

Please write clearly in block capitals.

Centre number

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Candidate signature

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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            |      |
| <b>TOTAL</b> |      |



J U N 2 0 8 4 6 5 2 F 0 1

**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 (%)<br>in Earth's early atmosphere | Percentage (%) in Earth's<br>atmosphere today |
|----------------|---------------------------------------------------------|-----------------------------------------------|
| Carbon dioxide | 95.0                                                    | 0.04                                          |
| Nitrogen       | 3.5                                                     | 78.08                                         |
| Oxygen         | 0.5                                                     | 20.95                                         |
| Other gases    | <b>X</b>                                                | 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%

☐


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**

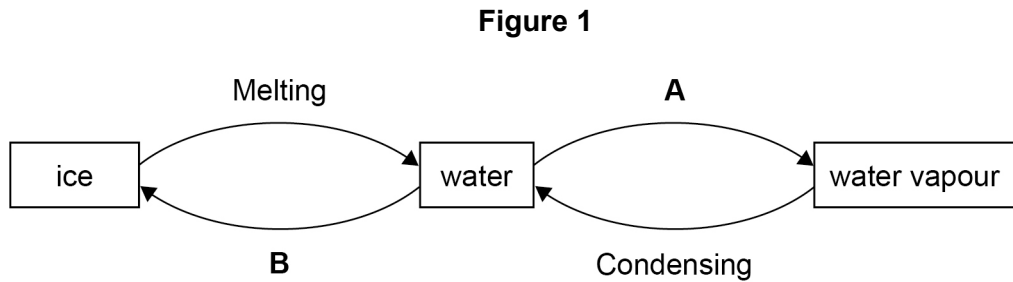
**Turn over ►**



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.



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.

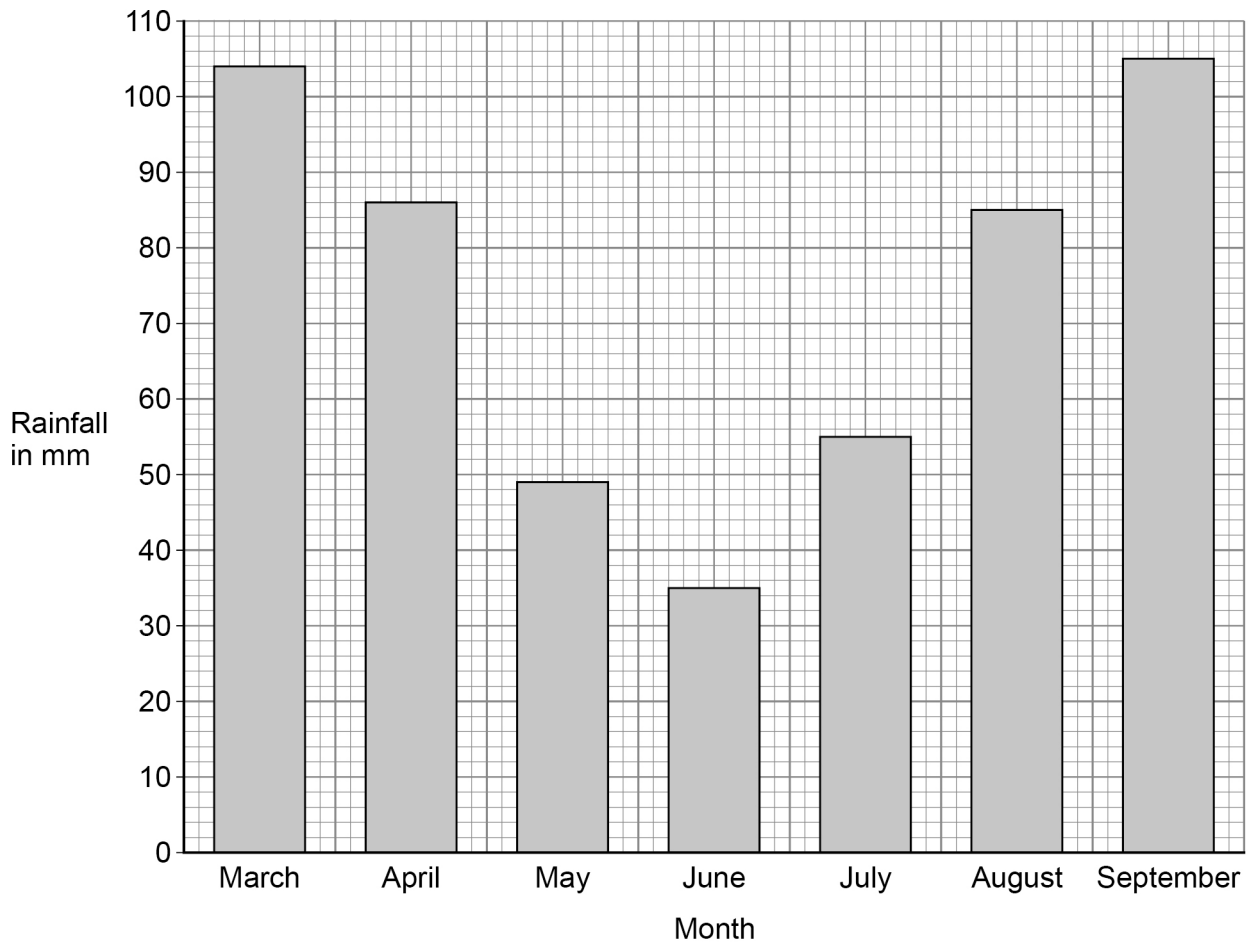
**[1 mark]**

\_\_\_\_\_  
\_\_\_\_\_



**Figure 2** 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]**

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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 | <input type="checkbox"/> |
| Predator   | <input type="checkbox"/> |
| Species    | <input type="checkbox"/> |



**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]**

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**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**

**Turn over ►**



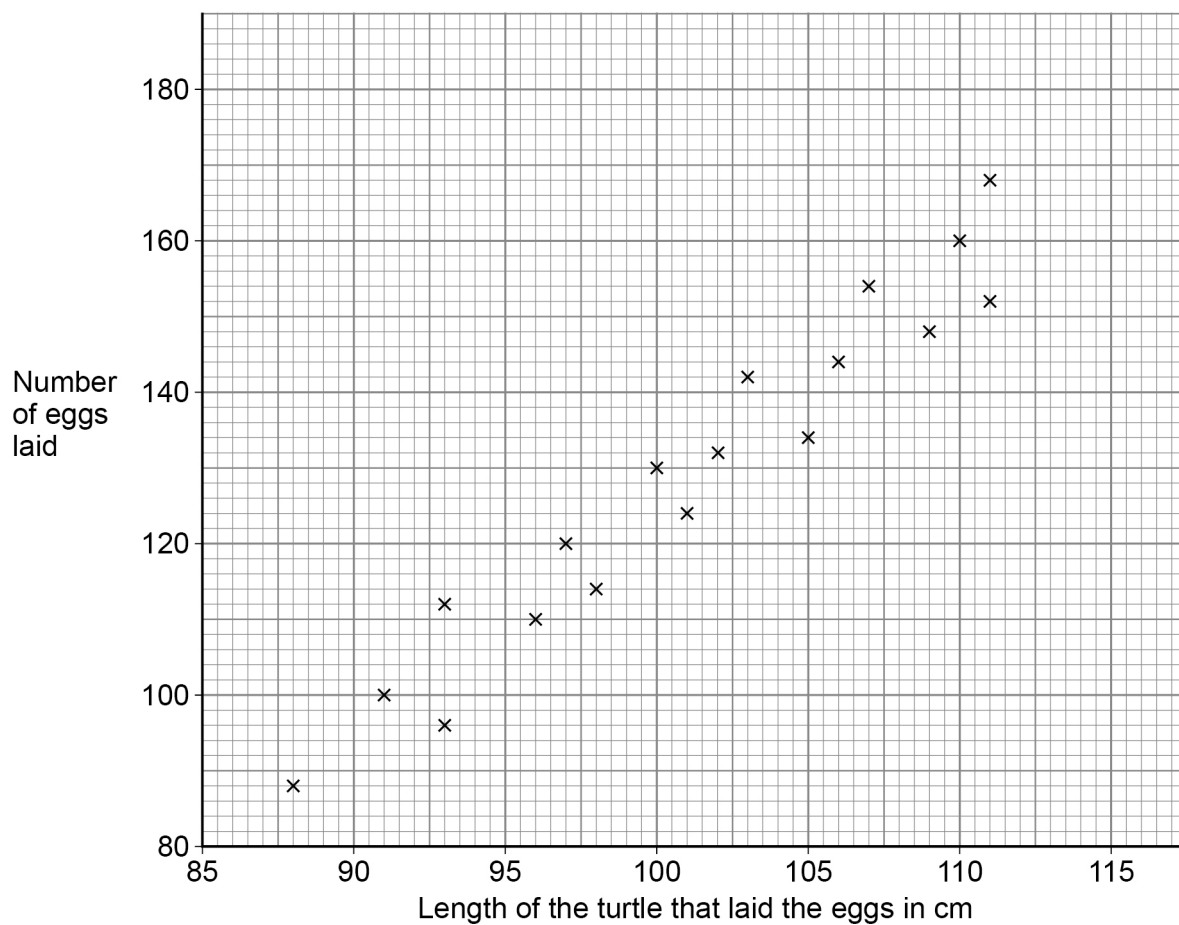
Female loggerhead turtles lay their eggs on sandy beaches.

**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]**

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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]

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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]

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Number of times greater = \_\_\_\_\_

**Question 2 continues on the next page**

**Turn over ►**



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

☐

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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

☐

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**.

**03.3** Calculate 25% of 11 g

[2 marks]

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25% of 11 g = \_\_\_\_\_ g

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

Use your answer from Question **03.3**.

[1 mark]

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Mass of sugar = \_\_\_\_\_ g

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

Give **one** other health benefit of eating less sugar.

[1 mark]

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**Question 3 continues on the next 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]**

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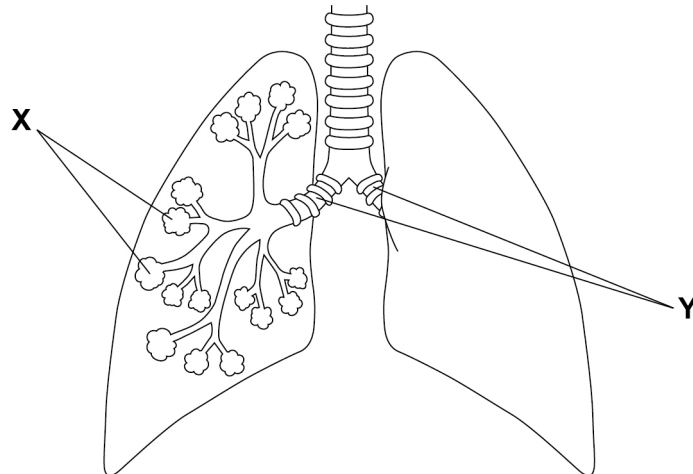


**0 4**

This question is about breathing and respiration.

**0 4****1**

What is the equation for aerobic respiration?

**[1 mark]**Tick (✓) **one** box.glucose + oxygen  $\longrightarrow$  carbon dioxide + water☐oxygen + water  $\longrightarrow$  carbon dioxide + glucose☐water + glucose  $\longrightarrow$  carbon dioxide + oxygen☐**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 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]**

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**Question 4 continues on the next page**

**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** shows the peak flow of four students.

**Table 3**

| Student | Peak flow<br>in arbitrary units |
|---------|---------------------------------|
| A       | 470                             |
| B       | 515                             |
| C       | 260                             |
| D       | 420                             |

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

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<br>per minute |
|-----------------|-----------------------------------------|
| Before exercise | 15                                      |
| After exercise  | 41                                      |

Explain the effect of exercise on breathing rate.

**[2 marks]**

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**10**



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  
implantingSlows 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

Turn over ►



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]

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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]

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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 

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2 

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8


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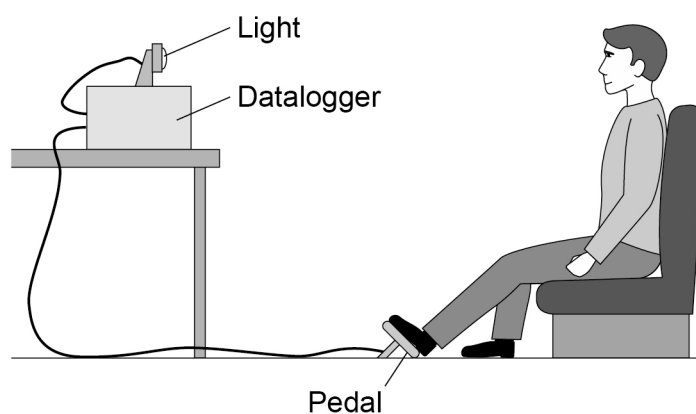


0 6

Four students investigated their reaction times.

**Figure 7** shows the equipment the students used.

**Figure 7**

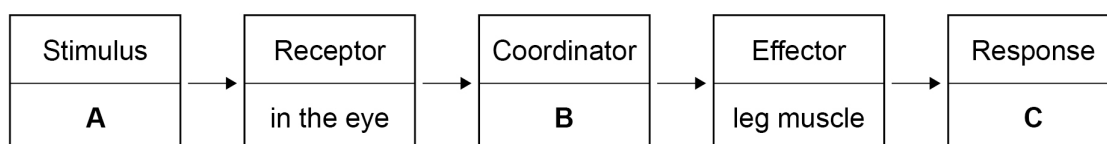


This is the method used.

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**



**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]

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**Question 6 continues on the next page**

**Turn over ►**



**Table 5** shows the results for each student.

**Table 5**

| Student  | Student age<br>in years | Reaction time in seconds |        |        |        |
|----------|-------------------------|--------------------------|--------|--------|--------|
|          |                         | Test 1                   | Test 2 | Test 3 | Test 4 |
| <b>A</b> | 11                      | 0.74                     | 0.72   | 0.71   | 0.71   |
| <b>B</b> | 14                      | 0.80                     | 0.79   | 0.78   | 0.76   |
| <b>C</b> | 15                      | 0.85                     | 0.84   | 0.83   | 0.82   |
| <b>D</b> | 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]**

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**0 6 . 6** Suggest what might cause an anomalous result in this reaction time investigation.

**[1 mark]**

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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****Turn over ►**

**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.

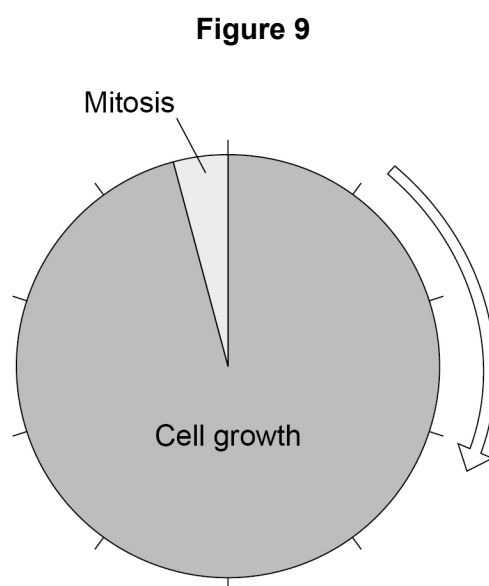
Give **one** other reason plant cells divide by mitosis.Do **not** refer to growth in your answer.**[1 mark]**

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**Figure 9** shows a cell cycle.



**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**

**Turn over ►**



0 7 5

In mitosis and meiosis cells divide to produce new cells.

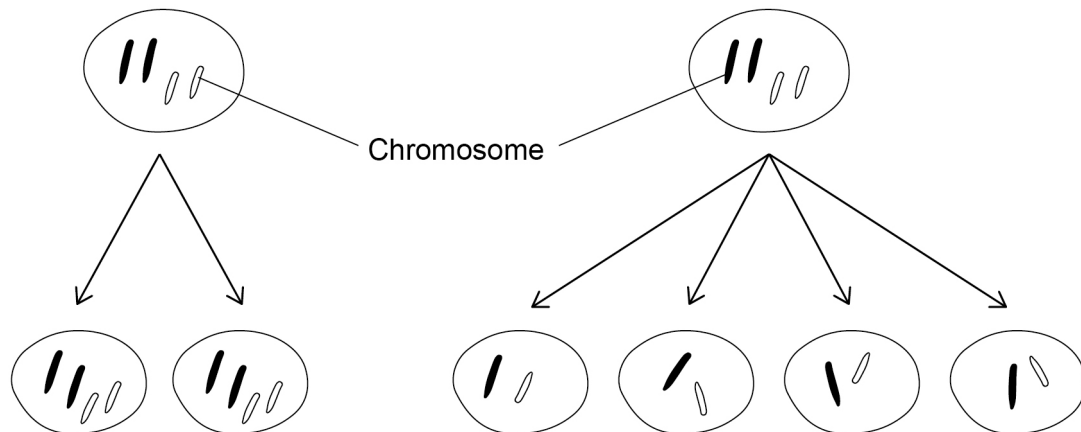
Cell division by meiosis produces gametes.

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

**Figure 10**

**Cell dividing by mitosis**

**Cell dividing by meiosis**



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

Use information from **Figure 10**.

**[3 marks]**

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07.6

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 $\mu\text{m}$ | 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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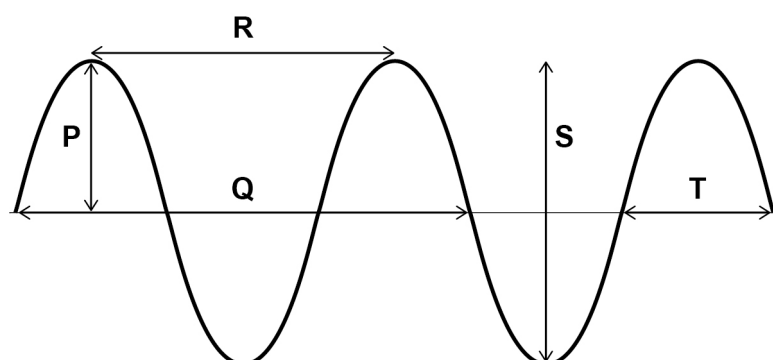
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0 8

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 ☐

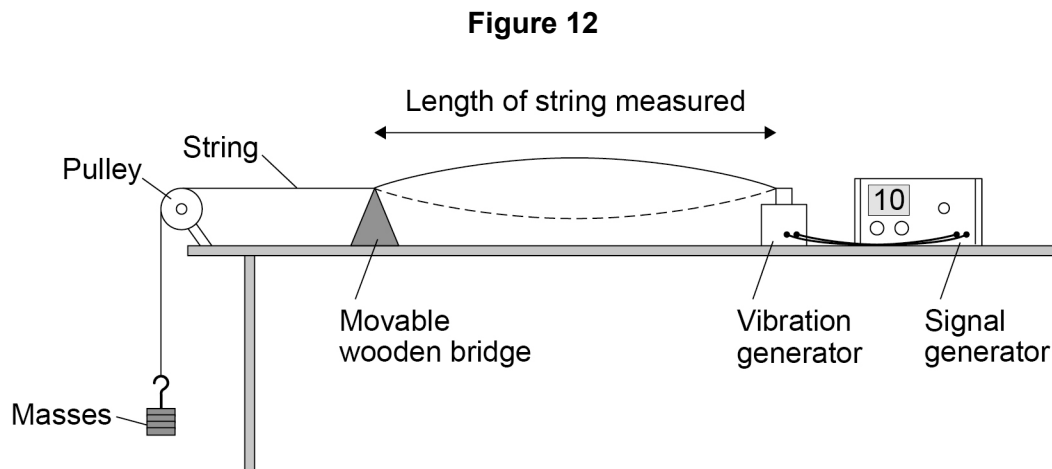
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A teacher demonstrated waves on a string.

**Figure 12** shows the apparatus used.



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]



|   |   |   |   |
|---|---|---|---|
| 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**

**Turn over ►**



**Table 7** shows the results.

**Table 7**

| Frequency<br>in Hz | Wave pattern<br>on 1.50 m string<br> | Number of<br>loops in wave<br>pattern | Wavelength<br>in m |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------|
| 10                 |                                      | 1                                     | 3.00               |
| 20                 |                                      | 2                                     | 1.50               |
| 30                 |                                      | 3                                     | 1.00               |
| 40                 |                                      | 4                                     | 0.75               |
| 50                 |                                    | 5                                     | <b>X</b>           |

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

**[1 mark]**

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**0 8 . 6** Each loop of the wave pattern is the length of half a wavelength.

Determine wavelength **X** in **Table 7**.

**[2 marks]**

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Wavelength **X** = \_\_\_\_\_ m



|   |   |   |   |
|---|---|---|---|
| 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]**

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Period (2 significant figures) = \_\_\_\_\_ s

|    |
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| 11 |
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**Turn over ►**



**0 9**

Plants absorb light to photosynthesise.

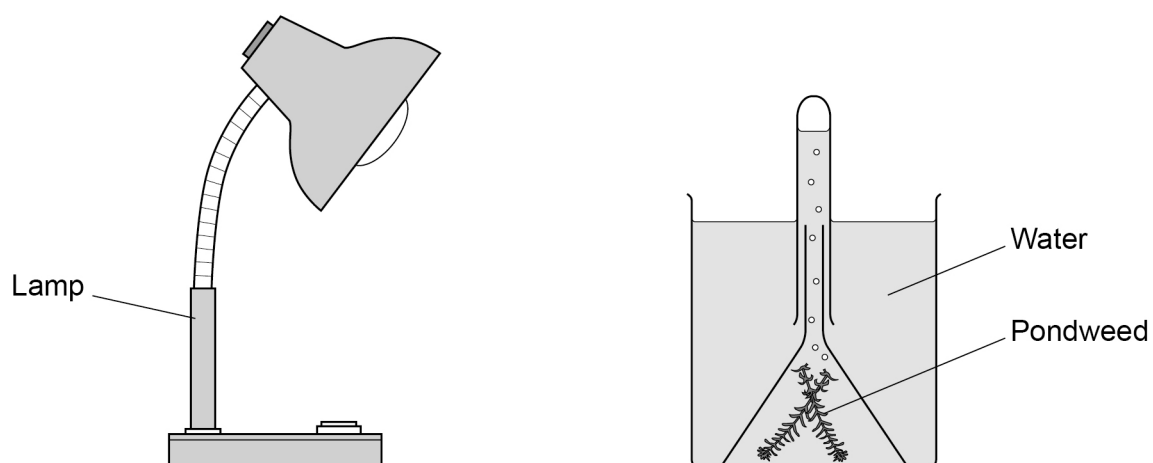
**0 9 . 1**

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**

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

**[6 marks]**

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.

**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<br>in lux | Number of EXTRA algal cells<br>after two days |
|---------------------------|-----------------------------------------------|
| 0                         | no extra cells                                |
| 250                       | $1.00 \times 10^6$                            |
| 500                       | $1.65 \times 10^6$                            |
| 750                       | $2.15 \times 10^6$                            |
| 1000                      | $2.40 \times 10^6$                            |
| 1250                      | $2.50 \times 10^6$                            |
| 1500                      | $2.50 \times 10^6$                            |

**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]**

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Total number of algal cells = \_\_\_\_\_



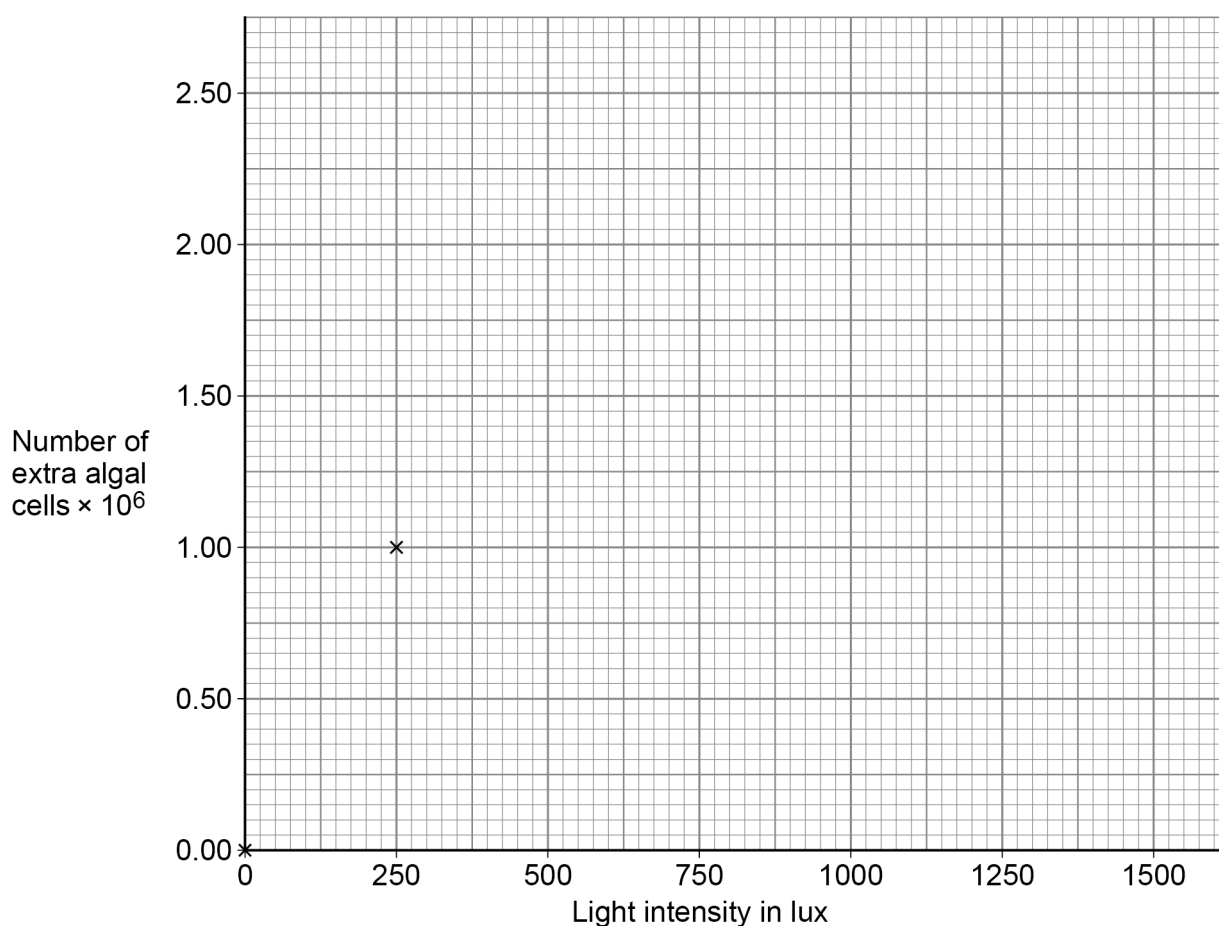
**0 9 . 4** Plot the data from **Table 8** on **Figure 14**.

The first two points have been plotted.

Draw a line of best fit.

**[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**

**Turn over ►**



09.6

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

**[2 marks]**

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**16****END OF QUESTIONS**

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