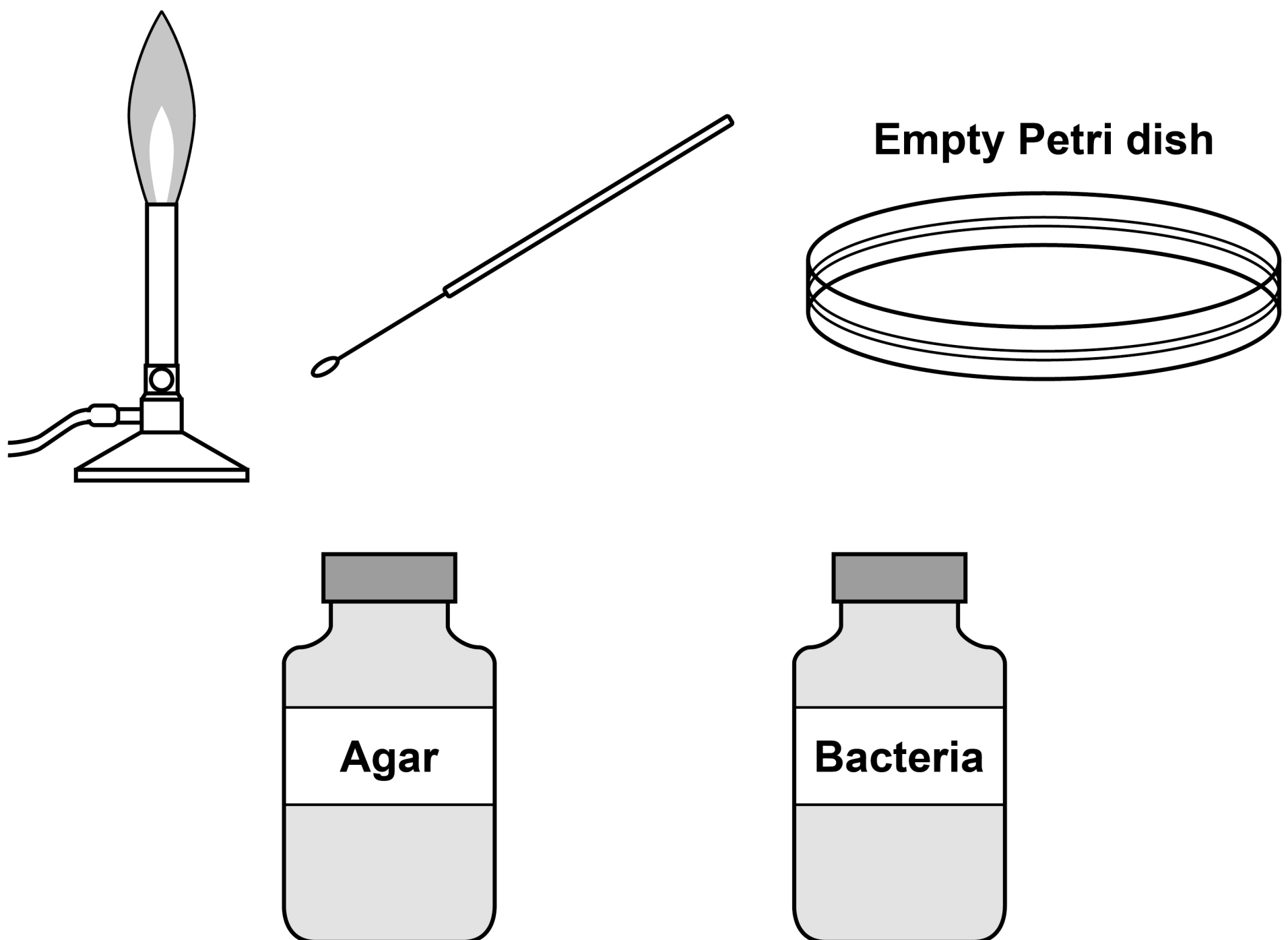
0	4
---	---

A student investigated the effect of antibiotics on the growth of bacteria.

The student prepared an agar gel plate.

FIGURE 5 shows some of the equipment the student used.

FIGURE 5



0 4 . 1

Describe a method the student could use to:

- **prepare a sterile agar gel plate**
- **grow an uncontaminated sample of bacteria on the agar gel plate.**

Use the equipment in FIGURE 5 in your answer.

[6 marks]

[illegible]

[Turn over]



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

BLANK PAGE

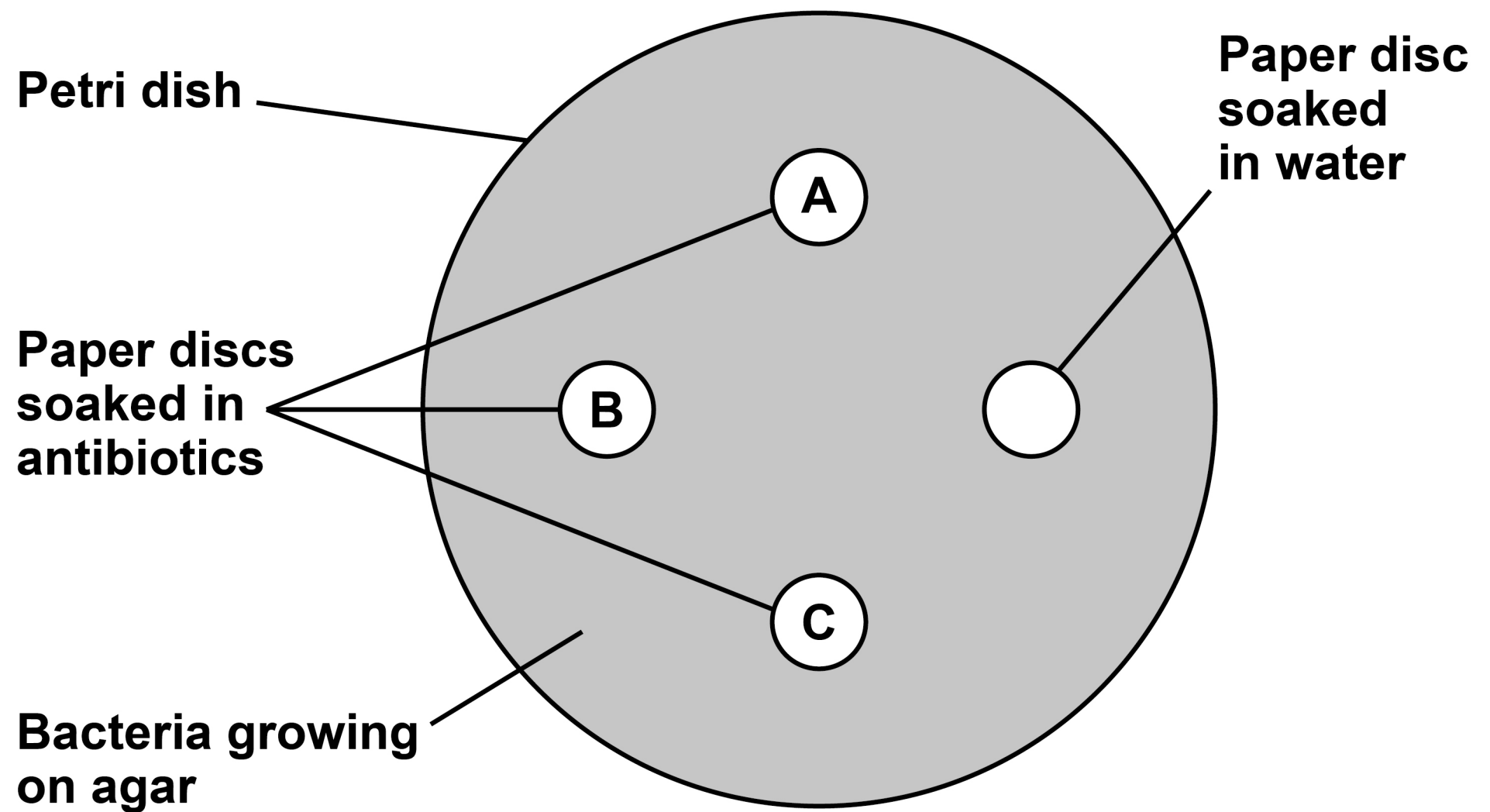
[Turn over]



The student used an agar gel plate to test three antibiotics, A, B and C.

FIGURE 6 shows how the agar gel plate was set up.

FIGURE 6



0	4	.	2
---	---	---	---

The student incubated the agar gel plate at 25 °C.

Why should the temperature NOT be higher than 25 °C?
[1 mark]

0	4	.	3
---	---	---	---

What was the purpose of the paper disc soaked in water?
[1 mark]

Tick (✓) ONE box.

☐

To check the bacteria were uncontaminated.

☐

To make the investigation more accurate.

☐

To show the effect of no antibiotics.

[Turn over]



04.4

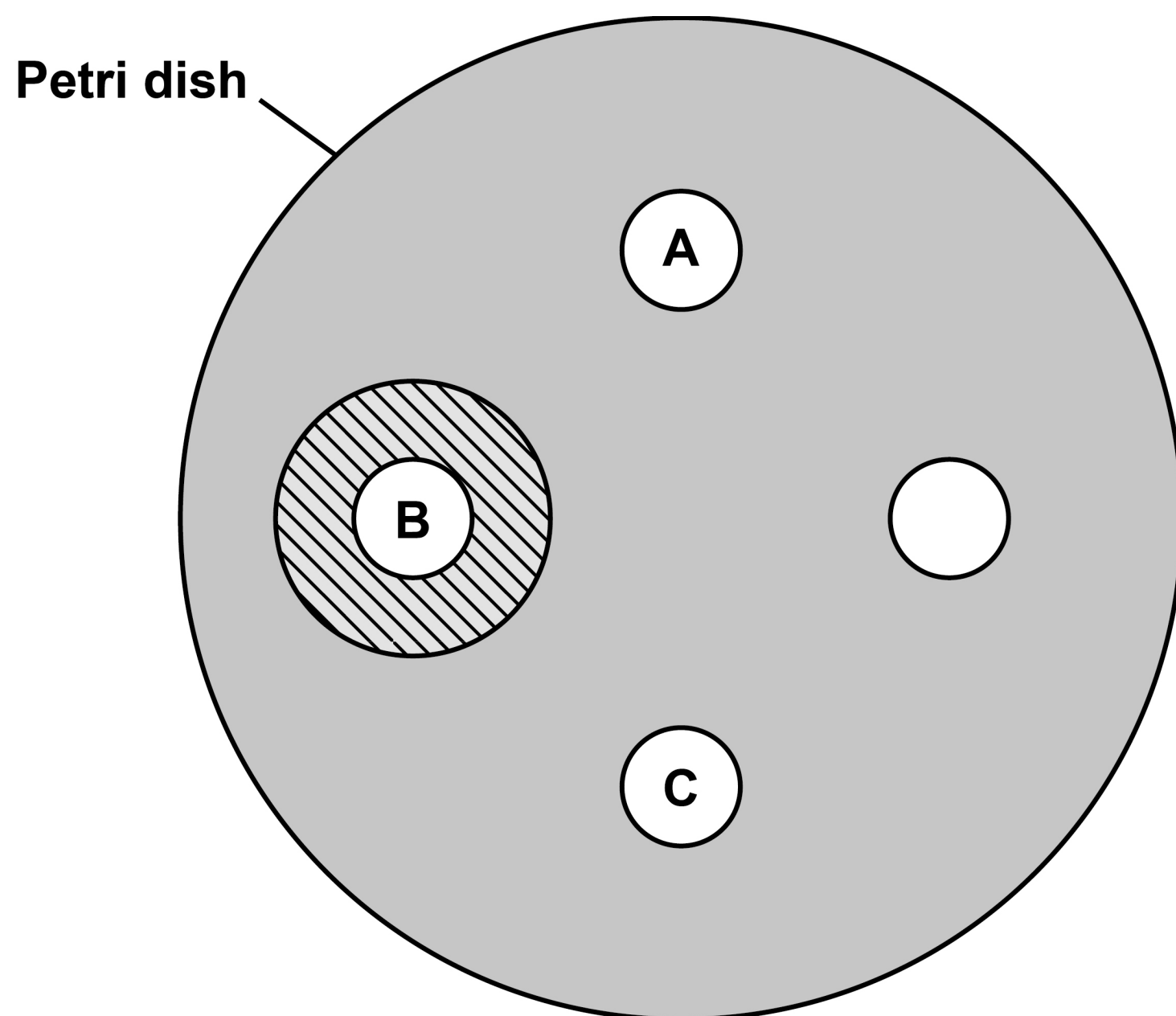
The student removed the agar gel plate from the incubator after 48 hours.

Antibiotic A was the **MOST** effective at killing the bacteria.

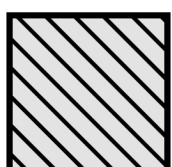
Antibiotic C was the **LEAST** effective at killing the bacteria.

FIGURE 7 shows the results for the disc soaked in antibiotic B.

FIGURE 7



KEY



Area where bacteria are killed

Complete FIGURE 7 to show the results you would expect.

You should:

- **draw a ring around the disc soaked in antibiotic A**
- **draw a ring around the disc soaked in antibiotic C.**

[2 marks]

0 4 . 5

The student repeated the investigation with antibiotic D.

The bacteria were resistant to antibiotic D.

What effect would antibiotic D have had on the bacteria?
[1 mark]

Tick (✓) ONE box.

☐

All of the bacteria would have been killed.

☐

Some of the bacteria would have been killed.

☐

None of the bacteria would have been killed.

[Turn over]

11



0	5
---	---

Plants and animals have adaptations that help them survive.

A stingray is an animal that lives in the sea.

Seagrass is a plant that grows on the sea floor.

FIGURE 8 shows a stingray swimming above seagrass.

FIGURE 8



0	5	.	1
---	---	---	---

Draw ONE line from each adaptation of SEAGRASS to how the adaptation helps the seagrass survive. [2 marks]

**ADAPTATION OF
SEAGRASS**

**HOW THE ADAPTATION
HELPS THE SEAGRASS
TO SURVIVE**

Flexible leaves

Keep seagrass in one
place on the sea floor

Long, deep roots

Poison animals that
try to eat the seagrass

Stop seagrass
breaking in strong
water currents

[Turn over]



In the stingray, gas exchange takes place in the gills.

05.2

Name the organs where gas exchange takes place in humans.
[1 mark]

05.3

Gills are adapted to maximise gas exchange.

Which TWO features of gills help to maximise gas exchange?
[2 marks]

Tick (✓) TWO boxes.

☐

Gills are not open at night.

☐

Gills have a large surface area.

☐

Gills have a low temperature.

☐

Gills have thin walls.

☐

Gills have very few capillaries.



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[Turn over]



05.4

Stingrays rest on the sea floor.

TABLE 4 shows information about the metabolic rate of a stingray.

TABLE 4

ACTIVITY OF STINGRAY	METABOLIC RATE IN ARBITRARY UNITS
Resting	484
Swimming	944

Calculate how many times greater the metabolic rate of the stingray is when swimming compared with when resting.

Give your answer to the nearest whole number. [3 marks]

[Turn over]



0	5	.	5
---	---	---	---

When the metabolic rate of the stingray increases, the rate of aerobic respiration in the stingray increases.

Complete the word equation for aerobic respiration.

Choose answers from the list. [3 marks]

- carbon dioxide
- magnesium
- nitrogen
- oxygen
- water

glucose + _____ $\longrightarrow$

_____ + _____



0	5	.	6
---	---	---	---

Explain why the rate of respiration in the stingray increases when the stingray starts to swim. [3 marks]

[Turn over]



0	5	.	7
---	---	---	---

Some plants can use anaerobic respiration.

Which TWO substances are produced during anaerobic respiration in plants? [2 marks]

Tick (✓) TWO boxes.

☐

Carbon dioxide

☐

Ethanol

☐

Hydrochloric acid

☐

Oil

☐

Protein

16



0	6
---	---

Measles is an infectious disease caused by a pathogen.

0	6	.	1
---	---	---	---

What type of pathogen causes measles? [1 mark]

0	6	.	2
---	---	---	---

Give ONE way measles is spread from one person to another person. [1 mark]

[Turn over]



0	6	.	3
---	---	---	---

One symptom of measles is pain.

In adults, aspirin can be used to treat the pain.

Which plant did aspirin originate from? [1 mark]

0	6	.	4
---	---	---	---

Give ONE other symptom of measles.

Do NOT refer to pain in your answer. [1 mark]



The spread of measles can be reduced by vaccination.

06.5

Explain why vaccinating large numbers of children helps to reduce the spread of the measles pathogen in the population.
[2 marks]

[Turn over]



FIGURE 9, on the opposite page, shows information about the severity of measles infection in vaccinated and unvaccinated children.

06.6

There were 240 children in the survey.

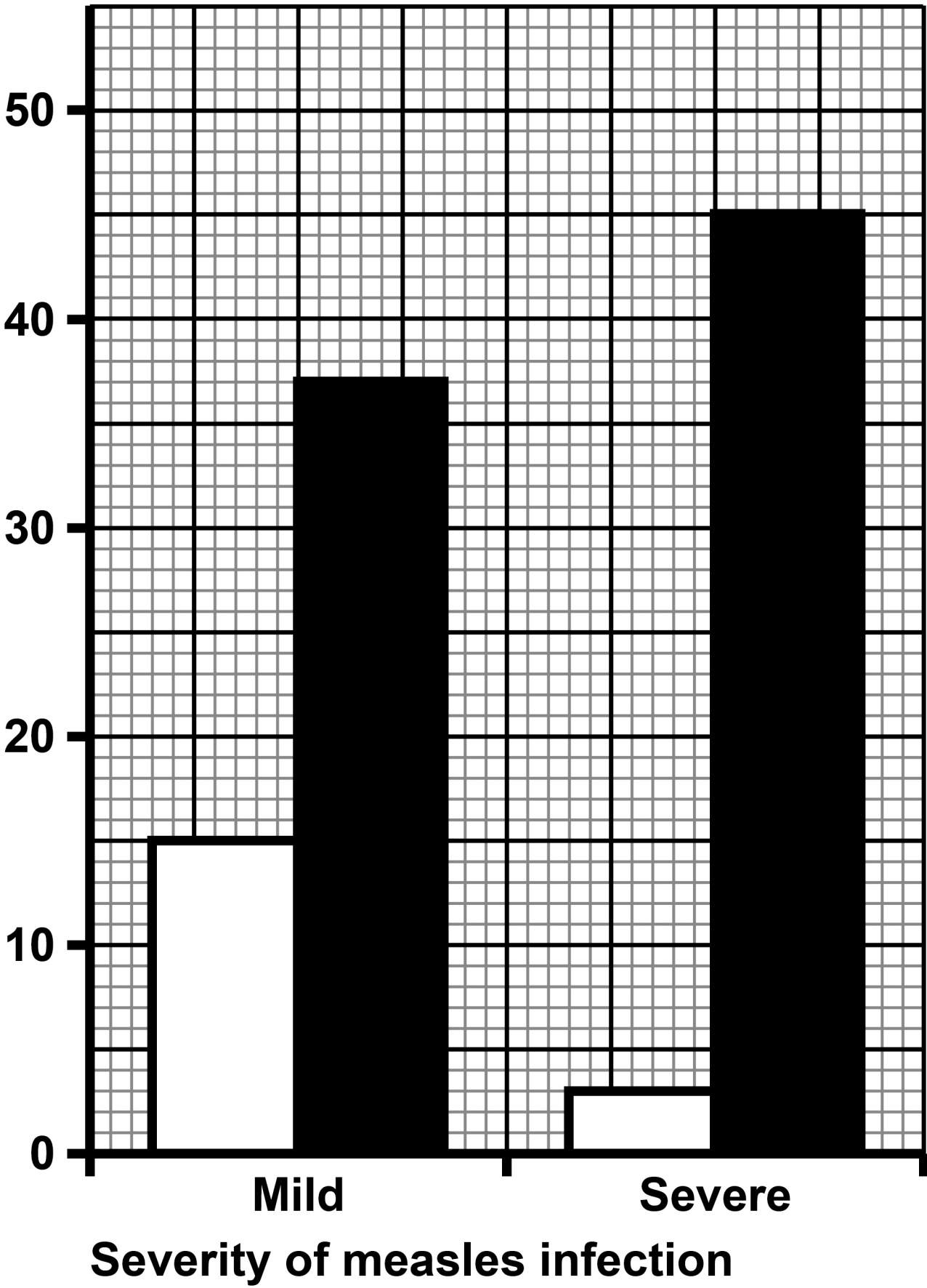
Calculate how many UNVACCINATED children had a severe measles infection.

Use FIGURE 9. [3 marks]

Number of unvaccinated children = _____

FIGURE 9

Percentage
(%) of
children



KEY

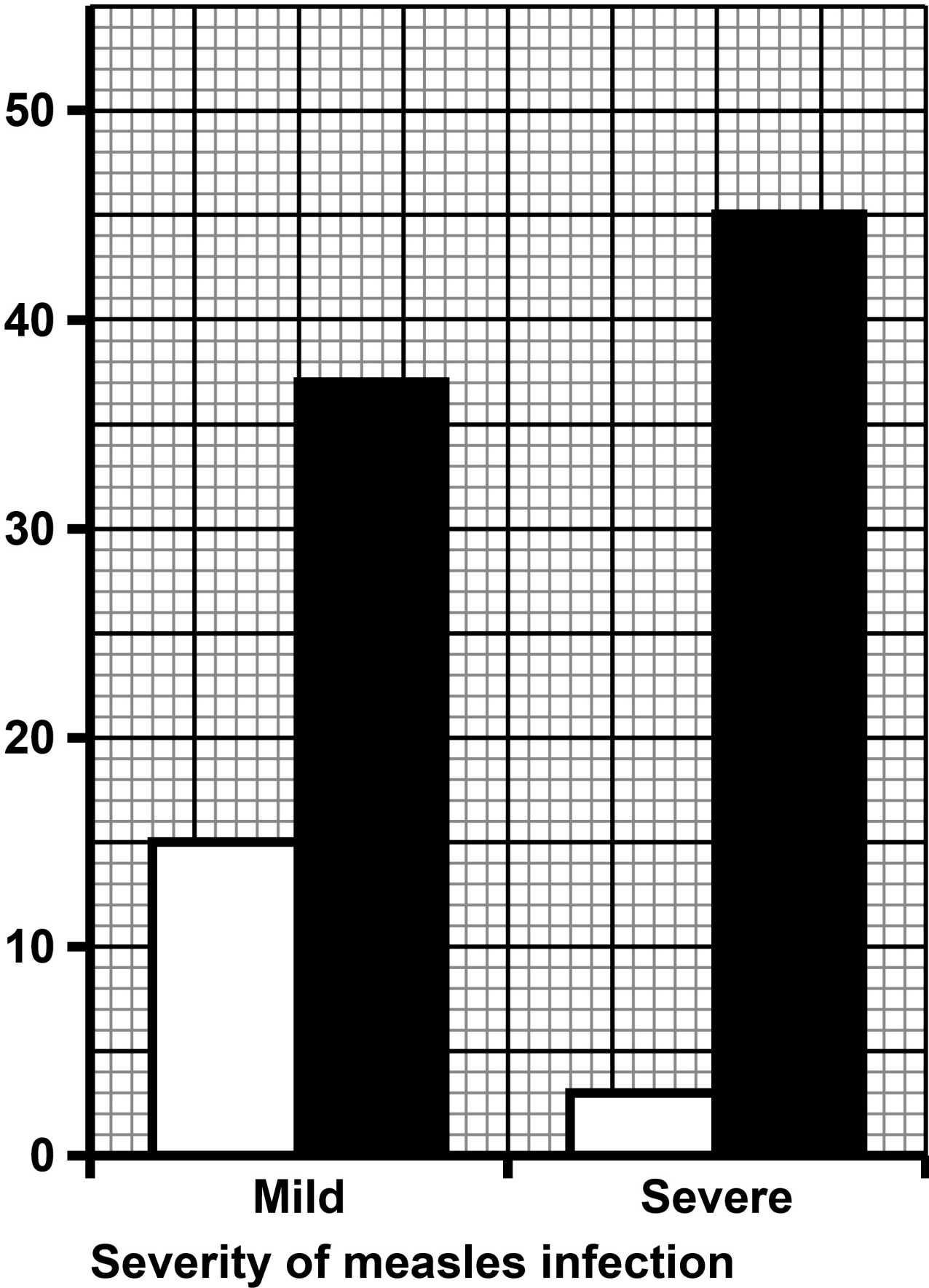
- ☐ Vaccinated
- ☒ Unvaccinated

[Turn over]



REPEAT OF FIGURE 9

Percentage
(%) of
children



KEY

- ☐ Vaccinated
- ☒ Unvaccinated



06.7

It is recommended that all children are given a measles vaccination.

Give evidence from FIGURE 9 to support the recommendation.

Include data from FIGURE 9 in your answer. [2 marks]

[Turn over]

11



BLANK PAGE



0	7
---	---

Eating too much carbohydrate can cause obesity.

0	7	.	1
---	---	---	---

Name ONE disease that obesity is a risk factor for.
[1 mark]

[Turn over]



TABLE 5 shows information about sugar intake and obesity in different countries.

TABLE 5

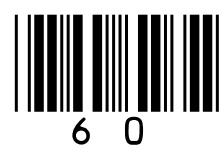
COUNTRY	Mean sugar intake per person per day in grams	Mean obesity rate in arbitrary units
A	122	18
B	80	9
C	172	25
D	150	23
E	110	15
F	144	19
G	192	32

07.2

Complete FIGURE 10, on the opposite page.

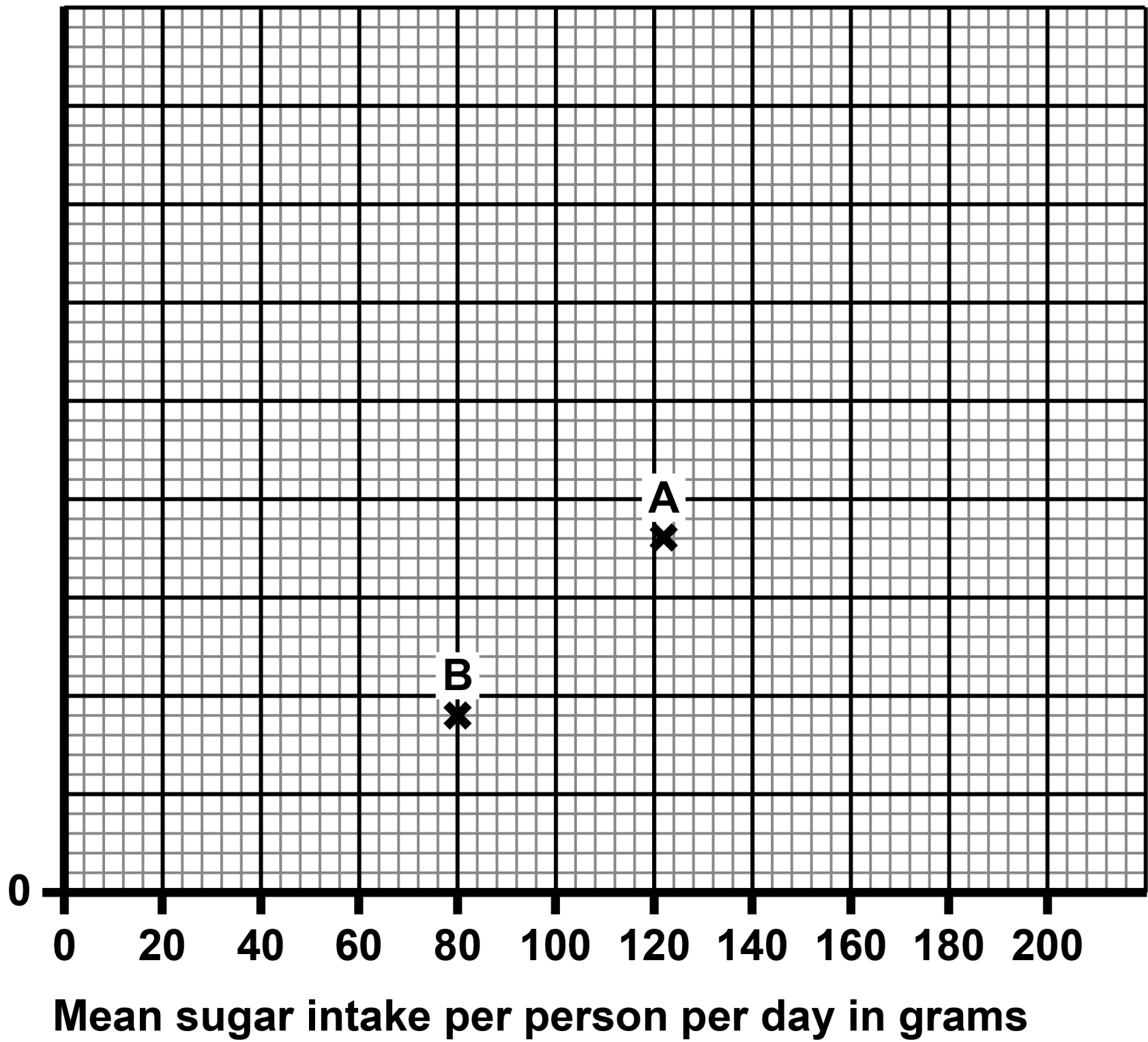
You should:

- label the *y*-axis
- add the scale for the *y*-axis
- plot the data for countries C, D, E, F and G from TABLE 5
- draw a line of best fit.



Countries A and B have been completed for you.
[4 marks]

FIGURE 10

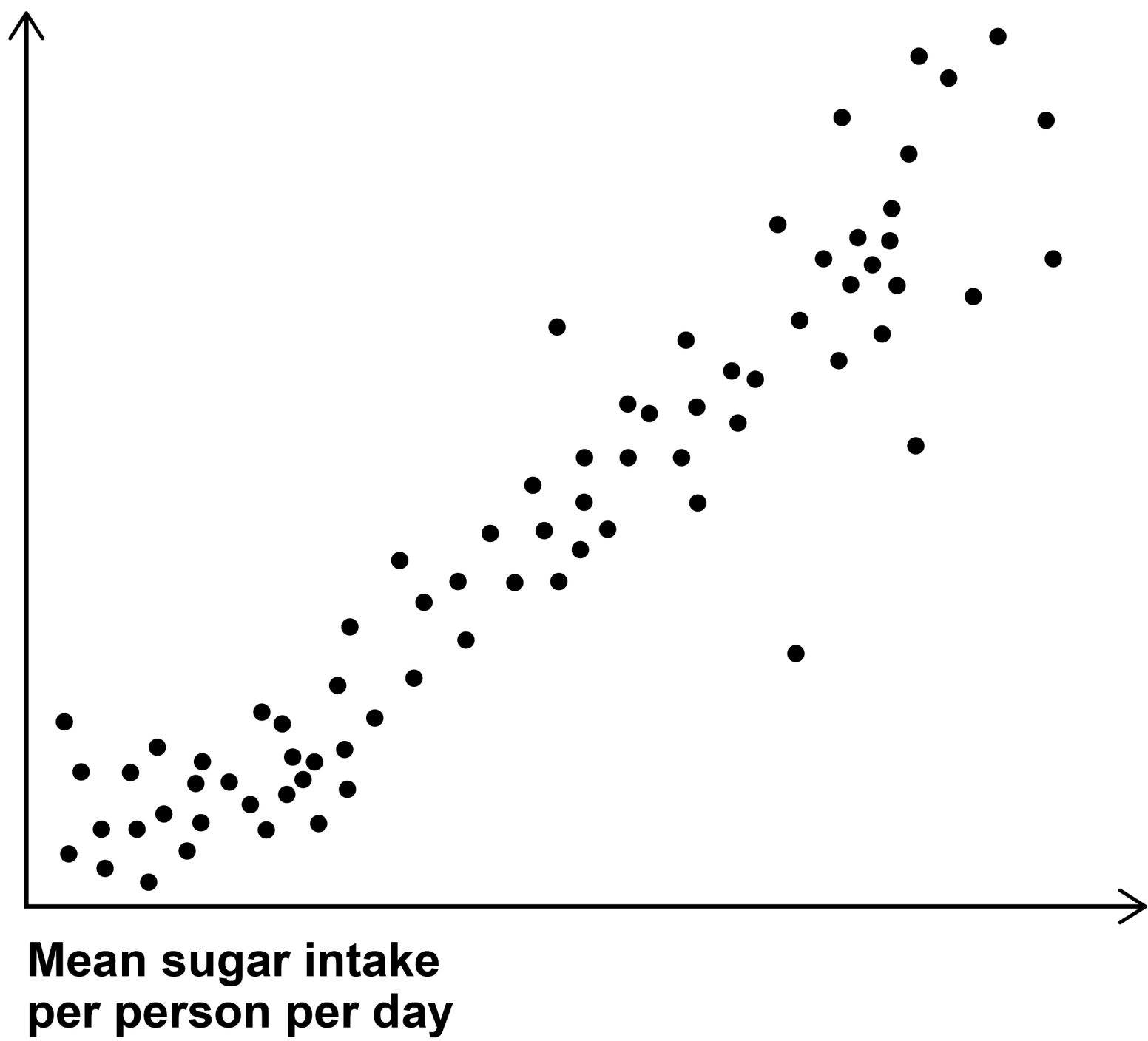


[Turn over]

FIGURE 11 shows information about the relationship between sugar intake and tooth decay.

FIGURE 11

Mean number of decayed teeth per person



07.3

Name the type of graph shown in FIGURE 11. [1 mark]

0	7	.	4
---	---	---	---

What relationship is shown between the two variables in FIGURE 11? [1 mark]

Tick (✓) ONE box.

☐

Inversely proportional

☐

No correlation

☐

Positive correlation

[Turn over]



Sugars and starch are carbohydrates.

A student investigated the effect of temperature on the activity of amylase.

For each temperature, the student:

- **mixed starch and amylase together**
- **added iodine solution after 5 minutes.**

The iodine solution was yellow-brown before it was added to the mixture.

TABLE 6 shows the results.

TABLE 6

TEMPERATURE IN °C	COLOUR OF IODINE SOLUTION
10	blue-black
30	yellow-brown
60	blue-black
90	blue-black



0	7	.	5
---	---	---	---

Explain the results at 30 °C and at 90 °C. [4 marks]

30 °C _____

90 °C _____

[Turn over]



0	7	.	6
---	---	---	---

How could the student change the investigation to find a more precise temperature that amylase works best at?
[1 mark]

Tick (✓) ONE box.

☐

Test more temperatures between 10 °C and 30 °C.

☐

Test more temperatures between 10 °C and 60 °C.

☐

Test more temperatures between 30 °C and 60 °C.

☐

Test more temperatures between 30 °C and 90 °C.



07.7

Protease enzymes are involved in protein digestion.

Different types of protease enzyme are active in different organs of the digestive system.

Complete TABLE 7 to identify the organ where each protease enzyme is active. [2 marks]

TABLE 7

PROTEASE ENZYME	OPTIMUM pH	ORGAN WHERE ENZYME IS ACTIVE
Pepsin	2	
Trypsin	8	

[Turn over]



0	8
---	---

A student investigated osmosis in pieces of potato.

This is the method used.

- 1. Cut a piece of potato into a cube.**
- 2. Record the mass of the cube.**
- 3. Place the cube into a beaker containing 0.4 mol/dm^3 salt solution.**
- 4. After some time, remove the cube and record the mass.**
- 5. Calculate the change in the mass of the cube.**
- 6. Repeat steps 1 to 5 using two more different concentrations of salt solution.**

0	8	.	1
---	---	---	---

Evaluate the student's method.

You should include how the student could improve the validity of their results. [6 marks]



[illegible]

[Turn over]





0	8	.	2
---	---	---	---

Why would a potato cube placed into distilled water increase in mass? [1 mark]

Tick (✓) ONE box.

☐

The solution in the potato cells was less concentrated than the distilled water.

☐

The solution in the potato cells was more concentrated than the distilled water.

☐

The volume of water in the potato cells was greater than the volume of distilled water.

☐

The volume of water in the potato cells was less than the volume of distilled water.

[Turn over]



0	8	.	3
---	---	---	---

Active transport is another process used by potato cells.

Give ONE way active transport is different from osmosis.
[1 mark]

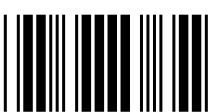
END OF QUESTIONS

8



Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

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