A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY

Foundation Tier Paper 2

Life and Environmental Sciences

F

8465/2F

Wednesday 20 May 2020 Afternoon

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

JUN208465 2F01

For this paper you must have:

- **a ruler**
- **a protractor**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **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

0 1

This question is about gases in the atmosphere.

TABLE 1 shows the percentage of gases in Earth's early atmosphere and in Earth's atmosphere today.

TABLE 1

Gas	Estimated percentage (%) in Earth's early atmosphere	Percentage (%) in Earth's atmosphere today
Carbon dioxide	95.0	0.04
Nitrogen	3.5	78.08
Oxygen	0.5	20.95
Other gases	X	0.93

0 1 . 1

Which gas has the largest percentage in Earth's atmosphere today? [1 mark]

Tick (✓) ONE box.

- ☐ **Carbon dioxide**
- ☐ **Nitrogen**
- ☐ **Oxygen**

BLANK PAGE

0 1 . 2

What is value X in TABLE 1, on page 4?
[1 mark]

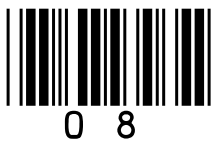
Tick (✓) ONE box.

- ☐ **0.5%**
- ☐ **1.0%**
- ☐ **1.5%**
- ☐ **4.5%**

[Turn over]

REPEAT OF TABLE 1

Gas	Estimated percentage (%) in Earth's early atmosphere	Percentage (%) in Earth's atmosphere today
Carbon dioxide	95.0	0.04
Nitrogen	3.5	78.08
Oxygen	0.5	20.95
Other gases	X	0.93



0 1 . 3

Describe THREE differences between Earth's early atmosphere and Earth's atmosphere today.

Use TABLE 1. [3 marks]

1

2

3

0 1 . 4

What released the gases into Earth's early atmosphere? [1 mark]

Tick (✓) ONE box.

☐ **Fossil fuels**

☐ **Sedimentary rocks**

☐ **Volcanoes**

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[Turn over]

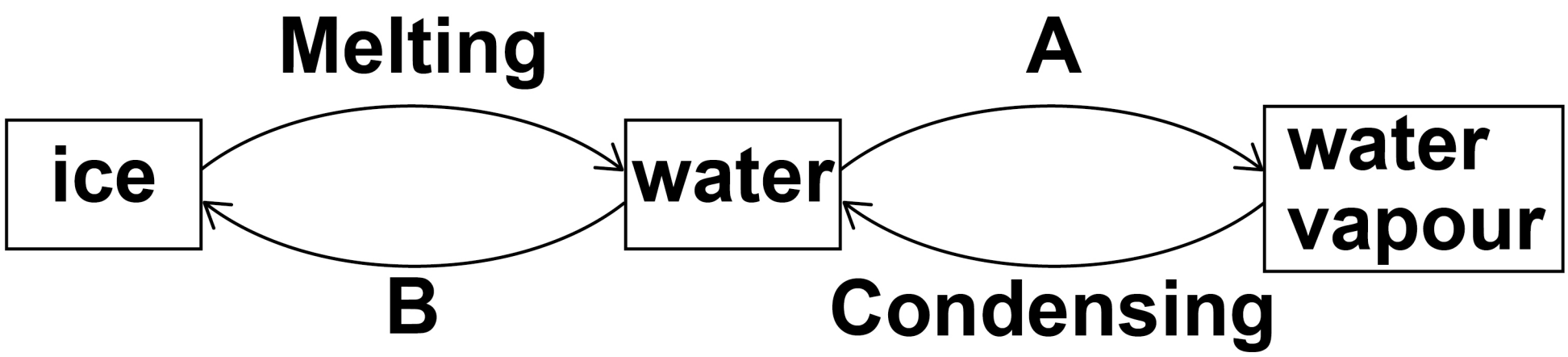
One of the other gases in Earth's atmosphere today is water vapour.

0 1 . 5

Water can exist in three different states of matter.

FIGURE 1 shows the different states of water.

FIGURE 1



Name processes A and B. [2 marks]

A _____

_____

_____

B _____

_____

_____

Water vapour precipitates as rain.

0 1 . 6

Name ONE other form of precipitation of water from the atmosphere.

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

_____

_____

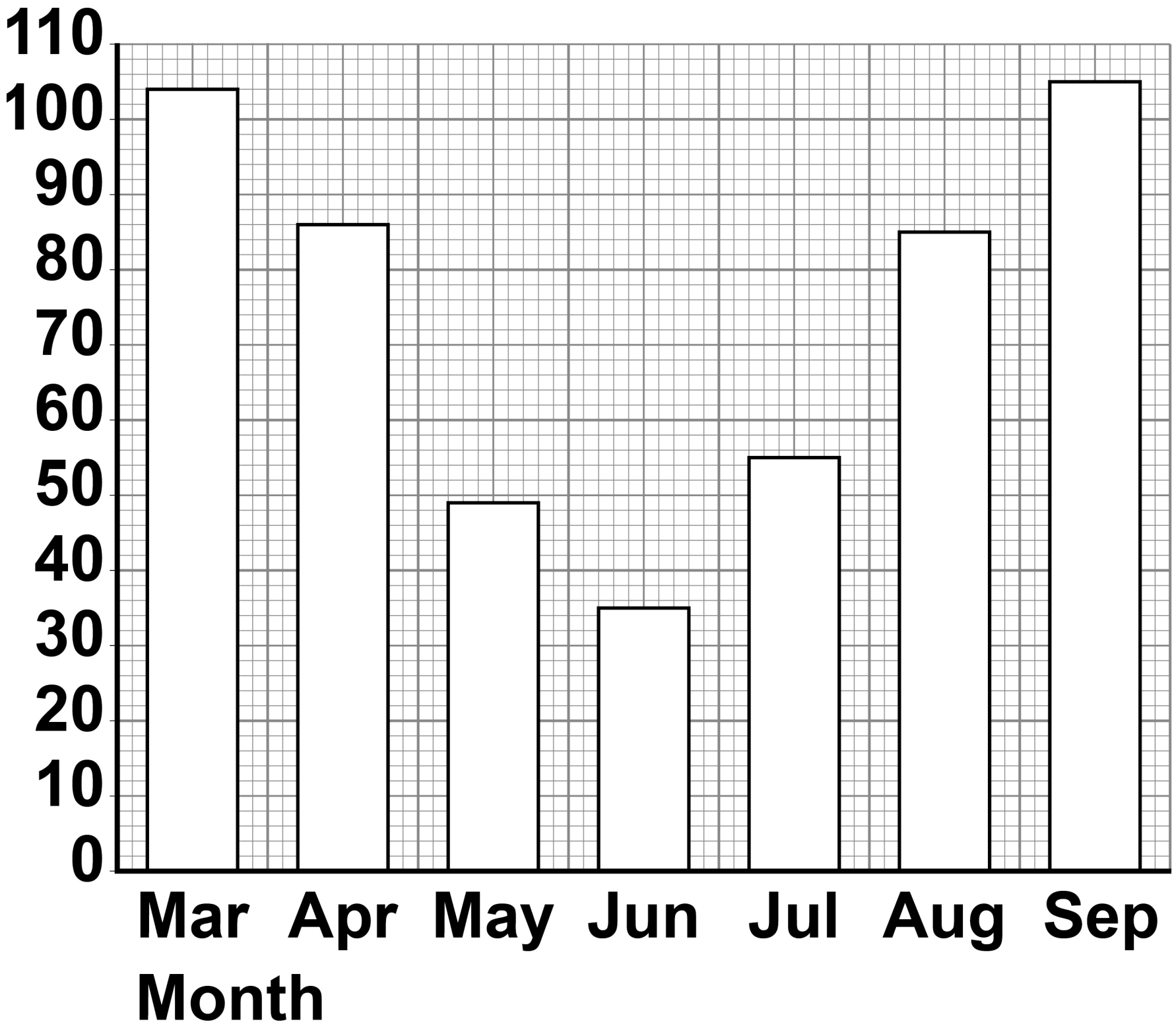
FIGURE 2, on the opposite page, shows the rainfall from March to September in the UK.

0 1 . 7

What was the rainfall in the month of April? [1 mark]

Rainfall = _____ mm

FIGURE 2



KEY

Mar = March
Apr = April
May = May
Jun = June
Jul = July
Aug = August
Sep = September

[Turn over]

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0 1 . 8

Describe the pattern in rainfall between March and September.

Include data from FIGURE 2, on page 15, in your answer. [2 marks]

0 2

FIGURE 3 shows a food chain.

FIGURE 3

0 2 . 1

Draw ONE line from each description to the organism in the food chain. [3 marks]

Description	Organism in the food chain
Primary consumer	Algae
Producer	Crab
Tertiary consumer	Shark
	Loggerhead turtle

0 2 . 2

Which word describes the total number of crabs in this habitat? [1 mark]

Tick (✓) ONE box.

- ☐ **Population**
- ☐ **Predator**
- ☐ **Species**

REPEAT OF FIGURE 3

Algae → Crab → Loggerhead turtle → Shark

0 2 . 3

Explain what will happen to the number of loggerhead turtles if there are fewer crabs.

Use information from FIGURE 3.
[2 marks]

0 2 . 4

What type of factor is a new predator?
[1 mark]

Tick (✓) ONE box.

- ☐ **Abiotic**
- ☐ **Biotic**
- ☐ **Control**

Female loggerhead turtles lay their eggs on sandy beaches.

0 2 . 5

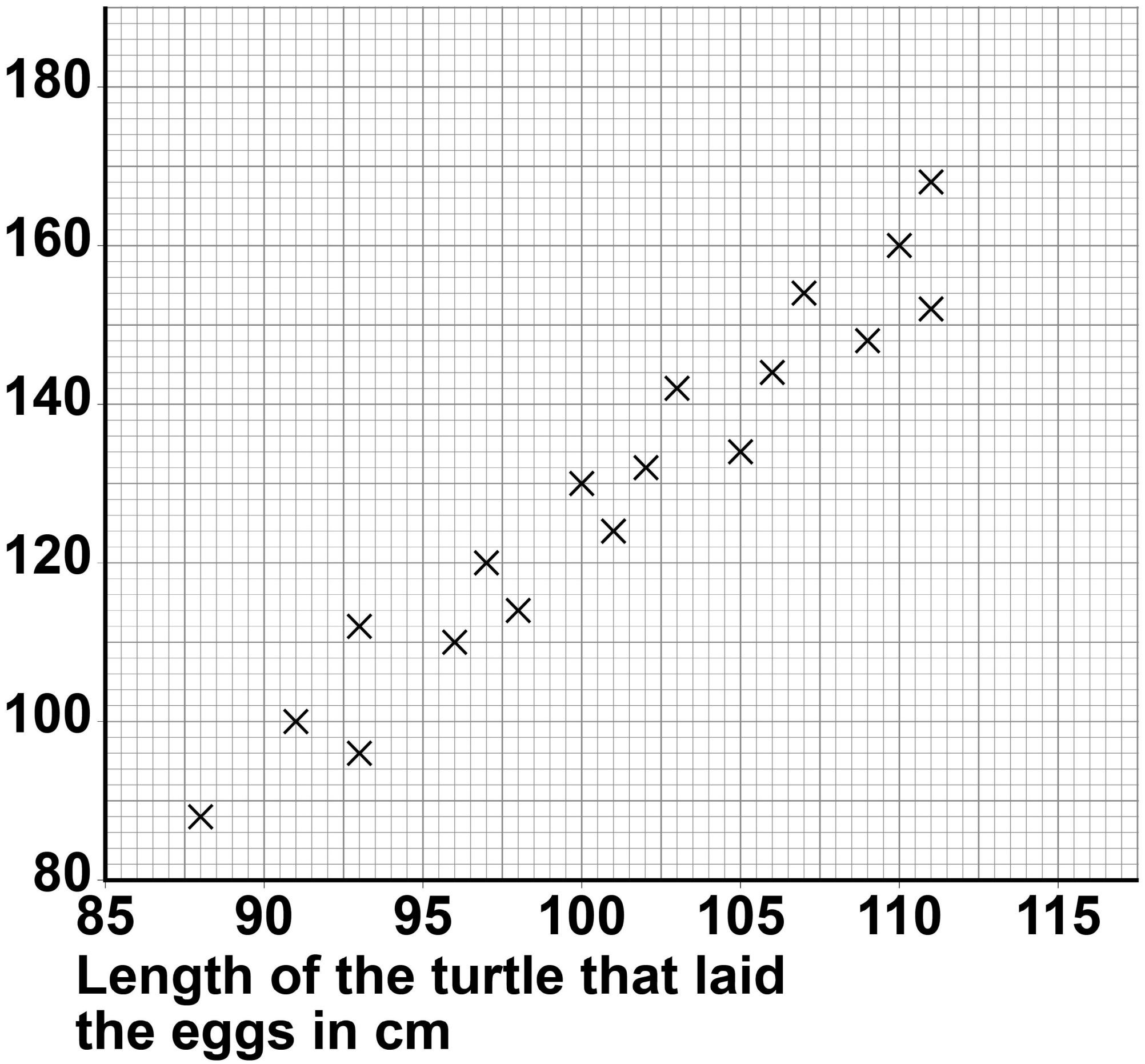
Scientists recorded data about turtles on one beach.

FIGURE 4, on the opposite page, shows:

- **the number of eggs each turtle laid**
- **the length of the turtle that laid the eggs.**

Describe the trend in the data on FIGURE 4. [1 mark]

FIGURE 4



[Turn over]

0 2 . 6

Female loggerhead turtles return to the same beach each year to lay their eggs.

Global warming is causing the sea level to rise.

Explain the effect that sea levels rising might have on the number of loggerhead turtles. [2 marks]

Greenhouse gases are one cause of global warming.

0 2 . 7

Methane is a greenhouse gas.

The concentration of methane in the atmosphere was:

- **720 arbitrary units in 1840**
- **1872 arbitrary units in 2018.**

How many times greater was the concentration of methane in the atmosphere in 2018 than in 1840?
[1 mark]

Number of times greater = _____

[Turn over]

0 2 . 8

Which TWO human activities cause an increase in greenhouse gases in the atmosphere? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Burning wood on a fire**
- ☐ **Planting trees in new areas**
- ☐ **Switching off lights in the home**
- ☐ **Travelling by aeroplane**
- ☐ **Using wind turbines to generate electricity**

13

0 3

Diabetes is a condition where the concentration of sugar in the blood can become too high.

0 3 . 1

Which chemical decreases the concentration of sugar in the blood? [1 mark]

Tick (✓) ONE box.

☐ **Glucose**

☐ **Glycogen**

☐ **Insulin**

[Turn over]

0 3 . 2

Which organ monitors and controls the concentration of sugar in the blood?
[1 mark]

Tick (✓) ONE box.

- ☐ **Kidney**
- ☐ **Pancreas**
- ☐ **Stomach**

A company produces two breakfast cereals.

In a 30 g serving:

- **cereal A contains 11 g of sugar**
- **cereal B contains 25% less sugar than cereal A.**

0 3 . 3

Calculate 25% of 11 g [2 marks]

25% of 11 g = _____ g

0 3 . 4

Calculate the mass of sugar in a 30 g serving of cereal B.

Use your answer from Question 03.3.

[1 mark]

Mass of sugar = _____ g

[Turn over]

0 3 . 5

Decreasing sugar in the diet can help prevent Type 2 diabetes.

Give ONE other health benefit of eating less sugar. [1 mark]

BLANK PAGE

[Turn over]

0 3 . 6

Taking regular exercise can improve health.

TABLE 2 shows how walking quickly or running may reduce the risk of developing different medical conditions.

The greater the percentage reduction in risk, the less chance there is of developing the medical condition.

TABLE 2

Medical condition	Percentage (%) reduction in risk of developing the medical condition	
	Walking quickly	Running
Coronary heart disease	9.3	4.5
Diabetes	12.3	12.1
High cholesterol	7.0	4.3

Compare the effects of walking quickly with the effects of running on the medical conditions given in TABLE 2. [4 marks]

10

BLANK PAGE

0 4

This question is about breathing and respiration.

0 4 . 1

What is the equation for aerobic respiration? [1 mark]

Tick (✓) ONE box.

☐ **glucose + oxygen ⟶ carbon dioxide + water**

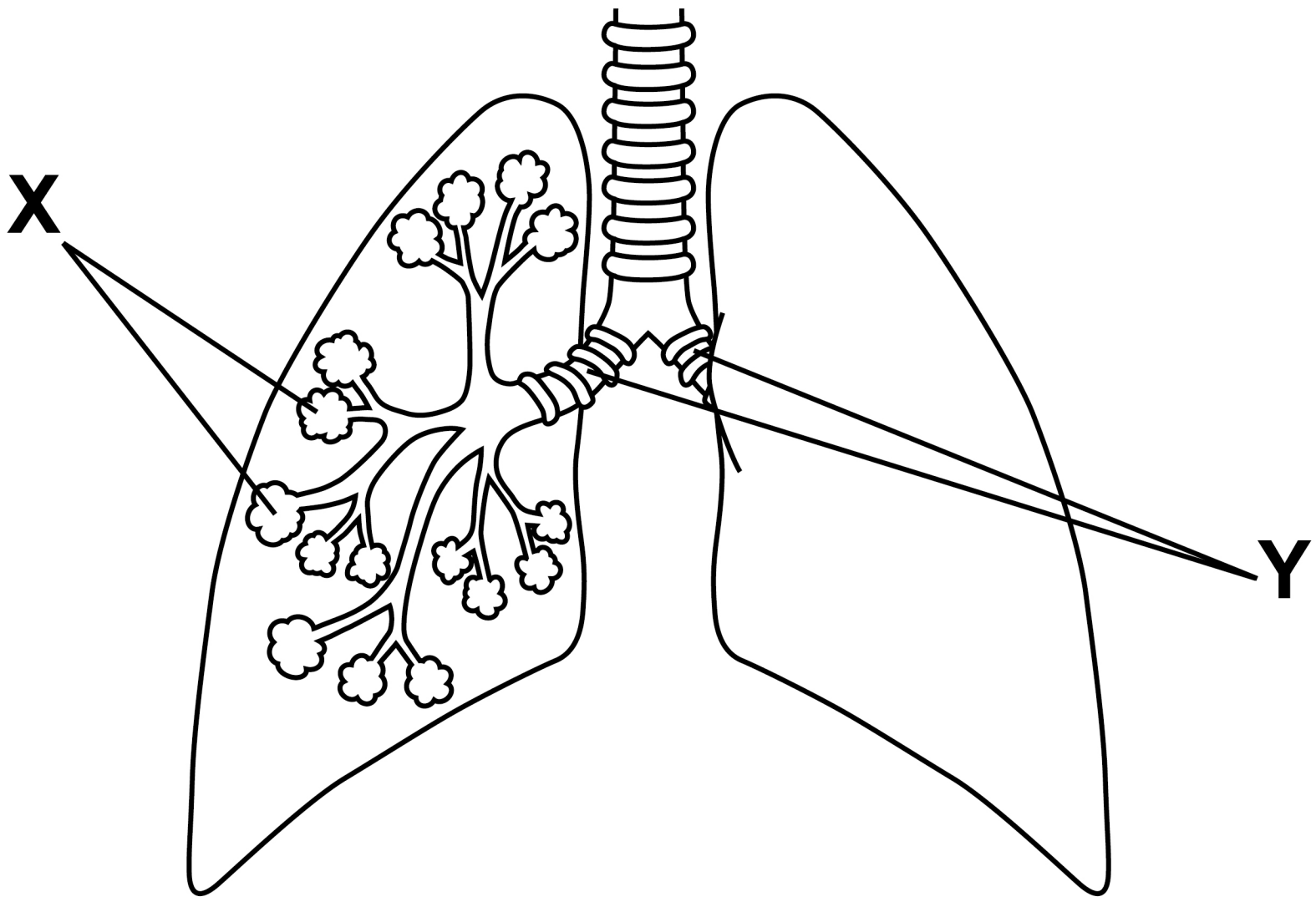
☐ **oxygen + water ⟶ carbon dioxide + glucose**

☐ **water + glucose ⟶ carbon dioxide + oxygen**

[Turn over]

FIGURE 5 shows part of the human breathing system.

FIGURE 5



0 4 . 2

Name X and Y shown in FIGURE 5.

Choose answers from the list. [2 marks]

- **alveoli**
- **arteries**

- bronchi
- capillaries
- neurones

X _____

Y _____

0 4 . 3

Structure X has adaptations for efficient gas exchange.

Give ONE adaptation of structure X.
[1 mark]

_____

_____

_____

[Turn over]

FIGURE 6 shows a person using a peak flow meter.

FIGURE 6

Peak flow is how quickly air can be breathed out of the lungs.

TABLE 3, on the opposite page, shows the peak flow of four students.

TABLE 3

Student	Peak flow in arbitrary units
A	470
B	515
C	260
D	420

[Turn over]

BLANK PAGE

Asthma is a condition that causes the muscles in the walls of the airways to contract.

0 4 . 4

What effect will the contracting muscles have on the size of the airways? [1 mark]

Tick (✓) ONE box.

☐ **Lengthen the airways**

☐ **Narrow the airways**

☐ **Stretch the airways**

☐ **Widen the airways**

[Turn over]

REPEAT OF TABLE 3

Student	Peak flow in arbitrary units
A	470
B	515
C	260
D	420

0 4 . 5

Which student in TABLE 3, on page 42, is most likely to have asthma? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

REPEAT OF TABLE 3

Student	Peak flow in arbitrary units
A	470
B	515
C	260
D	420

0 4 . 6

TABLE 3 shows that each student has a different peak flow.

Suggest TWO factors that may affect peak flow.

Do NOT refer to asthma in your answer.
[2 marks]

1 _____

_____

_____

2 _____

_____

[Turn over]

0 4 . 7

A student measured her breathing rate before exercise and after exercise.

TABLE 4 shows the results.

TABLE 4

	Breathing rate in breaths per minute
Before exercise	15
After exercise	41

Explain the effect of exercise on breathing rate. [2 marks]

10

0 5

This question is about contraception.

0 5 . 1

On the opposite page, draw ONE line from each method of contraception to how the method works. [3 marks]

Method of contraception	How the method works
	Uses hormones to stop the egg maturing
Condom	Prevents sperm from reaching the egg
IUD (intrauterine device)	Prevents the embryo from implanting
Oral contraceptive pill	Slows down the production of sperm

[Turn over]

0 5 . 2

Which method of contraception can protect against sexually transmitted diseases? [1 mark]

Tick (✓) ONE box.

- ☐ **Condom**
- ☐ **IUD**
- ☐ **Oral contraceptive pill**

0 5 . 3

The oral contraceptive pill has to be taken every day to be effective.

Suggest ONE reason why a woman taking the oral contraceptive pill may become pregnant. [1 mark]

_____

_____

_____

0 5 . 4

Surgical sterilisation is another method of contraception.

Suggest ONE disadvantage of surgical sterilisation compared with taking the oral contraceptive pill. [1 mark]

0 5 . 5

Suggest TWO reasons why a man and a woman in a sexual relationship might choose NOT to use contraception.

Do NOT refer to surgical sterilisation in your answer. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

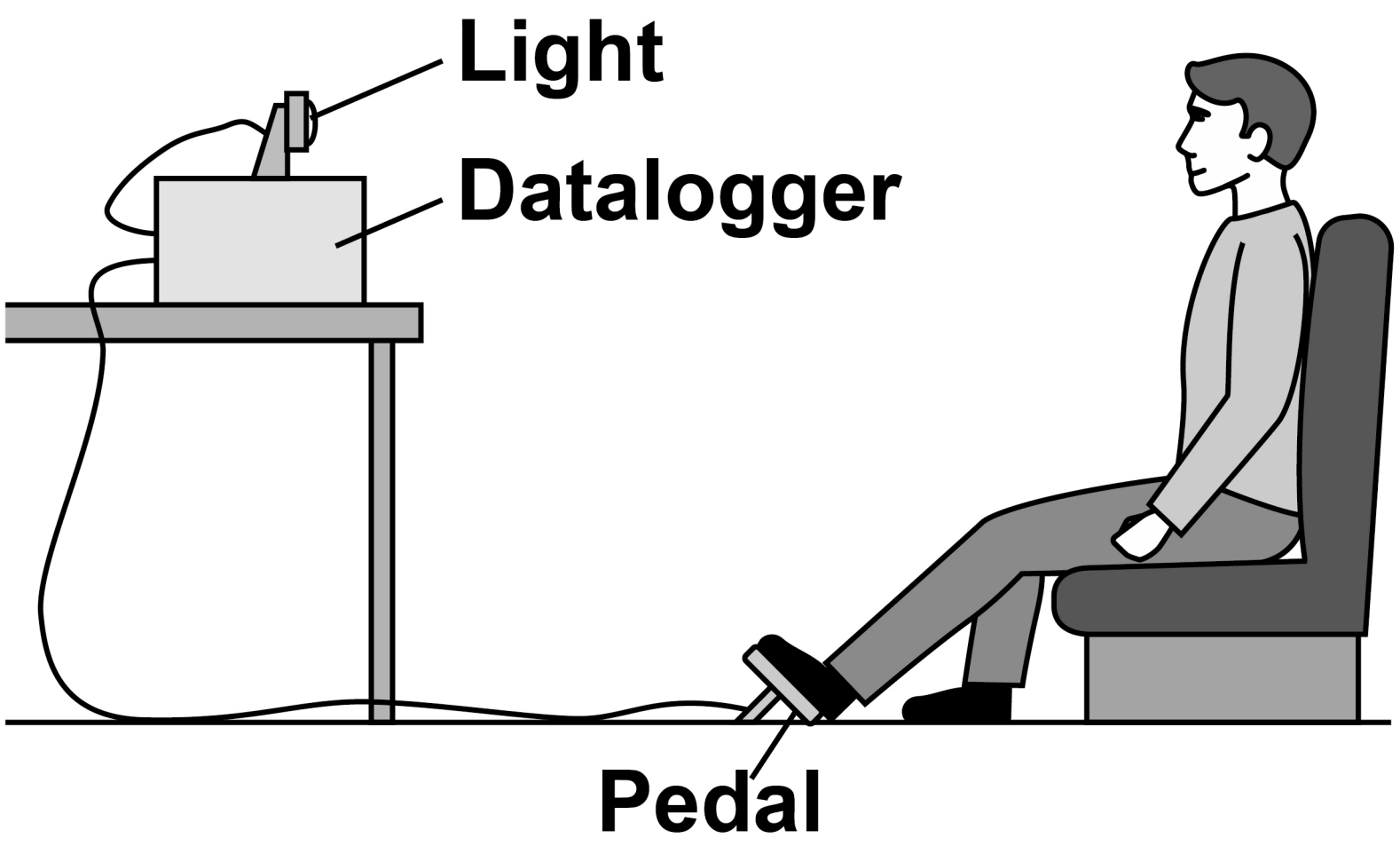
8

0 6

Four students investigated their reaction times.

FIGURE 7 shows the equipment the students used.

FIGURE 7



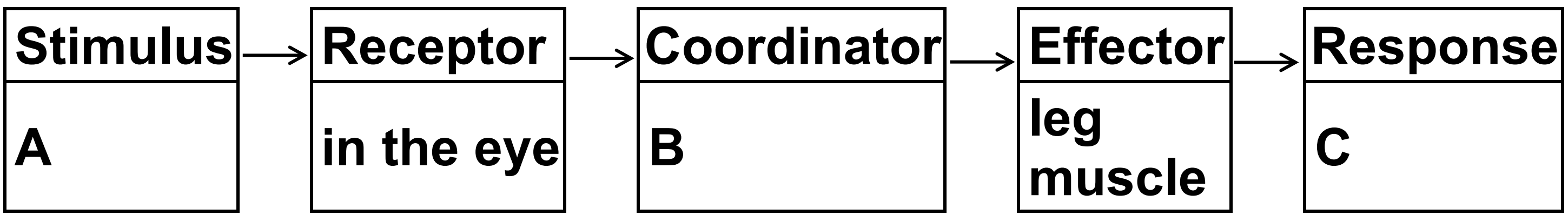
This is the method used.

1. Place one foot on the pedal.
2. When the light turns on, press the pedal as quickly as possible.
3. Record the time shown on the datalogger.
4. Repeat steps 1 to 3 another three times.
5. Repeat steps 1 to 4 with each student.

[Turn over]

FIGURE 8 shows information about the coordination of the action in this investigation.

FIGURE 8



0 6 . 1

What is stimulus A in FIGURE 8? [1 mark]

Tick (✓) ONE box.

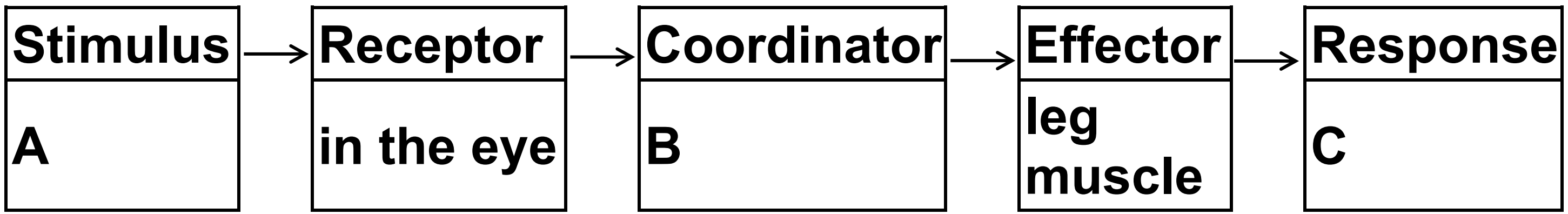
☐ **Chemical**

☐ **Light**

☐ **Sound**

[Turn over]

REPEAT OF FIGURE 8



0 6 . 2

What is coordinator B in FIGURE 8? [1 mark]

Tick (✓) ONE box.

☐ **Brain**

☐ **Sensory neurone**

☐ **Synapse**

0 6 . 3

What is the response C in FIGURE 8? [1 mark]

_____

_____

[Turn over]

TABLE 5 shows the results for each student.

TABLE 5

Student	Student age in years	Reaction time in seconds			
		Test 1	Test 2	Test 3	Test 4
A	11	0.74	0.72	0.71	0.71
B	14	0.80	0.79	0.78	0.76
C	15	0.85	0.84	0.83	0.82
D	16	0.87	0.86	0.99	0.84

0 6 . 4

Draw a ring around the anomalous result for student D in TABLE 5. [1 mark]

0 6 . 5

What should the students do with the anomalous result? [1 mark]

0 6 . 6

Suggest what might cause an anomalous result in this reaction time investigation. [1 mark]

[Turn over]

0 6 . 7

Give TWO conclusions about reaction time from the results in TABLE 5, on page 60. [2 marks]

1

2

0 6 . 8

Suggest TWO ways the investigation could be improved to produce valid results. [2 marks]

1 _____

_____

2 _____

_____

_____

[Turn over]

10

0 7

A plant shoot is made of several tissues.

0 7 . 1

What is a tissue? [1 mark]

Tick (✓) ONE box.

- ☐ **A group of organs with one function**
- ☐ **Cells with a similar structure and function**
- ☐ **The organ systems in an organism**

0 7 . 2

What is the name of the tissue at the growing tip of a plant shoot? [1 mark]

Tick (✓) ONE box.

- ☐ **Meristem**
- ☐ **Phloem**
- ☐ **Xylem**

0 7 . 3

Plant cells divide by mitosis so that the plant can grow.

Give ONE other reason plant cells divide by mitosis.

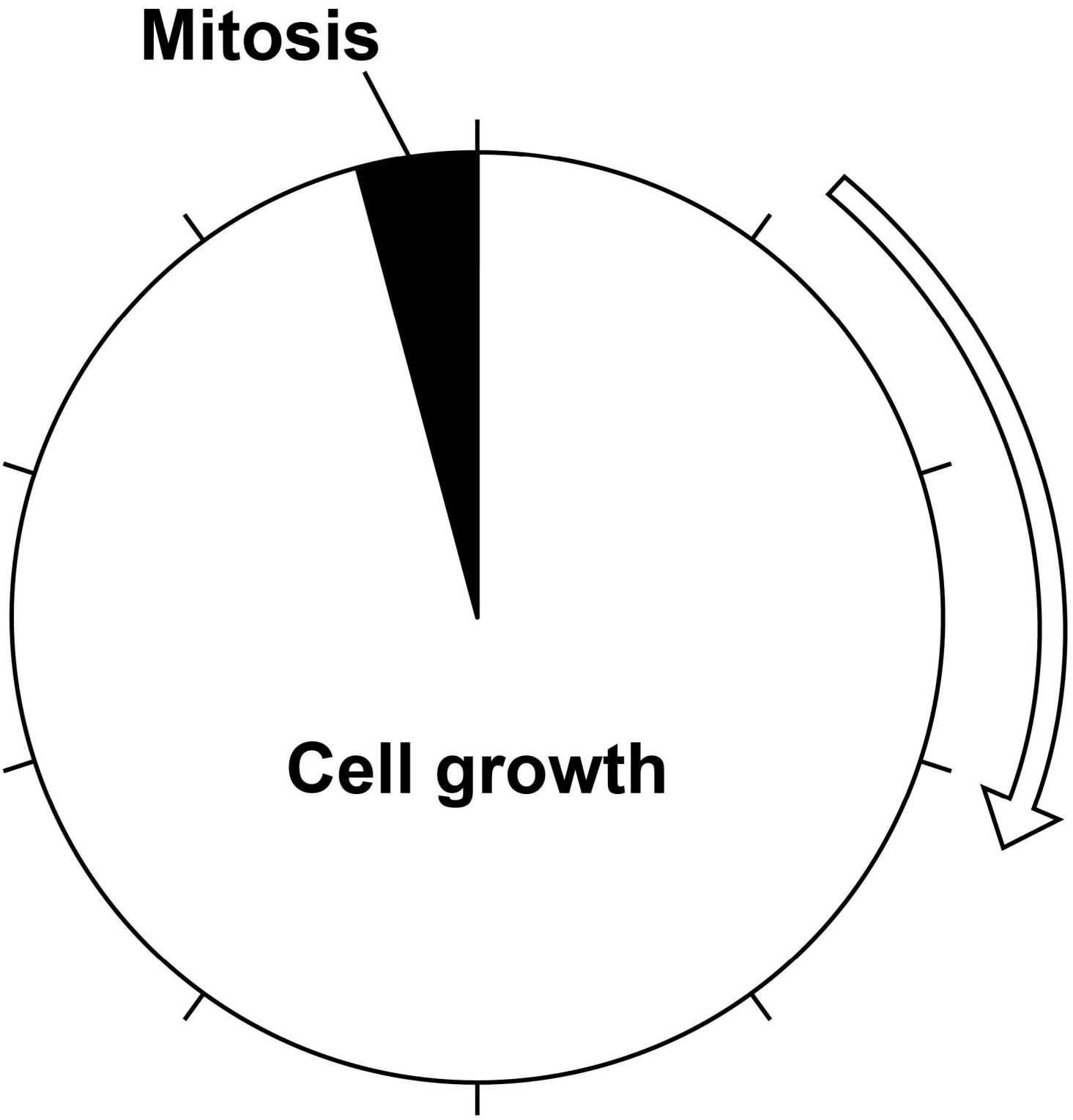
Do NOT refer to growth in your answer.
[1 mark]

BLANK PAGE

[Turn over]

FIGURE 9 shows a cell cycle.

FIGURE 9



0 7 . 4

Which TWO processes happen during cell growth in the cell cycle? [2 marks]

Tick (✓) TWO boxes.

- ☐ **The chromosomes are copied**
- ☐ **The chromosomes separate**
- ☐ **The cytoplasm divides in two**
- ☐ **The nucleus divides**
- ☐ **The organelles increase in number**

[Turn over]

0 7 . 5

In mitosis and meiosis cells divide to produce new cells.

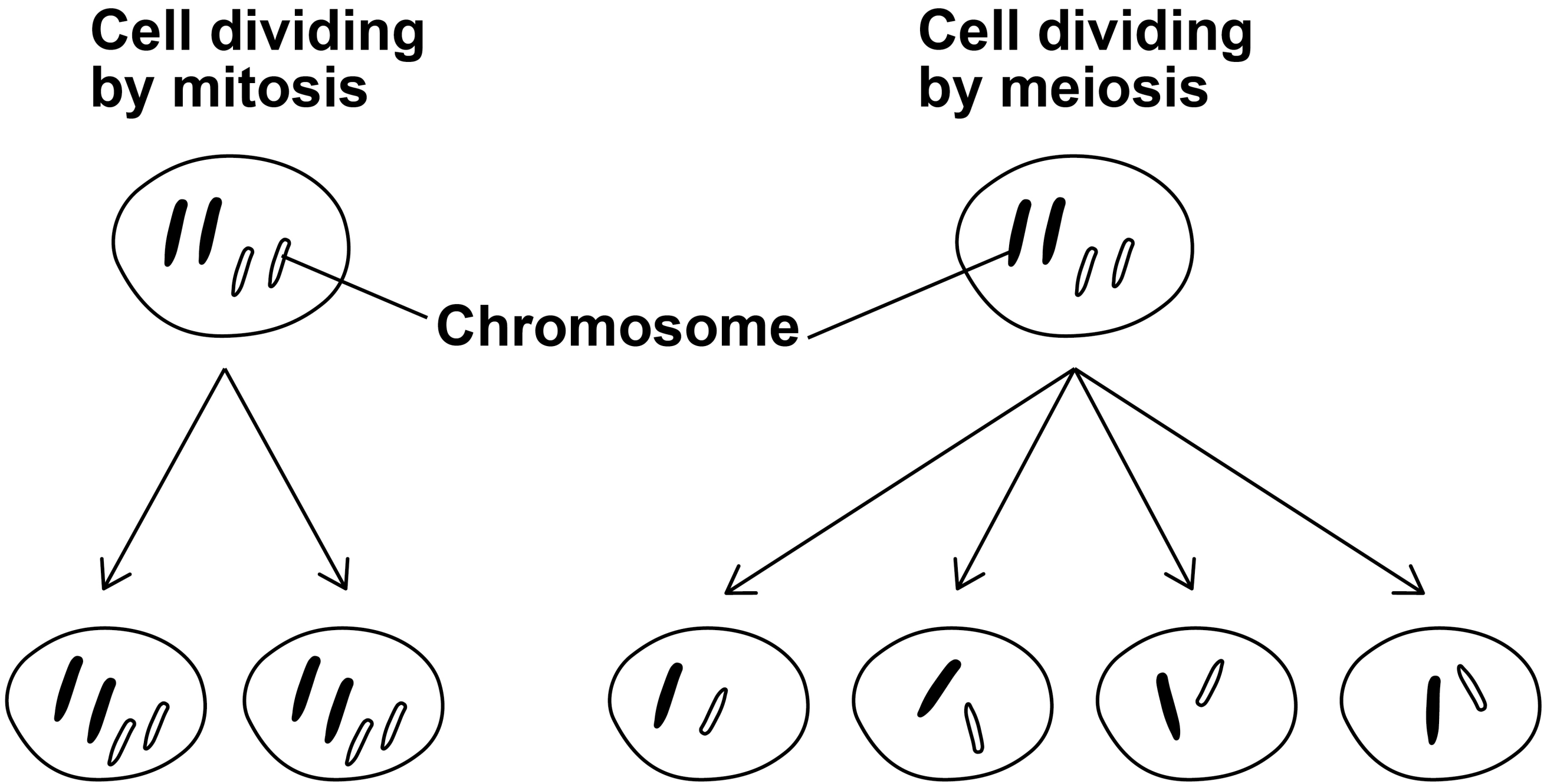
Cell division by meiosis produces gametes.

FIGURE 10, on page 70, shows a cell dividing by mitosis and a different cell dividing by meiosis.

BLANK PAGE

[Turn over]

FIGURE 10


Cell dividing by mitosis
Cell dividing by meiosis
Chromosome

Describe how the cells produced by mitosis are different from the cells produced by meiosis.

Use information from FIGURE 10. [3 marks]

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 7 . 6

A scientist investigated cell division in the growing tip of a plant shoot.

The scientist recorded data at different distances from the tip of the shoot.

TABLE 6 shows the results.

TABLE 6

Distance from shoot tip in mm	Mean cell length in µm	Percentage (%) of cells dividing
5	22	13
10	23	9
20	39	4
30	77	0
40	116	0

Give TWO conclusions from the data in TABLE 6. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

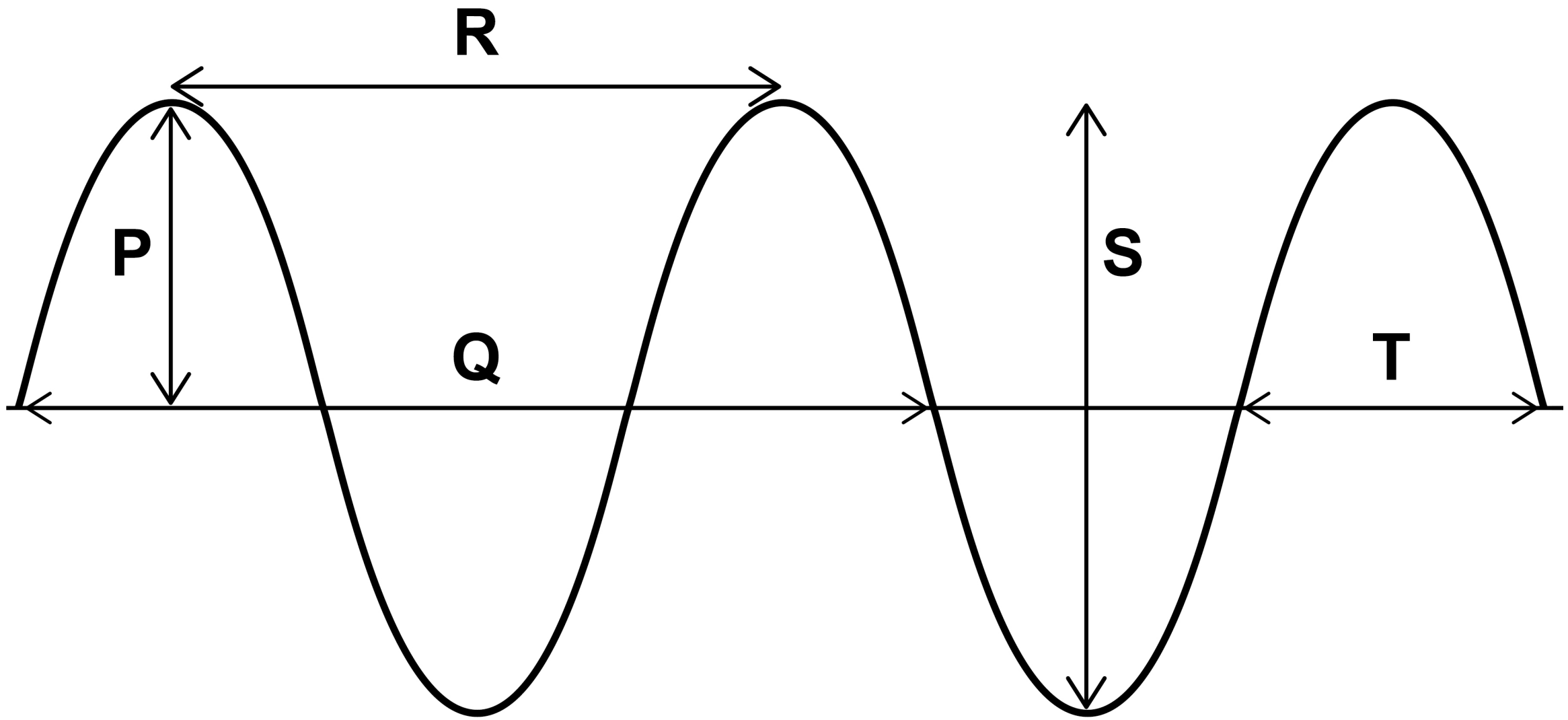
[Turn over]

10

0 8

FIGURE 11 shows a transverse wave.

FIGURE 11



0 8 . 1

Which arrow shows the amplitude of the wave? [1 mark]

Tick (✓) ONE box.

☐ **P**

☐ **Q**

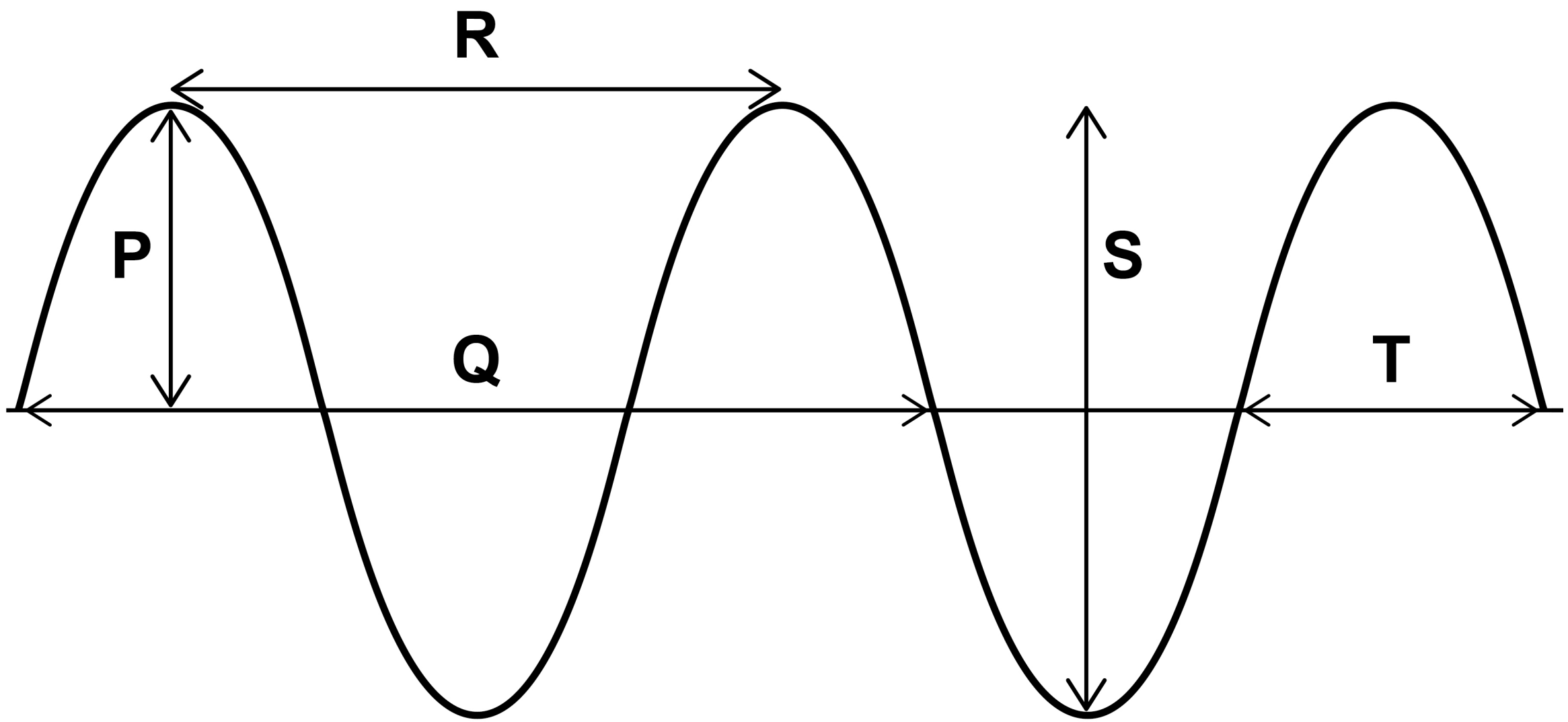
☐ **R**

☐ **S**

☐ **T**

[Turn over]

REPEAT OF FIGURE 11



78

0 8 . 2

Which arrow shows the wavelength of the wave? [1 mark]

Tick (✓) ONE box.

☐ **P**

☐ **Q**

☐ **R**

☐ **S**

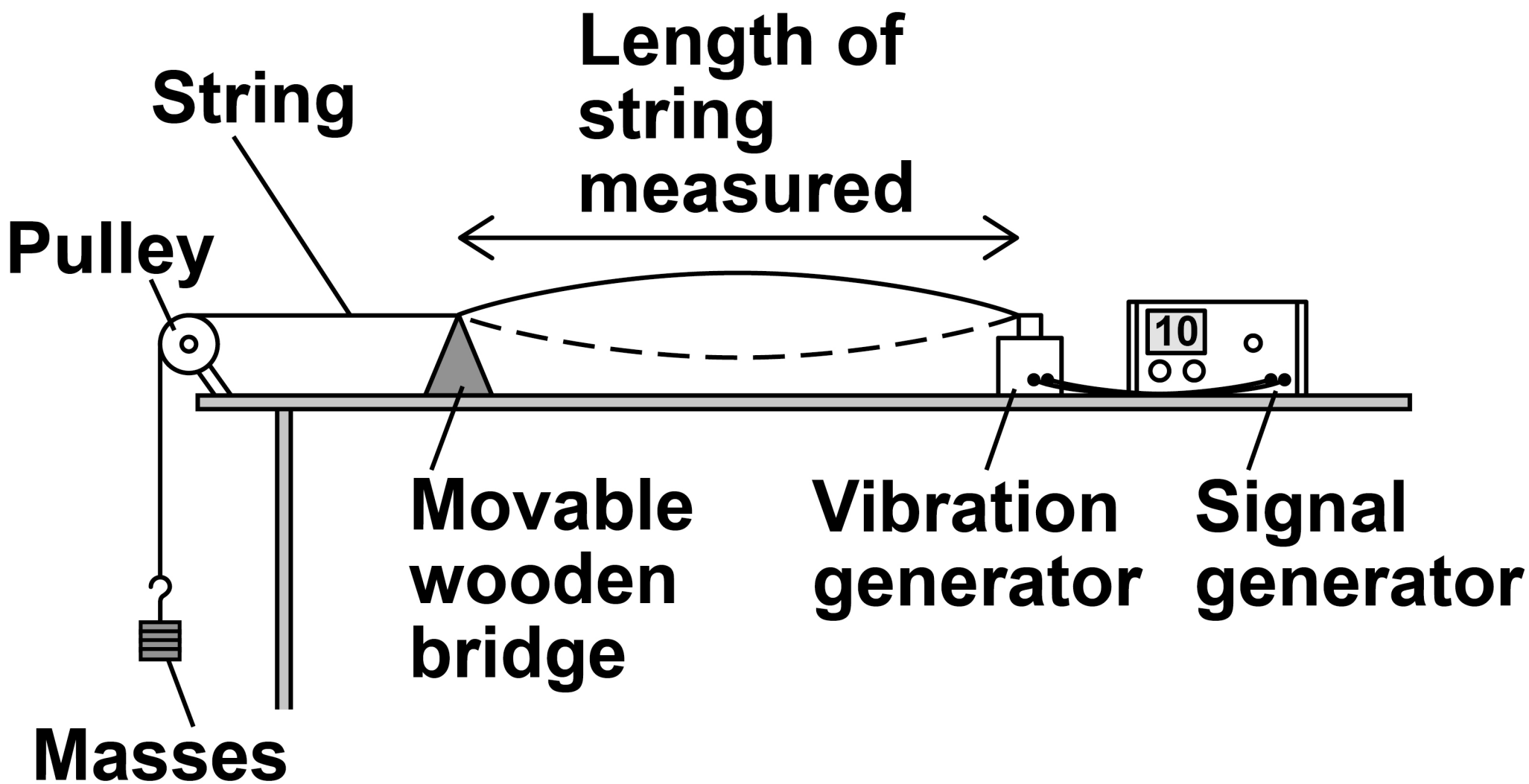
☐ **T**

[Turn over]

A teacher demonstrated waves on a string.

FIGURE 12 shows the apparatus used.

FIGURE 12



This is the method used.

1. Switch on the signal generator and vibration generator so the string vibrates up and down.
2. Move the wooden bridge until a clear wave pattern is formed between the wooden bridge and the vibration generator.
3. Use a metre rule to measure the length of the string between the wooden bridge and the vibration generator.
4. Record the frequency of the wave from the signal generator.
5. Record the number of loops in the wave pattern. The wave pattern shown in FIGURE 12 has one loop.
6. Change the frequency on the signal generator until a new wave pattern is formed.
7. Repeat steps 4 to 6.

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82

0 8 . 3

Give ONE control variable in this demonstration. [1 mark]

[Turn over]

0 8 . 4

The length of the string between the vibration generator and the wooden bridge was about 1.5 m

The teacher used a metre rule to measure the length of the string.

Suggest TWO reasons why making an accurate measurement was difficult. [2 marks]

1 _____

_____

2 _____

_____

BLANK PAGE

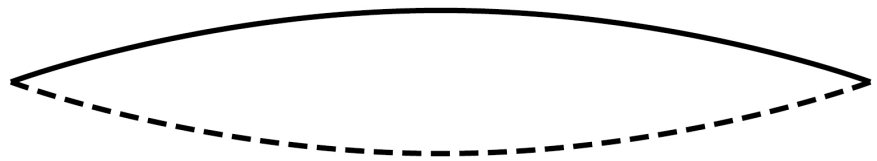
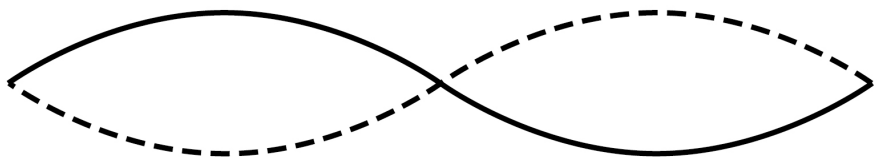
[Turn over]

TABLE 7, on the opposite page, shows the results.

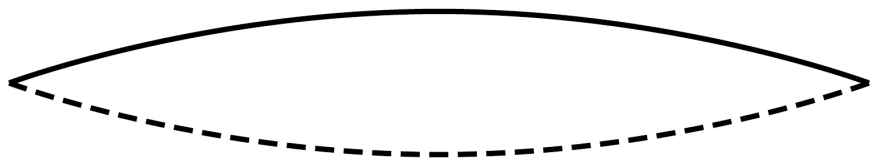
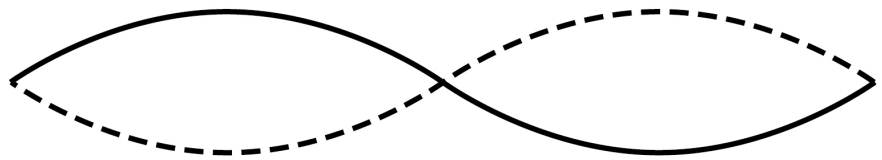
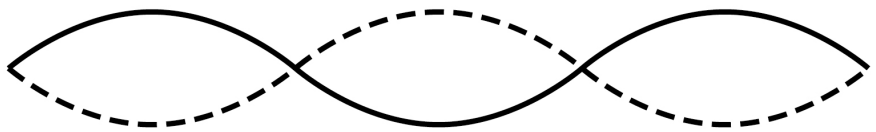
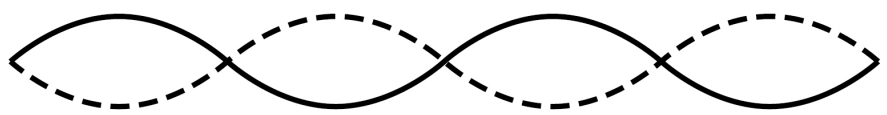
0 8 . 5

Give ONE conclusion about frequency and wavelength from the data in TABLE 7. [1 mark]

TABLE 7

Frequency in Hz	Wave pattern on 1.50 m string	Number of loops in wave pattern	Wave-length in m
10		1	3.00
20		2	1.50
30		3	1.00
40		4	0.75
50		5	X

REPEAT OF TABLE 7

Frequency in Hz	Wave pattern on 1.50 m string ⟷	Number of loops in wave pattern	Wave-length in m
10		1	3.00
20		2	1.50
30		3	1.00
40		4	0.75
50		5	X

0 8 . 6

Each loop of the wave pattern is the length of half a wavelength.

Determine wavelength X in TABLE 7. [2 marks]

Wavelength X = _____ m

[Turn over]

0 8 . 7

Calculate the period of the wave when the frequency was 30 Hz

Give your answer to 2 significant figures.

Use the Physics Equations Sheet. [3 marks]

Period (2 significant figures) = _____ s

0 9

Plants absorb light to photosynthesise.

0 9 . 1

Complete the word equation for photosynthesis. [1 mark]

_____ **+ water** ⟶

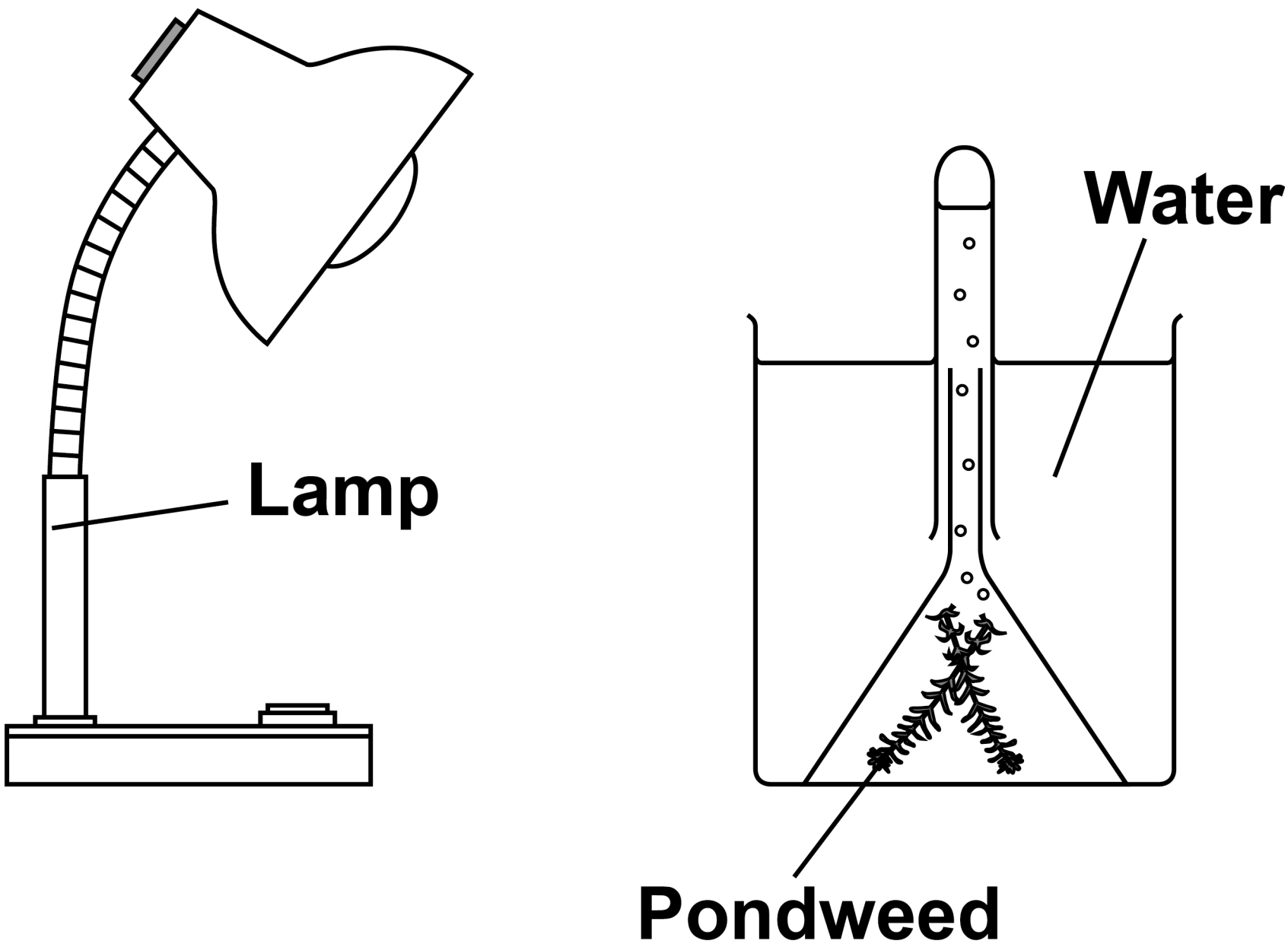
_____ **+ glucose**

[Turn over]

Light intensity affects the rate of photosynthesis.

FIGURE 13 shows some of the equipment used to measure the rate of photosynthesis.

FIGURE 13



0 9 . 2

Describe a method to investigate the effect of light intensity on the RATE of photosynthesis.

Use the equipment in FIGURE 13 and other laboratory equipment. [6 marks]

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[Turn over]

Algal cells photosynthesise.

Scientists investigated the effect of light intensity on algal cells.

The algal cells were placed in different light intensities.

TABLE 8 shows the number of EXTRA algal cells after two days.

TABLE 8

Light intensity in lux	Number of EXTRA algal cells after two days
0	no extra cells
250	1.00×10^6
500	1.65×10^6
750	2.15×10^6
1000	2.40×10^6
1250	2.50×10^6
1500	2.50×10^6

0 9 . 3

The initial number of algal cells was 200 000

Calculate the total number of algal cells after two days when the light intensity was 500 lux [2 marks]

Total number of algal cells =

0 9 . 4

Plot the data from TABLE 8 on FIGURE 14.

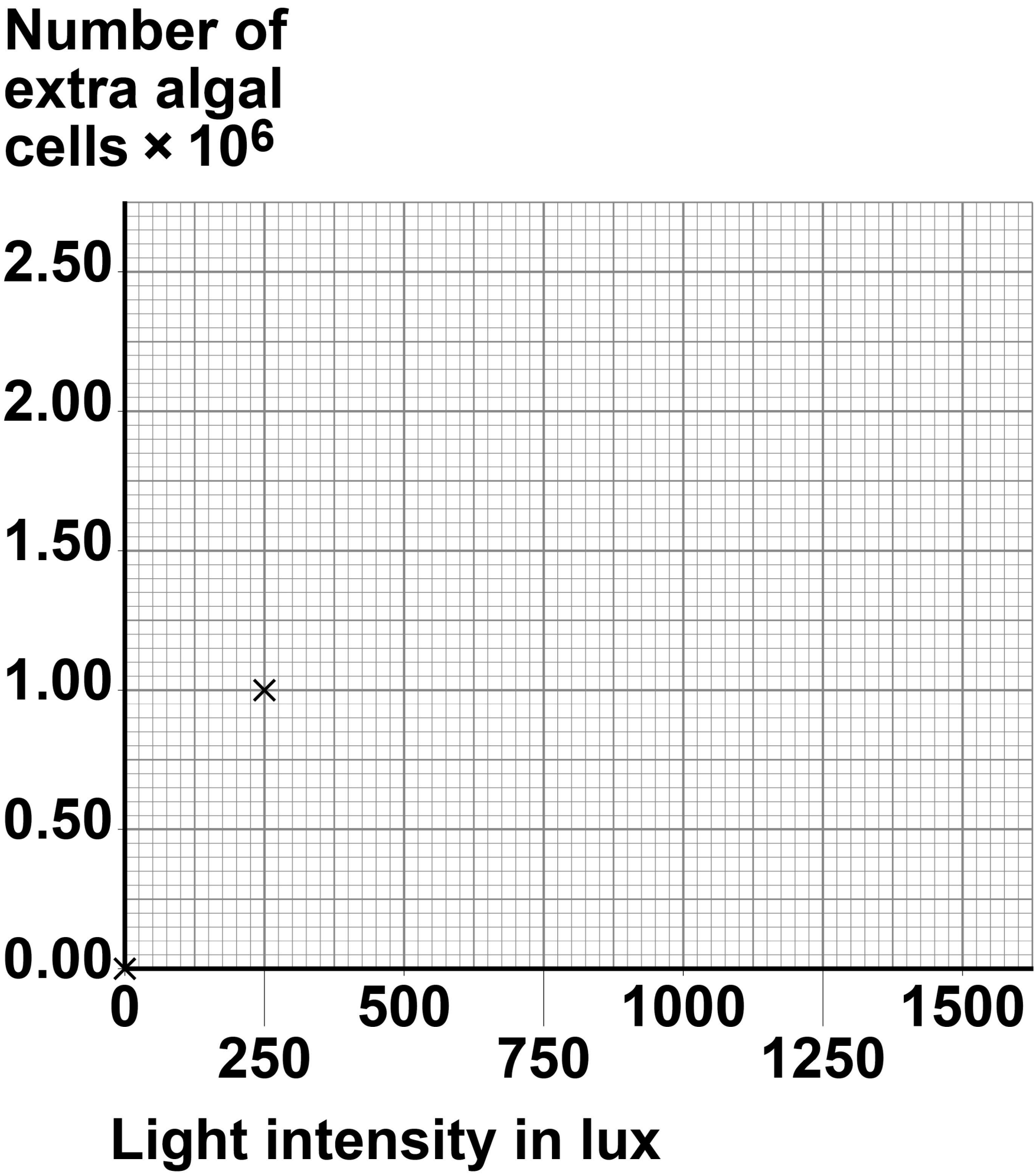
The first two points have been plotted.

Draw a line of best fit on the opposite page. [3 marks]

REPEAT OF TABLE 8

Light intensity in lux	Number of EXTRA algal cells after two days
0	no extra cells
250	1.00×10^6
500	1.65×10^6
750	2.15×10^6
1000	2.40×10^6
1250	2.50×10^6
1500	2.50×10^6

FIGURE 14



[Turn over]

0 9 . 5

Give TWO conclusions from the results.

Use information from TABLE 8, on page 96. [2 marks]

1

2

0 9 . 6

Explain how an increase in temperature from 20 °C to 25 °C would affect the number of algal cells. [2 marks]

END OF QUESTIONS

16

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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