



Surname \_\_\_\_\_

Other Names \_\_\_\_\_

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

**GCSE**

**COMBINED SCIENCE: SYNERGY**

**H**

Higher Tier      Paper 1 Life and environmental sciences

**8465/1H**

Tuesday 15 May 2018      Afternoon

Time allowed: 1 hour 45 minutes

**For this paper you must have:**

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

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

**[Turn over]**



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## INSTRUCTIONS

- Use black ink or black ball-point pen.
- Answer ALL questions in the spaces provided. Do not write on blank pages.
- 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**



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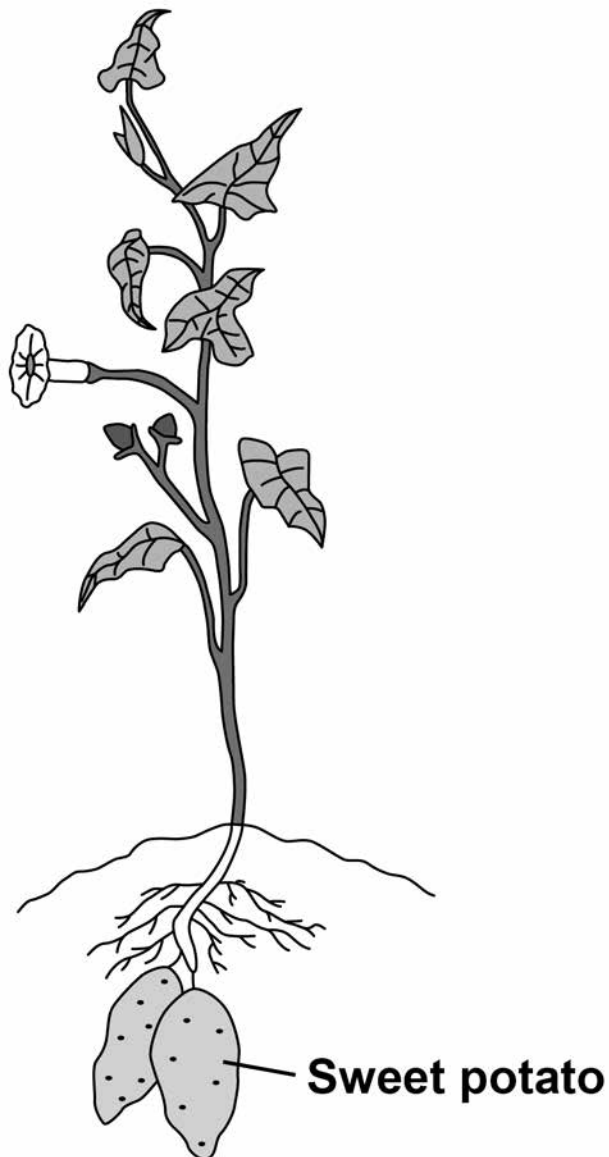


0 1

**FIGURE 1 shows a sweet potato plant.**

**The sweet potatoes grow underground and can be cooked and eaten.**

**FIGURE 1**



**[Turn over]**



**TABLE 1** shows some of the nutrients in cooked sweet potato.

**TABLE 1**

<b>Nutrient</b>	<b>Mass in grams per 100 grams of cooked sweet potato</b>
<b>Water</b>	<b>73.83</b>
<b>Protein</b>	<b>2.01</b>
<b>Fat</b>	<b>0.15</b>
<b>Total carbohydrate</b>	<b>20.71</b>
<b>of which sugars</b>	<b>6.55</b>
<b>Fibre</b>	<b>3.30</b>



**0 1 . 1** After cooked sweet potato is digested, sugars (including glucose) pass into the blood.

Give TWO other soluble molecules that would pass into the blood after cooked sweet potato is digested. [2 marks]

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

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**0 1 . 2** Calculate the mass of sugars in 180 g of cooked sweet potato.

Use the information from TABLE 1. [1 mark]

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\_\_\_\_\_

Mass of sugars = \_\_\_\_\_ g

[Turn over]



**0 1 . 3** The sweet potatoes found underground contain starch.

**Explain how starch in the sweet potato is produced from carbon dioxide in the air.  
[6 marks]**

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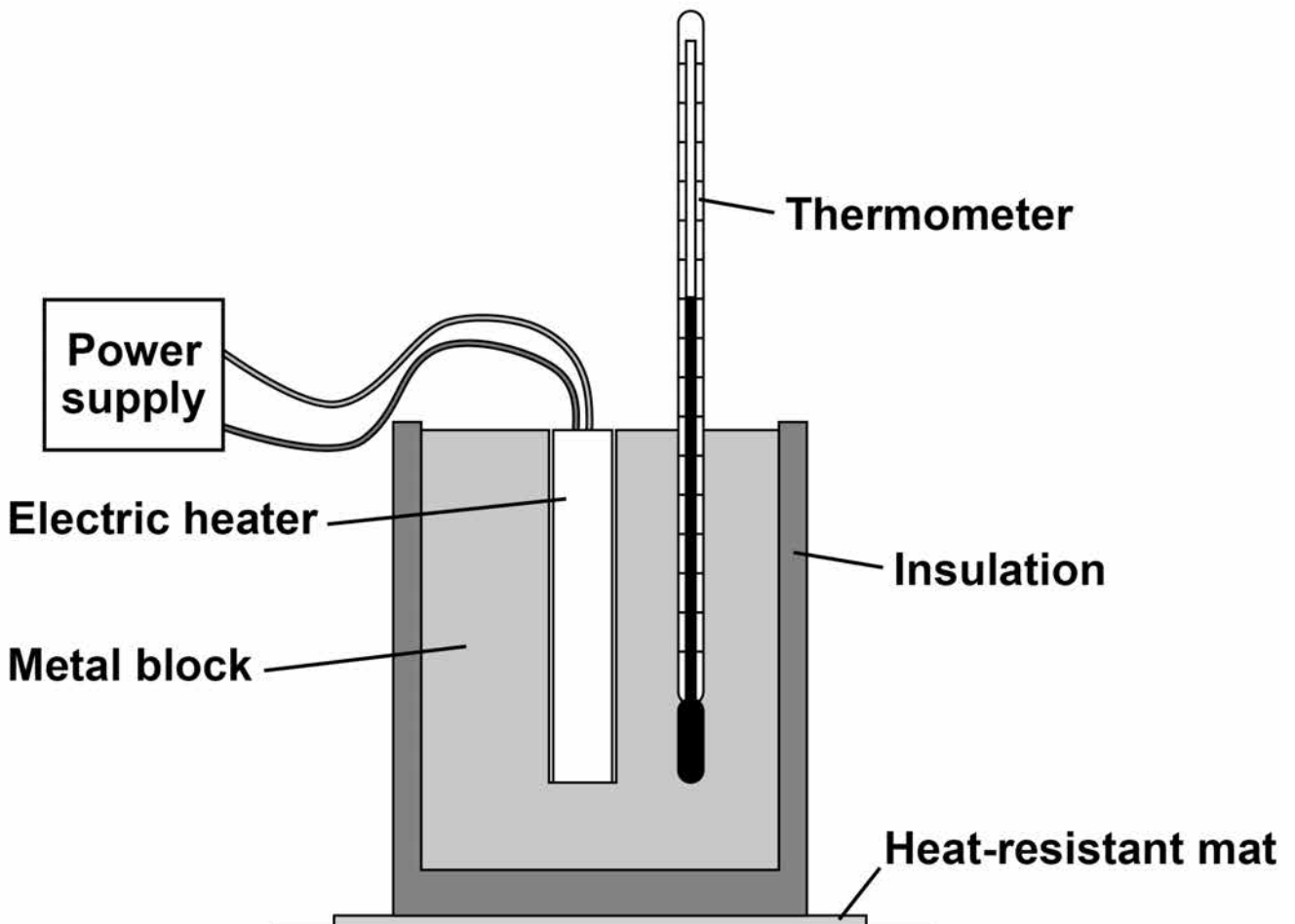
02

A student investigated how the temperature of a metal block changed with time.

An electric heater was used to increase the temperature of the block.

The heater was placed in a hole drilled in the block as shown in FIGURE 2.

FIGURE 2



[Turn over]



The student measured the temperature of the metal block every 60 seconds.

TABLE 2 shows the student's results.

TABLE 2

Time in s	Temperature in °C
0	20.0
60	24.5
120	29.0
180	31.0
240	31.5

**0 2 . 1** Complete the graph of the data from TABLE 2 on FIGURE 3.

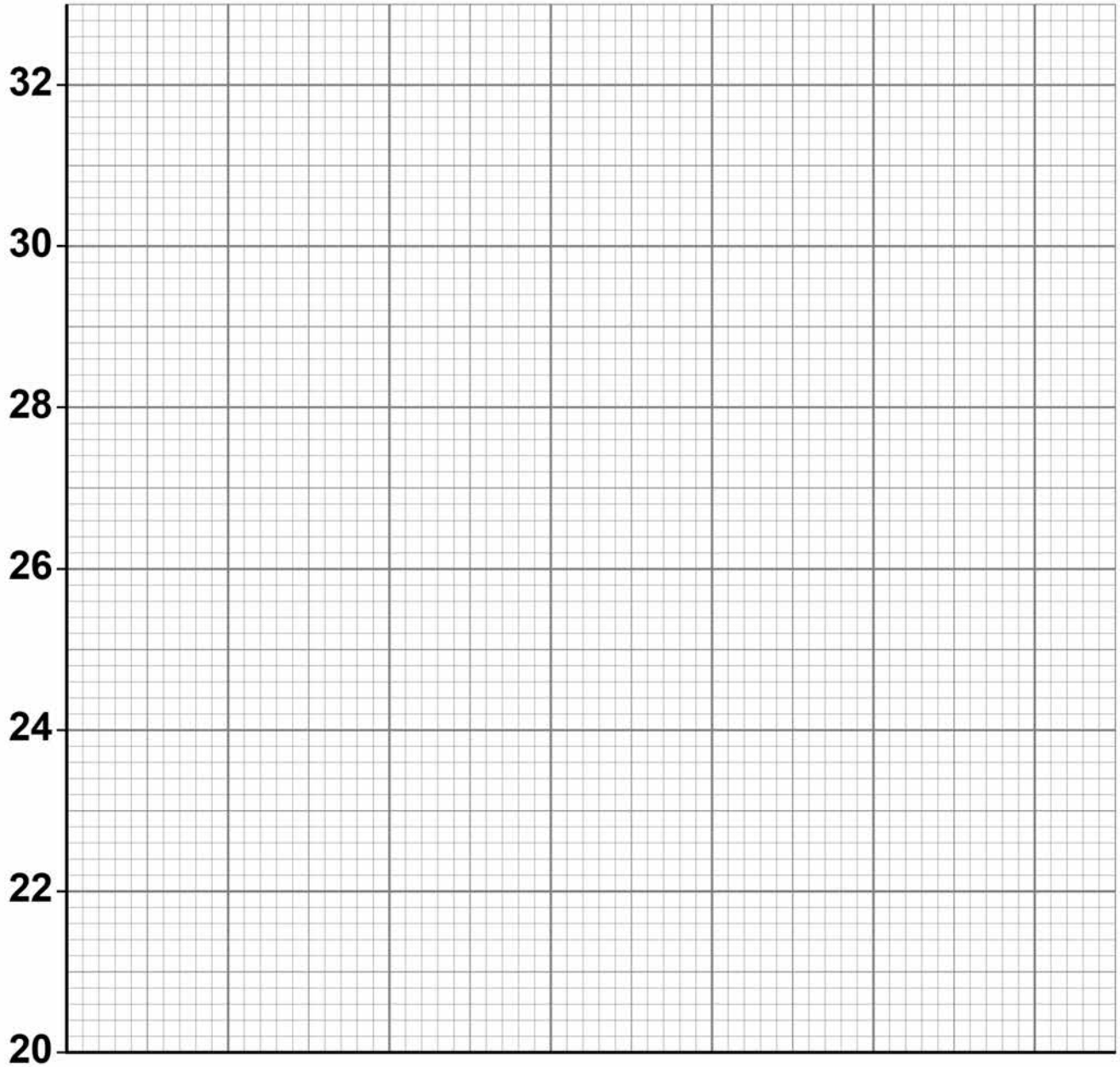
- Choose a suitable scale for the x-axis.
- Label the x-axis.
- Plot the student's results.
- Draw a line of best fit.

[4 marks]



**FIGURE 3**

**Temperature  
in °C**



**[Turn over]**



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**0 2 . 2** The rate of change of temperature of the block is given by the gradient of the graph on page 13.

**Determine the gradient of the graph over the first 60 seconds. [2 marks]**

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**Gradient =** \_\_\_\_\_

**[Turn over]**



**0 2 . 3** The metal block had a mass of 1.50 kg

The specific heat capacity of the metal was 900 J/kg °C

Calculate the change in thermal energy of the metal during 240 seconds.

Use the Physics Equations Sheet.

Give your answer in kilojoules. [4 marks]

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Change in thermal energy = \_\_\_\_\_ kJ

[Turn over]



TABLE 2

<b>Time in s</b>	<b>Temperature in °C</b>
<b>0</b>	<b>20.0</b>
<b>60</b>	<b>24.5</b>
<b>120</b>	<b>29.0</b>
<b>180</b>	<b>31.0</b>
<b>240</b>	<b>31.5</b>



**0 2 . 4** Another student repeated the investigation.

**Give TWO variables this student would need to control to be able to compare their results with the results in TABLE 2 on page 18. [2 marks]**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

**[Turn over]**

<b>12</b>



**0 3** There are several methods of contraception.

**0 3 . 1** Draw **ONE** line from each method of contraception to how the method works. [2 marks]

**Method of  
contraception**

**How the method  
works**

diaphragm

prevents embryo  
implanting

intrauterine device

prevents release of  
the egg

oral contraceptive

prevents sperm  
reaching the egg

**0 3 . 2** When a new oral contraceptive is tested on volunteers, the contraceptive is first given at a low dose. Later, the dose is increased.

**Why are new drugs given at low doses at first?**  
[1 mark]

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**[Turn over]**



**03.3** TABLE 3 shows information about three methods of contraception.

**TABLE 3**

	<b>Condom</b>	<b>Oral contraceptive</b>	<b>Hormone skin patch</b>
<b>Percentage (%) effectiveness</b>	<b>98.0</b>	<b>99.7</b>	<b>99.8</b>
<b>How contraception is obtained</b>	<b>From shops or sexual health clinic</b>	<b>From doctor or sexual health clinic</b>	
<b>Possible side effects</b>	<b>No serious side effects</b>	<b>Headaches, nausea, high blood pressure</b>	<b>Headaches, nausea, blood clots</b>

**Evaluate the use of these contraceptive methods. [6 marks]**

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**[Turn over]**



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**0 4**

There is limited evidence about the Earth's early atmosphere because of the age of the Earth.

**0 4 . 1**

The Earth is 4.6 billion years old.

Which is the correct age of the Earth? [1 mark]

Tick ONE box.

$4.6 \times 10^3$  years

$4.6 \times 10^6$  years

$4.6 \times 10^9$  years

$4.6 \times 10^{12}$  years

[Turn over]



Scientists think that the Earth's early atmosphere may have been similar to the atmosphere on Mars today.

Look at TABLE 4.

**TABLE 4**

<b>Gas</b>	<b>Concentration of gas in the atmosphere today in parts per million</b>	
	<b>Mars</b>	<b>Earth</b>
<b>Nitrogen</b>	<b>27 000</b>	<b>780 000</b>
<b>Oxygen</b>	<b>1 300</b>	<b>210 000</b>
<b>Argon</b>	<b>16 000</b>	<b>9 300</b>
<b>Carbon dioxide</b>	<b>950 000</b>	<b>400</b>
<b>Carbon monoxide</b>	<b>800</b>	<b>trace</b>



**04.2**

Calculate the percentage increase in nitrogen from the Earth's early atmosphere to the atmosphere today.

Assume the Earth's early atmosphere was the same as the atmosphere today on Mars.

Give your answer to 2 significant figures.  
[3 marks]

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Percentage increase in nitrogen =

\_\_\_\_\_ %

[Turn over]



04.3

Which process releases carbon monoxide into the Earth's atmosphere? [1 mark]

Tick ONE box.

Aerobic respiration

Bacterial decomposition

Incomplete combustion

Photosynthesis

04.4

Explain how the oceans were formed in the first billion years of the Earth's existence. [2 marks]

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Describe how the increase in greenhouse gases has increased the mass of liquid water in the oceans. [1 mark]

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8

[Turn over]



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**0 5**

**Alpha, beta and gamma are types of nuclear radiation.**

**0 5 . 1**

**Explain why gamma emission does NOT change the atomic number of an element.  
[2 marks]**

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**[Turn over]**



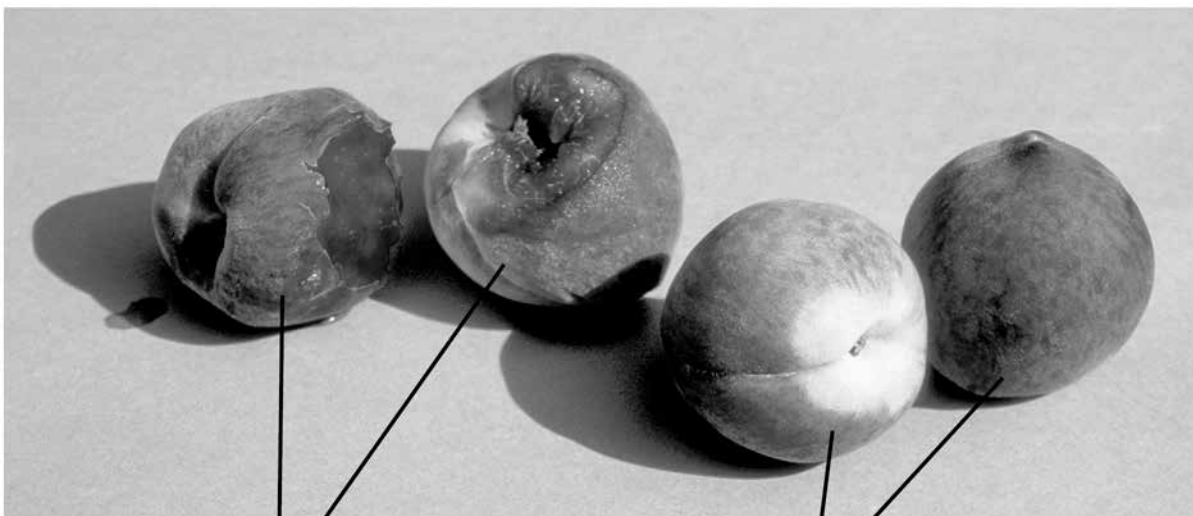
Food can be irradiated to make it safer to eat.

FIGURE 4 shows a photograph of peaches.

Two of the peaches were irradiated.

The photograph was taken one week after irradiation.

FIGURE 4



One week old,  
NOT irradiated

One week old,  
IRRADIATED





**0 5 . 2** Explain why irradiating food makes it safer to eat. [3 marks]

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**[Turn over]**



**05.3** Food is packaged and then irradiated.

**Explain why food is irradiated using gamma radiation rather than alpha or beta radiation.  
[2 marks]**

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05.4

Some people are concerned that irradiated food could be radioactive.

Describe how irradiated food is different from food that is radioactive. [2 marks]

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[Turn over]

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06

Water travels through plants in xylem tissue.

06.1

Describe the structure of xylem tissue.  
[2 marks]

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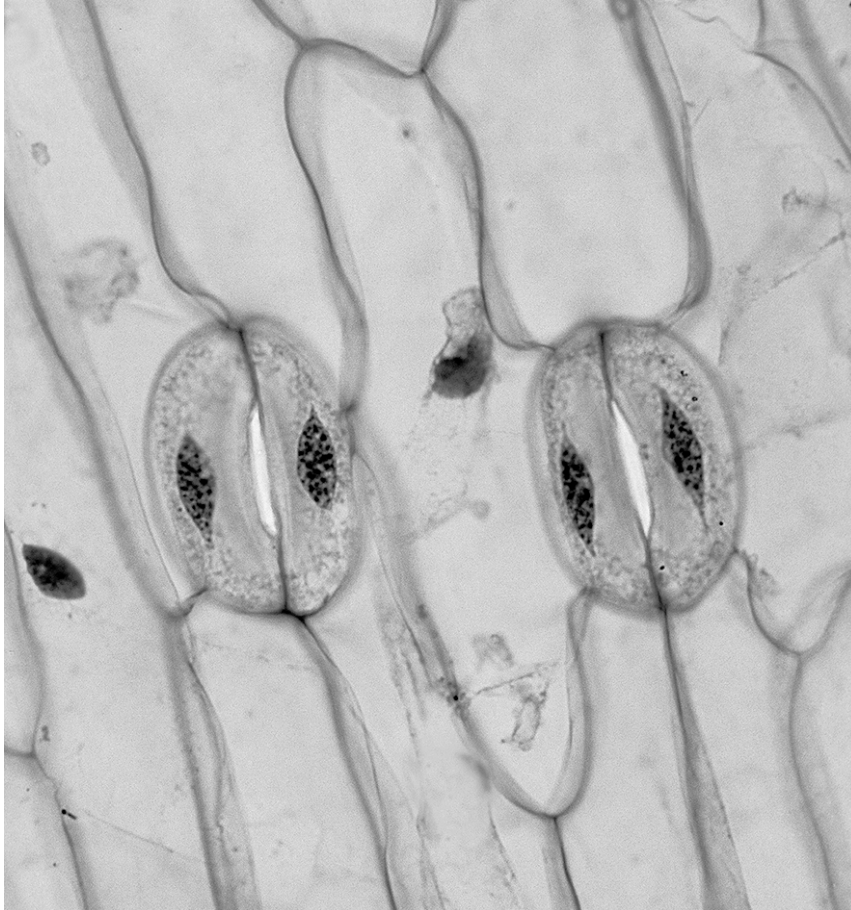
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[Turn over]



**FIGURE 5** shows guard cells around open stomata magnified 800 times.

**FIGURE 5**



**0 6 . 2** Take the image size of one of the guard cells to be 26 millimetres long.

**Calculate the real length of the guard cell in micrometres.**

**Include the equation you are using to calculate your answer. [3 marks]**

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**Real length of guard cell =**

**\_\_\_\_\_ micrometres**

**[Turn over]**



06.3

**Guard cells increase in volume and become curved to open stomata.**

**Explain how guard cells increase in volume.  
[2 marks]**

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**[Turn over]**

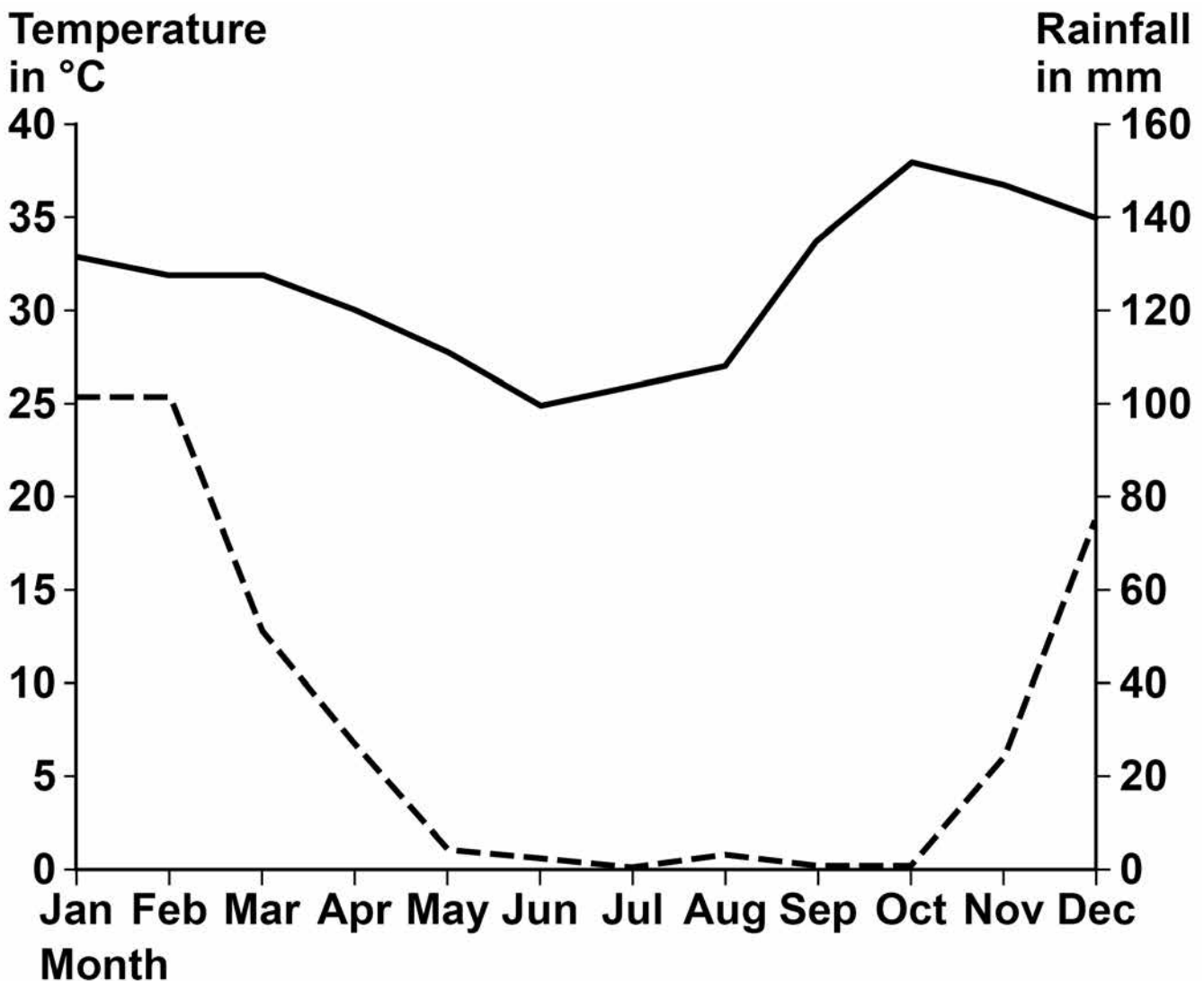


**06.4** The Baobab tree grows in Botswana, Africa.

The tree has no leaves for up to 9 months of the year.

FIGURE 6 shows the average temperature and rainfall each month in Botswana.

**FIGURE 6**



**KEY**

———— Average maximum temperature in °C

----- Average rainfall in mm



**Explain how having no leaves from March to November allows the Baobab tree to survive in Botswana. [3 marks]**

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<b>10</b>

**[Turn over]**



**07**

**Marfan syndrome is a rare genetic disorder that causes problems with many body systems.**

**07.1**

**Which sentence best describes a gene?  
[1 mark]**

**Tick ONE box.**

**A long chain of carbohydrate**

**A short section of DNA**

**All of the chromosomes in an organism**

**Several amino acids joined together**



**07.2** What does a gene code for? [1 mark]

**Tick ONE box.**

**A carbohydrate polymer**

**A DNA double helix**

**One glycerol and three fatty acids**

**A sequence of amino acids**

**07.3** What scientific term is used to describe all the genes of one organism? [1 mark]

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**[Turn over]**



07.4

What term is used to describe the observed characteristics of an individual? [1 mark]

Tick ONE box.

Allele

Genotype

Homozygous

Phenotype



**07.5** Marfan syndrome is caused by a dominant allele, R.

The normal allele is recessive, r.

A man who is heterozygous for Marfan syndrome has a child with a woman who does not have the disorder.

Draw a genetic diagram to show the probability of their child inheriting Marfan syndrome.

[4 marks]

Probability = \_\_\_\_\_

[Turn over]



**07.6**

**Very rarely, a new case of Marfan syndrome can occur because of a mutation during meiosis.**

**Explain how a mutation during meiosis could affect every cell in one offspring. [4 marks]**

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**12**





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**[Turn over]**



08

Some students investigated the compounds in a green lettuce leaf and a red cabbage leaf.

The students placed each leaf in boiling ethanol and then tested each leaf for starch.

08.1

The boiling point of ethanol is 78 °C

Ethanol is flammable so should not be directly heated with a Bunsen burner.

Give ONE way ethanol can be boiled safely.

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

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08.2

Describe how the students could test the leaves for starch.

Give the result if starch is present. [2 marks]

Test \_\_\_\_\_

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Result \_\_\_\_\_

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**0 8 . 3** The students used paper chromatography to investigate the coloured pigments in both types of leaf.

**Explain how paper chromatography causes the different pigments to separate. [3 marks]**

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**[Turn over]**



TABLE 5 shows the students' results. The distance the solvent and each pigment moved was measured from the start line.

TABLE 5

	Green lettuce		Red cabbage	
	Distance moved in mm	R <sub>f</sub> value	Distance moved in mm	R <sub>f</sub> value
<b>Solvent front</b>	<b>120</b>	<b>—</b>	<b>113</b>	<b>—</b>
<b>Yellow-green pigment</b>	<b>18</b>	<b>0.15</b>	<b>14</b>	<b>0.12</b>
<b>Bright green pigment</b>	<b>24</b>	<b>0.20</b>	<b>Not found</b>	<b>Not found</b>
<b>Yellow pigment</b>	<b>40</b>	<b>0.33</b>	<b>46</b>	<b>0.41</b>
<b>Orange pigment</b>	<b>120</b>	<b>1.00</b>	<b>113</b>	<b>1.00</b>



TABLE 6 shows the known  $R_f$  value ranges of some pigments.

TABLE 6

Pigment	$R_f$ value range
Carotene	0.89 – 0.98
Pheophytin a	0.42 – 0.49
Pheophytin b	0.33 – 0.40
Chlorophyll a	0.24 – 0.30
Chlorophyll b	0.20 – 0.26
Xanthophyll	0.04 – 0.28

[Turn over]



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**0 8 . 4** One pigment was found in the green lettuce leaf, but was NOT found in the red cabbage leaf.

**Describe why it is NOT possible to be certain what this pigment is.**

**Use the information in TABLE 5 on page 52 and TABLE 6 on page 53 to help you. [1 mark]**

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**[Turn over]**



## Repeat of TABLE 6

Pigment	R <sub>f</sub> value range
Carotene	0.89 – 0.98
Pheophytin a	0.42 – 0.49
Pheophytin b	0.33 – 0.40
Chlorophyll a	0.24 – 0.30
Chlorophyll b	0.20 – 0.26
Xanthophyll	0.04 – 0.28

**0 8 . 5** The experiment was repeated and the solvent front travelled 140 mm from the start line.

Calculate the range of distances where the pigment carotene would be seen.

Use the equation for calculating R<sub>f</sub> values and the information in TABLE 6 to help you.  
[5 marks]

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**Different coloured pigments absorb light at different wavelengths.**

**Explain how plants could have evolved to contain more than one pigment in their leaves.  
[6 marks]**

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18

[Turn over]



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**0 9** An understanding of relative size is essential in science.

**0 9 . 1** Draw ONE line from each structure to the approximate radius of that structure. [4 marks]

**Structure**

**Approximate radius**

a bacterial cell

$1 \times 10^{-14}$  m

$5 \times 10^{-10}$  m

a large molecule

$1 \times 10^{-10}$  m

an animal cell

$1 \times 10^{-6}$  m

$2 \times 10^{-5}$  m

an atom

$3 \times 10^{-9}$  m

[Turn over]

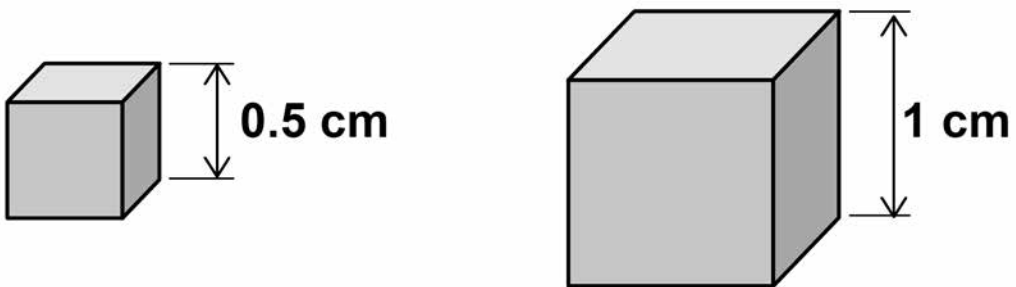


**FIGURE 7** shows two model cells.

**Both models are cubes.**

**They are not drawn to scale.**

**FIGURE 7**



09.2

**Describe how the surface area to volume ratio changes as the length of the side of the model cell increases.**

**You should include calculations in your answer. [3 marks]**

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**[Turn over]**



**09.3** Explain why a bacterium can rely on diffusion for gas exchange, but animals need a transport system. [3 marks]

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09.4

Some sugar molecules are absorbed from the small intestine into the blood by active transport.

Explain why the rate of absorption of these sugar molecules can depend on the concentration of oxygen in the cells lining the small intestine. [3 marks]

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13

END OF QUESTIONS



**There are no questions printed on this page**

For Examiner's Use	
Question	Mark
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<b>TOTAL</b>	

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