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AQA

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Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: SYNERGY

Higher Tier Paper 1 Life and environmental sciences

8465/1H

Tuesday 15 May 2018 Afternoon

H

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]

JUN188465 1H 01

For this paper you must have:

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

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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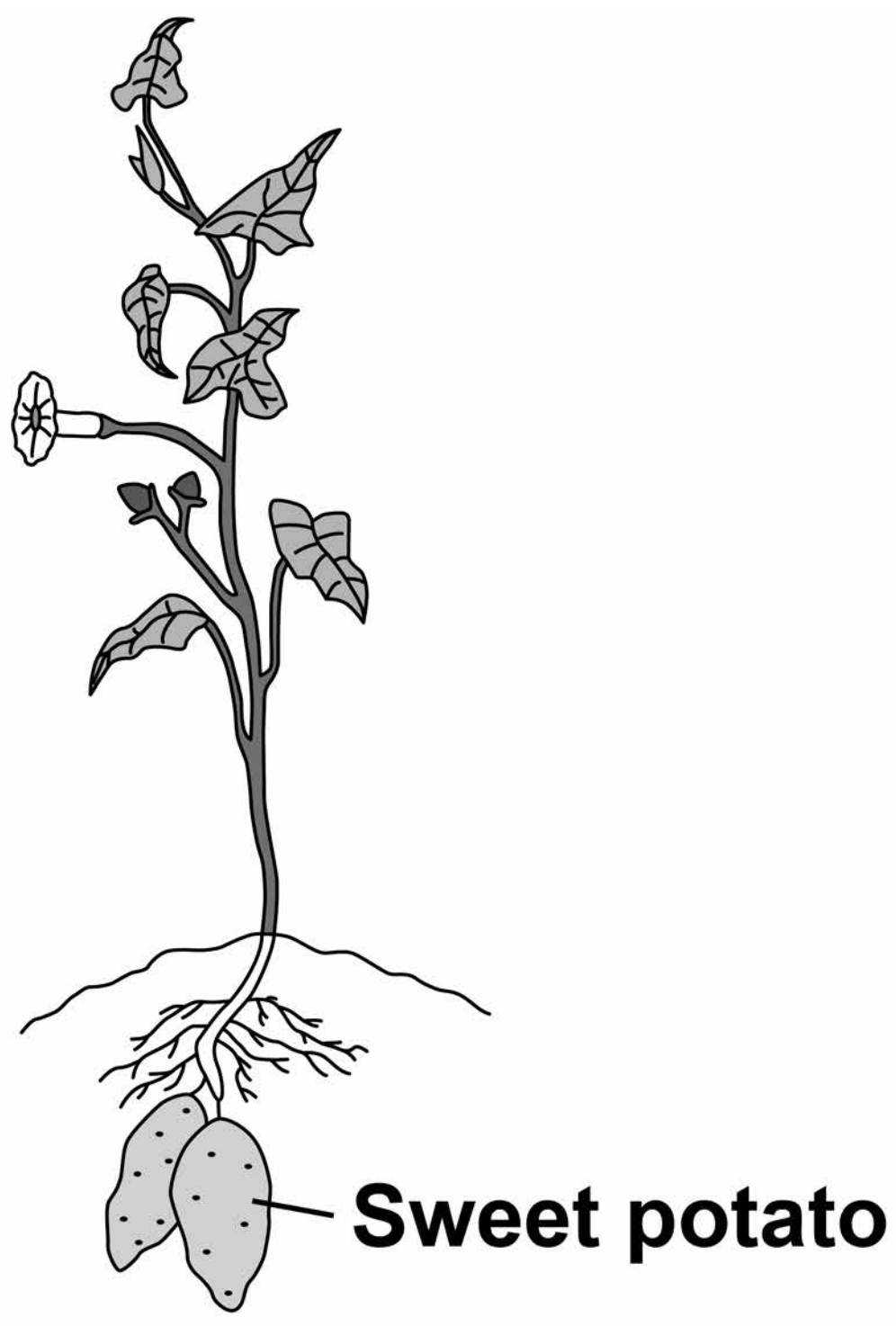
0 1 **FIGURE 1 shows a sweet potato plant.**

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

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

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 _____

_____

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

Use the information from TABLE 1. [1 mark]

_____

_____

_____

Mass of sugars = _____ g

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]

[Turn over]

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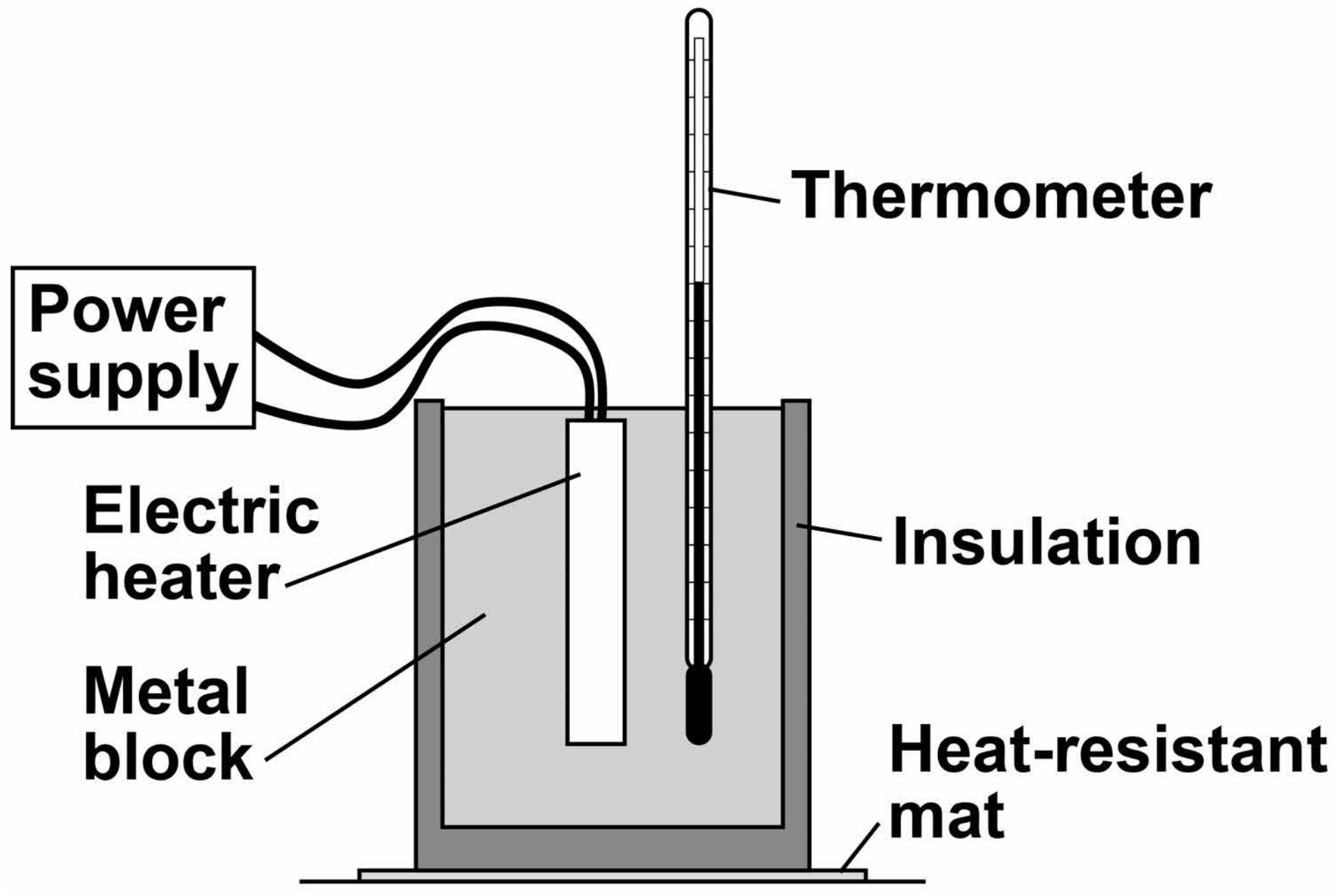
0 2 **A student investigated how the temperature of a metal block changed with time.**

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

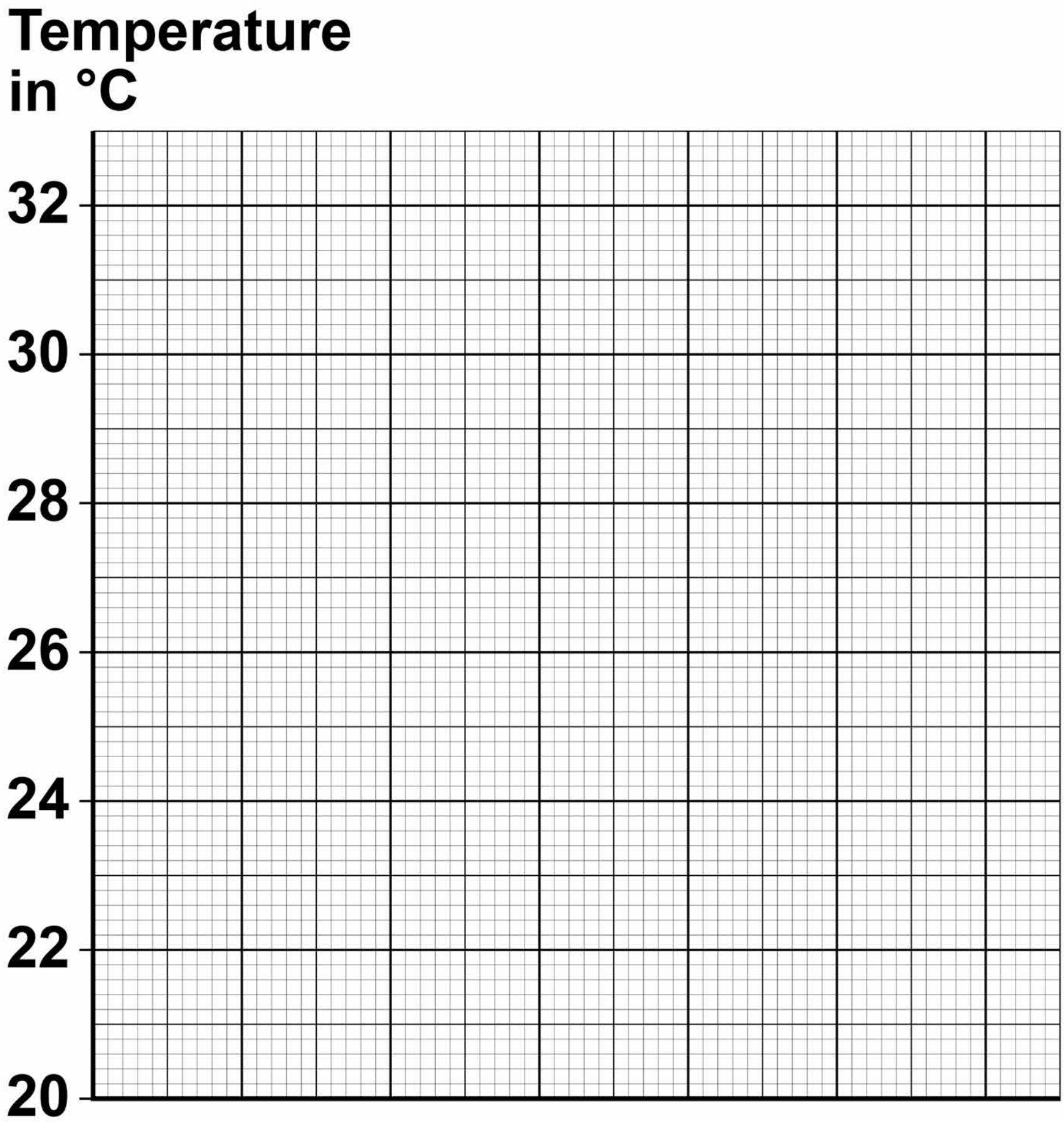
Time in s	Temperature in °C
0	20.0
60	24.5
120	29.0
180	31.0
240	31.5

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



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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]

Gradient =

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]

Change in thermal energy = _____ **kJ**

[Turn over]

Repeat of 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 . 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 _____

_____

12

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]

0 3 . 3 **TABLE 3 shows information about three methods of contraception.**

TABLE 3

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

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

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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.

☐ 4.6×10^3 years

☐ 4.6×10^6 years

☐ 4.6×10^9 years

☐ 4.6×10^{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

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

0 4 . 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]

Percentage increase in nitrogen

= _____ %

[Turn over]

0 4 . 3 **Which process releases carbon monoxide into the Earth's atmosphere? [1 mark]**

Tick ONE box.

- ☐ **Aerobic respiration**
- ☐ **Bacterial decomposition**
- ☐ **Incomplete combustion**
- ☐ **Photosynthesis**

0 4 . 4 **Explain how the oceans were formed in the first billion years of the Earth's existence.**
[2 marks]

0 4 . 5 **Describe how the increase in greenhouse gases has increased the mass of liquid water in the oceans. [1 mark]**

8

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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]**

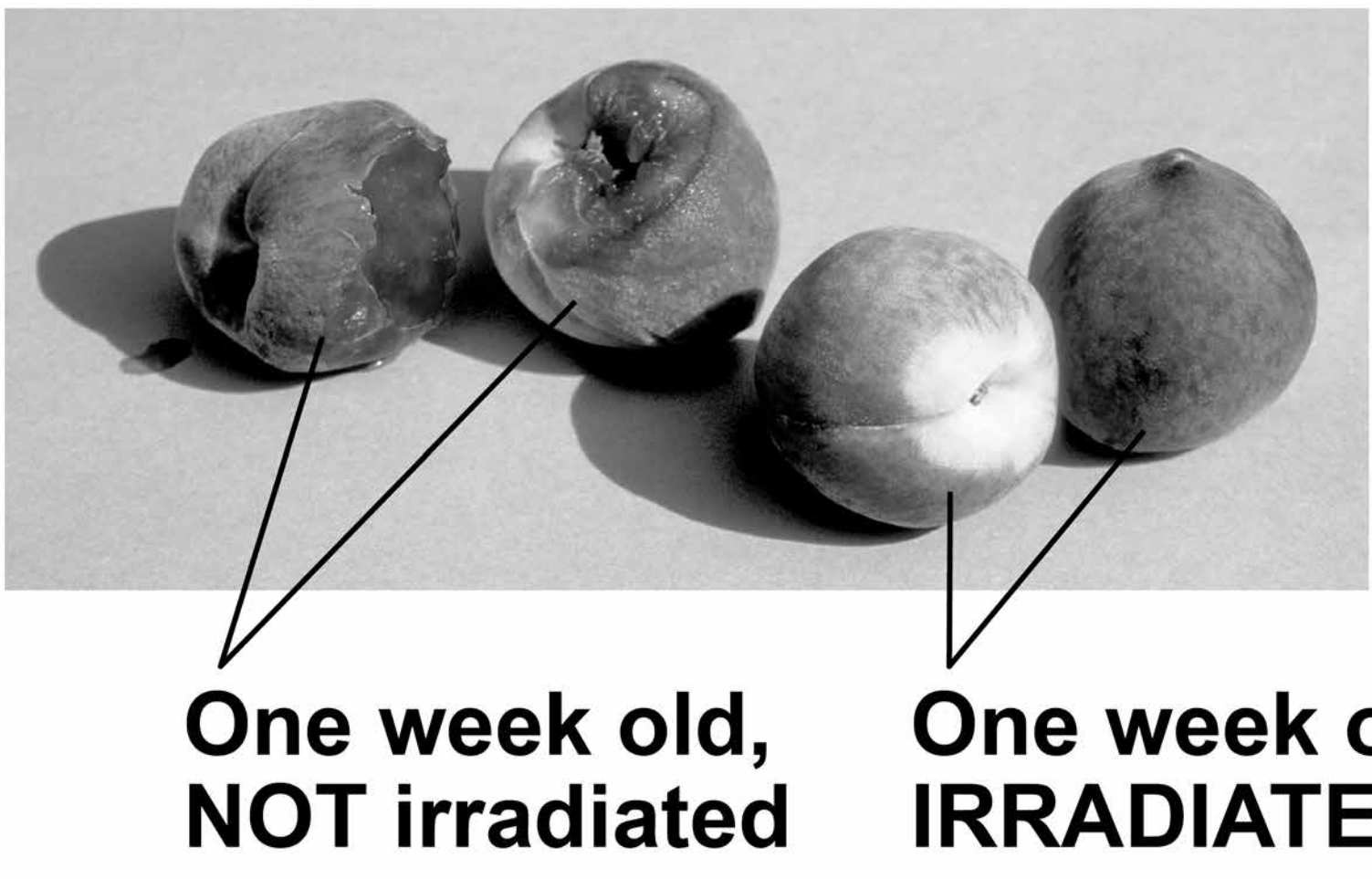
Food can be irradiated to make it safer to eat.

FIGURE 4 shows a photograph of peaches.

Two of the peaches were irradiated.

The photograph was taken one week after irradiation.

FIGURE 4



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

0 5 . 3 **Food is packaged and then irradiated.**

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

0 5 . 4 **Some people are concerned that irradiated food could be radioactive.**

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

9

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0 6 **Water travels through plants in xylem tissue.**

0 6 . 1 **Describe the structure of xylem tissue. [2 marks]**

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]

Real length of guard cell =

_____ micrometres

0 6 . 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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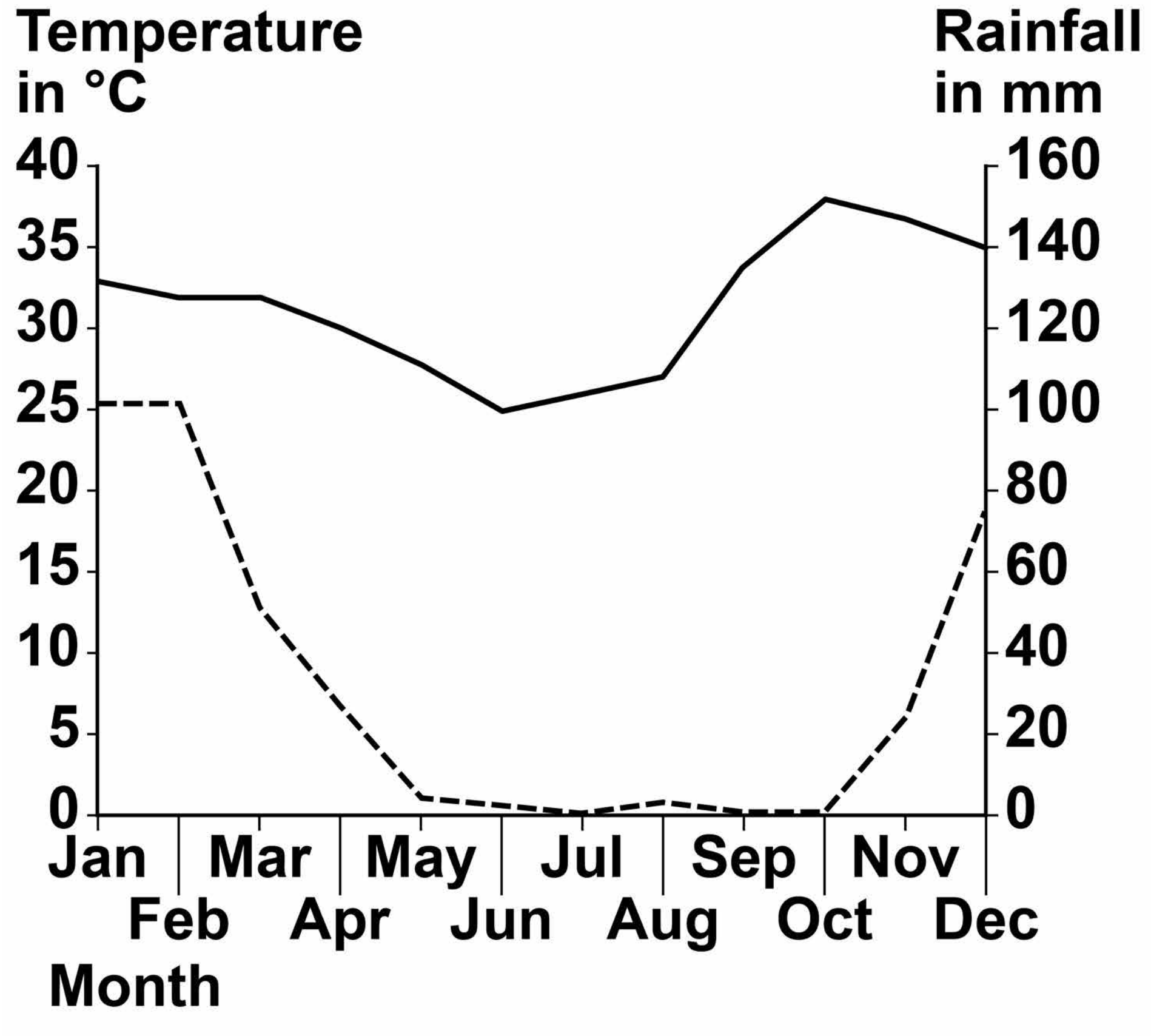
[Turn over]

0 6 . 4 **The Baobab tree grows in Botswana, Africa.**

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

FIGURE 6, on page 45, shows the average temperature and rainfall each month in Botswana.

FIGURE 6



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

[Turn over]

0 7 Marfan syndrome is a rare genetic disorder that causes problems with many body systems.

0 7 . 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

0 7 . 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**

0 7 . 3 **What scientific term is used to describe all the genes of one organism? [1 mark]**

_____

_____

[Turn over]

0 7 . 4 What term is used to describe the observed characteristics of an individual? [1 mark]

Tick ONE box.

- ☐ Allele
- ☐ Genotype
- ☐ Homozygous
- ☐ Phenotype

0 7 . 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 = _____

0 7 . 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]

12

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[Turn over]

0 8 **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.

0 8 . 1 **The boiling point of ethanol is 78 ºC**

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]

0 8 . 2 **Describe how the students could test the leaves for starch.**

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

Test _____

_____

Result _____

_____

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_f value	Distance moved in mm	R_f value
Solvent front	120	–	113	–
Yellow-green pigment	18	0.15	14	0.12
Bright green pigment	24	0.20	Not found	Not found
Yellow pigment	40	0.33	46	0.41
Orange pigment	120	1.00	113	1.00

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 58 and TABLE 6 on page 59 to help you. [1 mark]

Repeat of 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

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_f values and the information in TABLE 6 to help you. [5 marks]

From _____mm to _____mm

[Turn over]

0 8 . 6 **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]

[Turn over]

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]

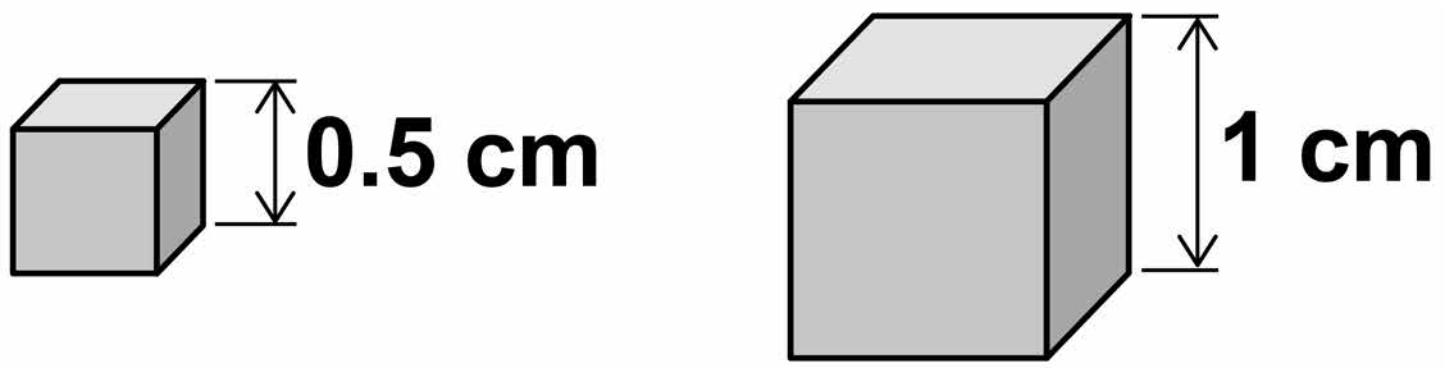
Structure	Approximate radius
a bacterial cell	1×10^{-14} m
a large molecule	5×10^{-10} m
an animal cell	1×10^{-10} m
an atom	1×10^{-6} m
	2×10^{-5} m
	3×10^{-9} m

FIGURE 7 shows two model cells.

Both models are cubes.

They are not drawn to scale.

FIGURE 7



0 9 . 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]

0 9 . 3 **Explain why a bacterium can rely on diffusion for gas exchange, but animals need a transport system. [3 marks]**

0 9 . 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]

END OF QUESTIONS

13

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For Examiner's Use	
Question	Mark
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