AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY

F

Foundation Tier Paper 2 Life and Environmental Sciences

Wednesday 20 May 2020 Afternoon Time allowed: 1 hour 45 minutes

Materials

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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Do not write outside the box

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 ☐

0 1 . 2 What is value **X** in **Table 1**?

[1 mark]

Tick (✓) **one** box.

0.5% ☐ 1.0% ☐ 1.5% ☐ 4.5% ☐

Do not write outside the box

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 ☐

Question 1 continues on the next page

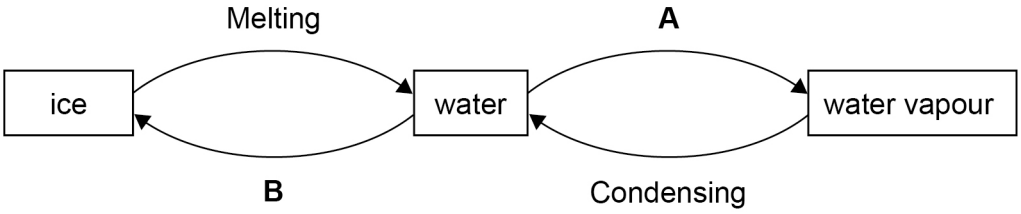
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One of the other gases in Earth's atmosphere today is water vapour.

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]

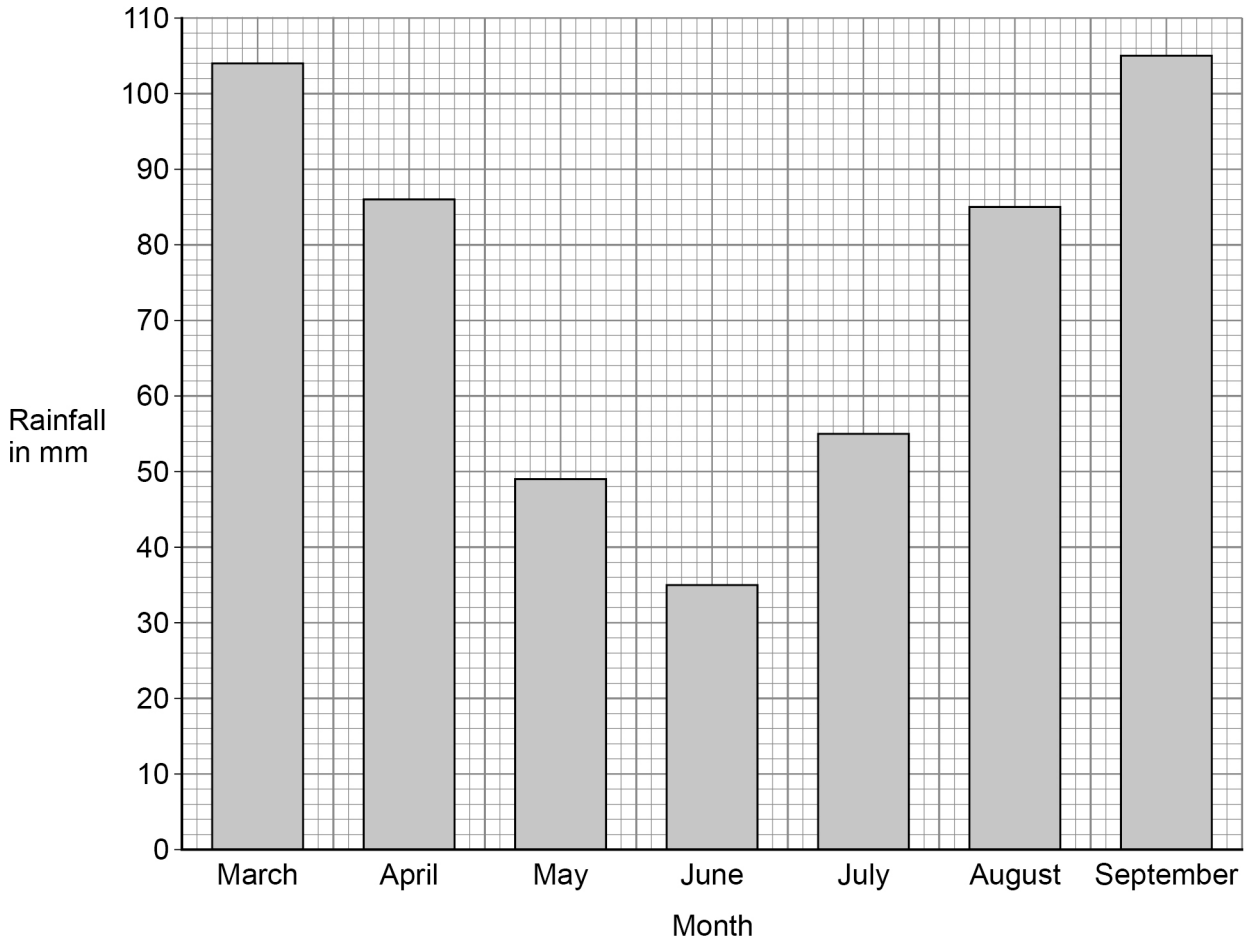
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Figure 2 shows the rainfall from March to September in the UK.

Figure 2



0 1 . 7 What was the rainfall in the month of April?

[1 mark]

Rainfall = _____ mm

0 1 . 8 Describe the pattern in rainfall between March and September.

Include data from **Figure 2** in your answer.

[2 marks]

_____

_____

_____

_____

12

Turn over ►

Do not write outside the box

0 2 **Figure 3** shows a food chain.

Figure 3

Algae ⟶ Crab ⟶ Loggerhead turtle ⟶ Shark

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 ☐

Do not write outside the box

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 ☐

Question 2 continues on the next page

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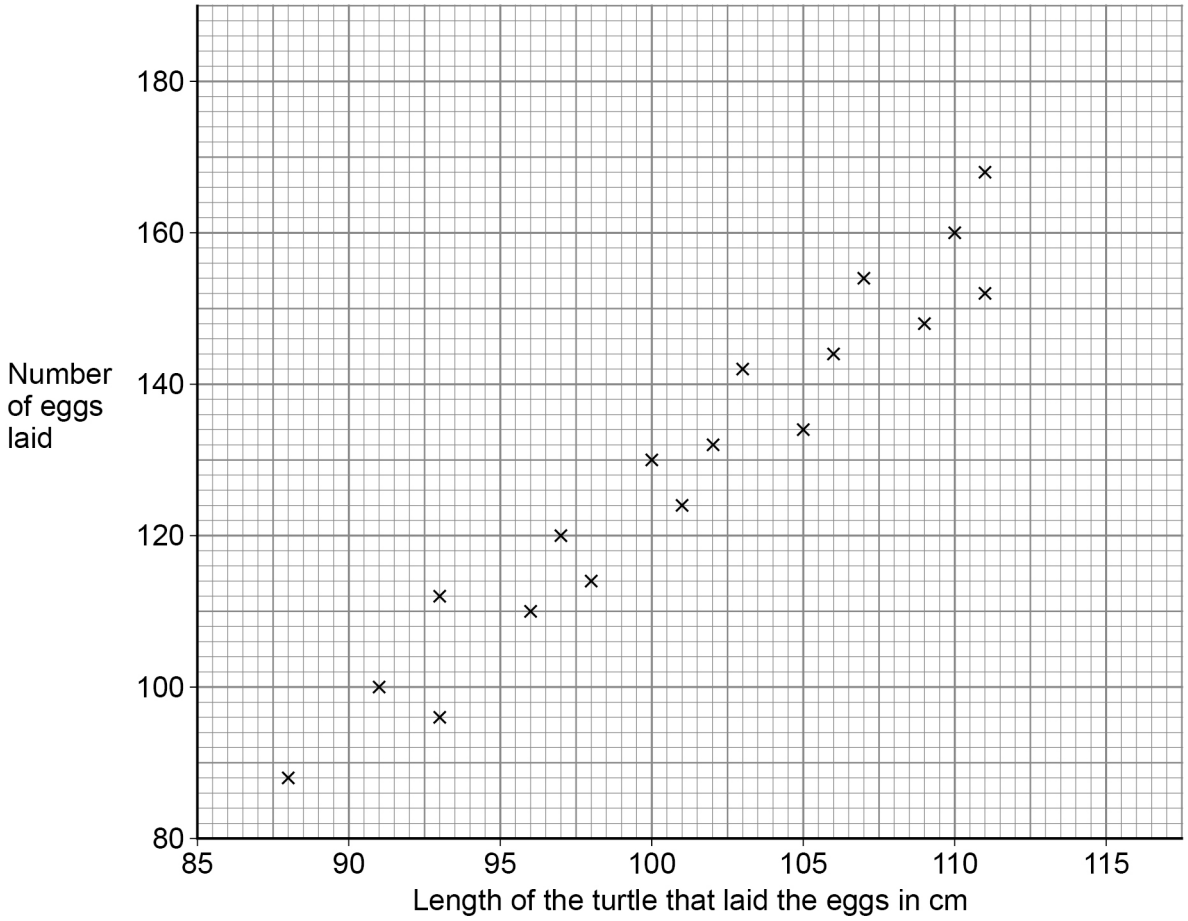
Female loggerhead turtles lay their eggs on sandy beaches.

0 2 . 5 Scientists recorded data about turtles on one beach.

Figure 4 shows:

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

Figure 4



Describe the trend in the data on **Figure 4**.

[1 mark]

Do not write outside the box

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 = _____

Question 2 continues on the next page

Do not write outside the box

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

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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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 ☐

0 3 . 2 Which organ monitors and controls the concentration of sugar in the blood?

[1 mark]

Tick (✓) **one** box.

Kidney ☐

Pancreas ☐

Stomach ☐

Do not write outside the box

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

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]

Question 3 continues on the next page

Do not write outside the box

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

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Turn over for the next question

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0 4 This question is about breathing and respiration.

0 4 . 1 What is the equation for aerobic respiration?

[1 mark]

Tick (✓) **one** box.

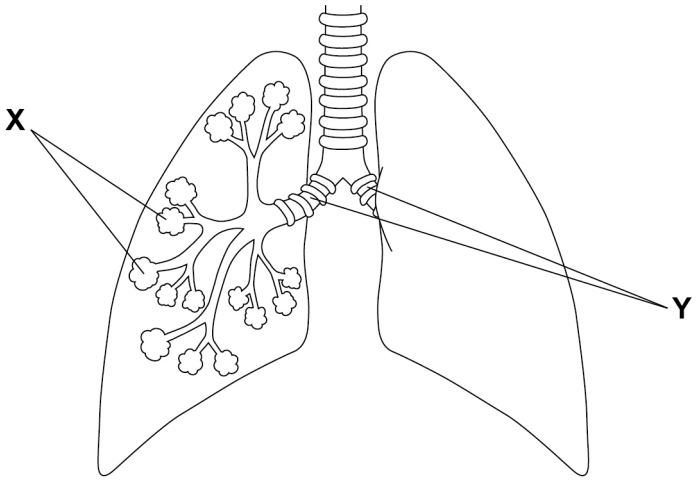
glucose + oxygen ⟶ carbon dioxide + water ☐

oxygen + water ⟶ carbon dioxide + glucose ☐

water + glucose ⟶ carbon dioxide + oxygen ☐

Figure 5 shows part of the human breathing system.

Figure 5



Do not write outside the box

0 4 . 2 Name **X** and **Y** shown in **Figure 5**.

Choose answers from the box.

[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]

_____

_____

Question 4 continues on the next page

Do not write outside the box

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 shows the peak flow of four students.

Table 3

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

Do not write outside the box

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 ☐

0 4 . 5 Which student in **Table 3** is most likely to have asthma?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

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 _____

_____

Question 4 continues on the next page

Do not write outside the box

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

Do not write outside the box

0 5 This question is about contraception.

0 5 . 1 Draw **one** line from each method of contraception to how the method works.

[3 marks]

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

0 5 . 2 Which method of contraception can protect against sexually transmitted diseases?

[1 mark]

Tick (✓) **one** box.

- Condom ☐
- IUD ☐
- Oral contraceptive pill ☐

Question 5 continues on the next page

Do not write outside the box

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

8

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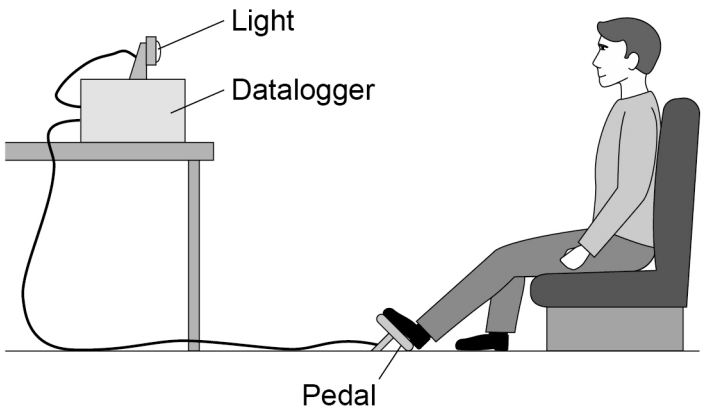
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ANSWER IN THE SPACES PROVIDED

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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.

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

Figure 8

Stimulus	Receptor	Coordinator	Effector	Response
A	in the eye	**B**	leg muscle	**C**

Do not write outside the box

0 6 . 1 What is stimulus **A** in **Figure 8**?

[1 mark]

Tick (✓) **one** box.

Chemical ☐

Light ☐

Sound ☐

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]

Question 6 continues on the next page

Do not write outside the box

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]

Do not write outside the box

0 6 . 7 Give **two** conclusions about reaction time from the results in **Table 5**.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 8 Suggest **two** ways the investigation could be improved to produce valid results.

[2 marks]

1 _____

_____

2 _____

_____

10

Turn over for the next question

Do not write outside the box

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.

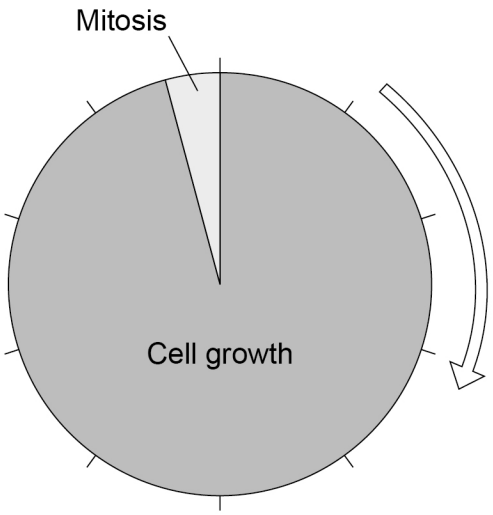
Do **not** refer to growth in your answer.

[1 mark]

Do not write outside the box

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 ☐

Question 7 continues on the next page

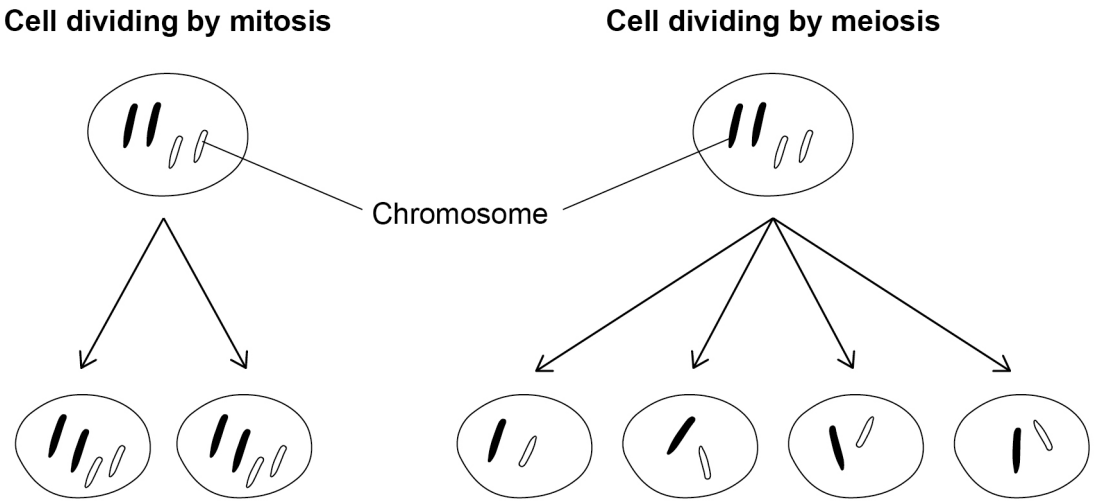
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0 7 . 5 In mitosis and meiosis cells divide to produce new cells.

Cell division by meiosis produces gametes.

Figure 10 shows a cell dividing by mitosis and a different cell dividing by meiosis.

Figure 10



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

Use information from **Figure 10**.

[3 marks]

Do not write outside the box

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 _____

_____

10

Turn over for the next question

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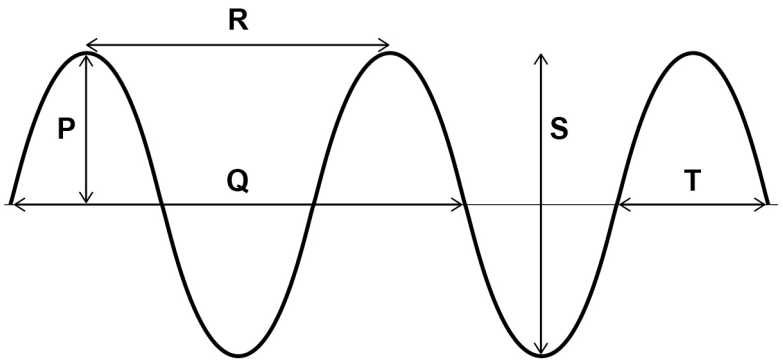
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ANSWER IN THE SPACES PROVIDED

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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** ☐

0 8 . 2 Which arrow shows the wavelength of the wave?

[1 mark]

Tick (✓) **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐ **T** ☐

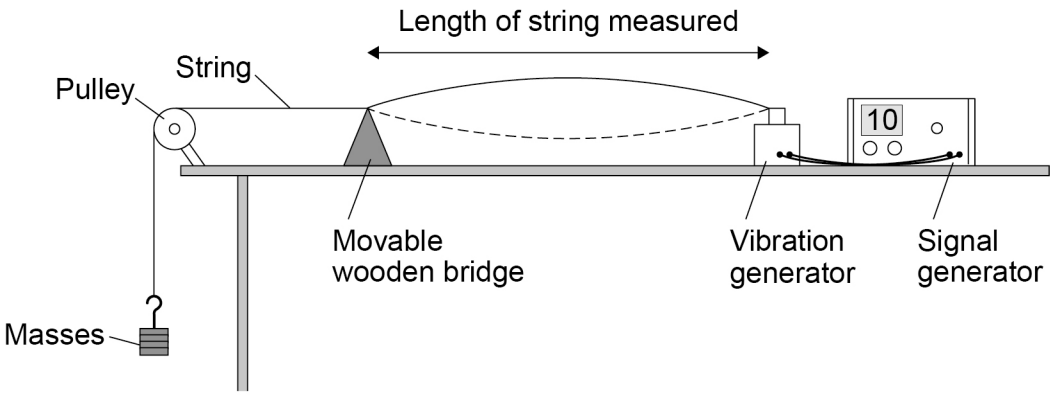
Question 8 continues on the next page

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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**.

0 8 . 3 Give **one** control variable in this demonstration.

[1 mark]

Do not write outside the box

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 _____

_____

Question 8 continues on the next page

Do not write outside the box

Table 7 shows the results.

Table 7

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

0 8 . 5 Give **one** conclusion about frequency and wavelength from the data in **Table 7**.

[1 mark]

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

Do not write outside the box

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

11

Turn over for the next question

Do not write outside the box

0 9 Plants absorb light to photosynthesise.

0 9 . 1 Complete the word equation for photosynthesis.

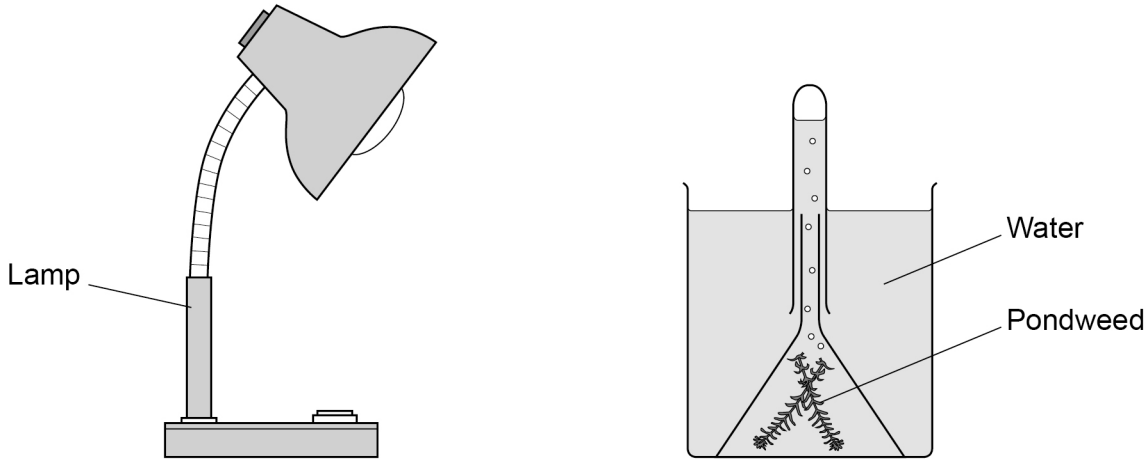
[1 mark]

_____ + water ⟶ _____ + glucose

Light intensity affects the rate of photosynthesis.

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

Figure 13



Do not write outside the box

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]

Question 9 continues on the next page

Do not write outside the box

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 = _____

Do not write outside the box

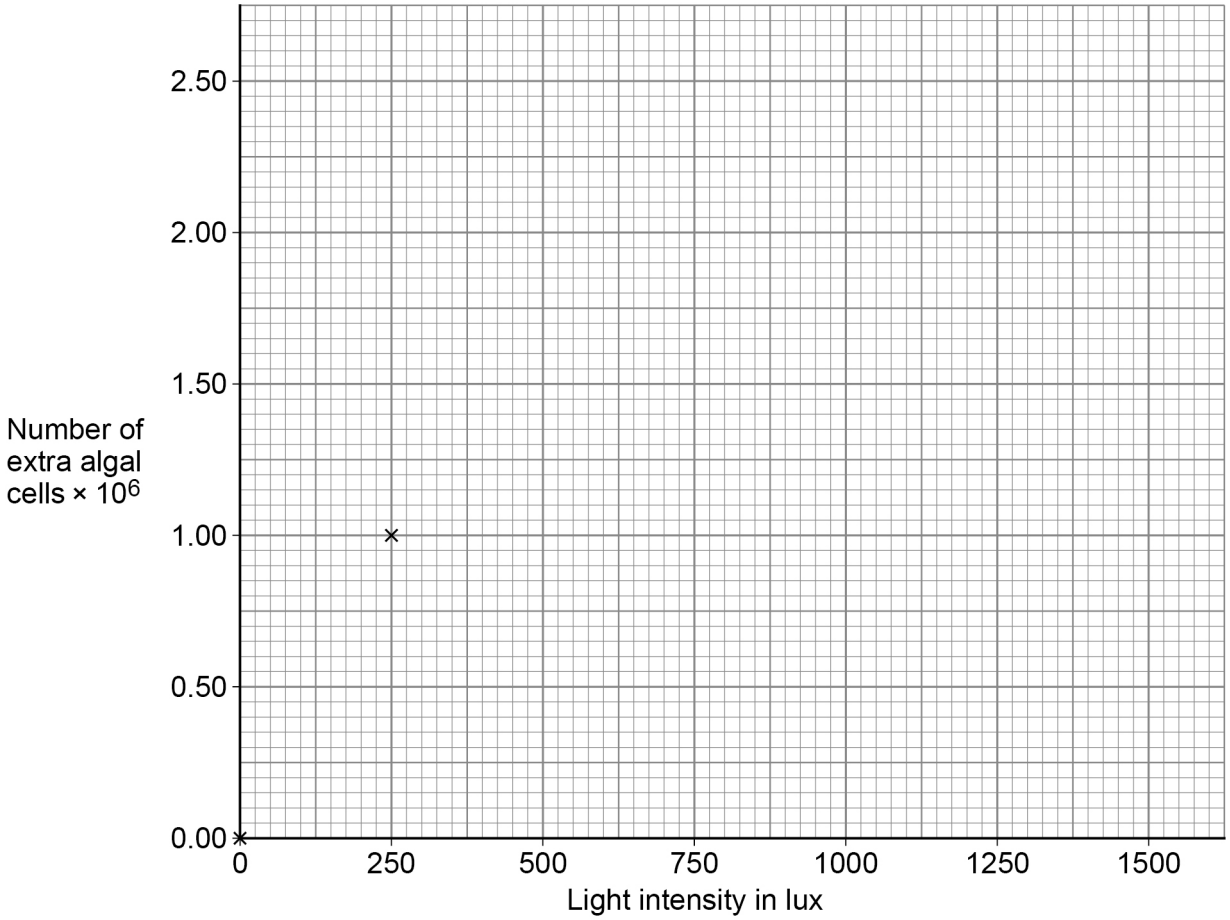
0 9 . 4 Plot the data from **Table 8** on **Figure 14**.

The first two points have been plotted.

Draw a line of best fit.

[3 marks]

Figure 14



0 9 . 5 Give **two** conclusions from the results.

Use information from **Table 8**.

[2 marks]

1 _____

_____

2 _____

_____

Question 9 continues on the next page

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0 9 . 6 Explain how an increase in temperature from 20 °C to 25 °C would affect the number of algal cells.

[2 marks]

16

END OF QUESTIONS

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