OCR
Oxford Cambridge and RSA

Friday 7 June 2024 – Afternoon

GCSE (9–1) Biology B (Twenty First Century Science)

J257/02 Depth in Biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You can use:
- an HB pencil
- a scientific or graphical calculator

F

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

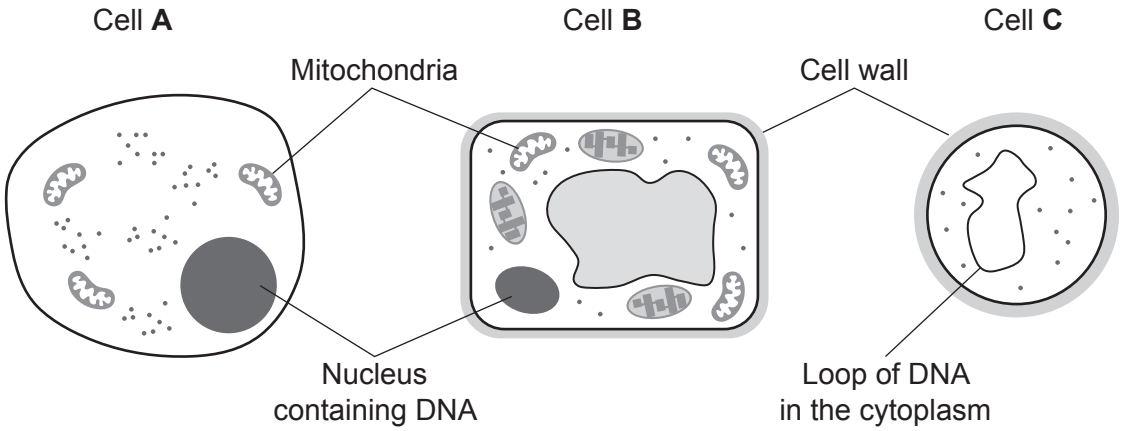
INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

1 Some types of bacteria can make us unwell.

(a) Here is a diagram of three cells.



Which cell is a bacteria cell?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

Use the diagram to explain your answer.

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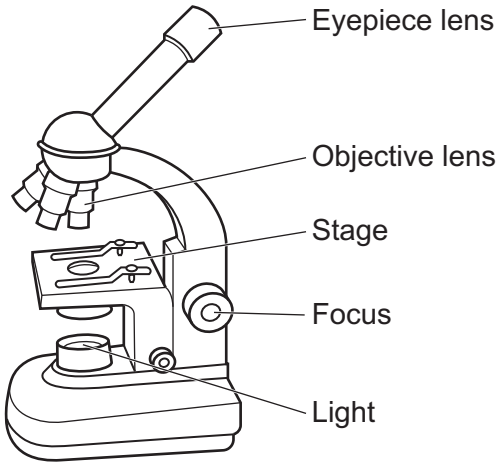
..... **[2]**

(b) Light microscopes can be used to observe bacteria.

Here is a labelled diagram of a light microscope:



Complete the sentences to describe how to use the microscope to observe bacteria on a slide.

Use words from the labelled microscope.

Place the slide on the ..... .

Turn on the ..... so the image is as bright as possible.

Turn the ..... into position above the slide.

Adjust the ..... until the image is as clear as possible.

[4]

(c) Which of these infections is caused by bacteria?

Tick (✓) **one** box.

Athlete's foot ☐

Influenza ☐

Malaria ☐

Salmonella food poisoning ☐

[1]

(d) Explain why washing your hands before making a sandwich can help stop you from getting unwell.

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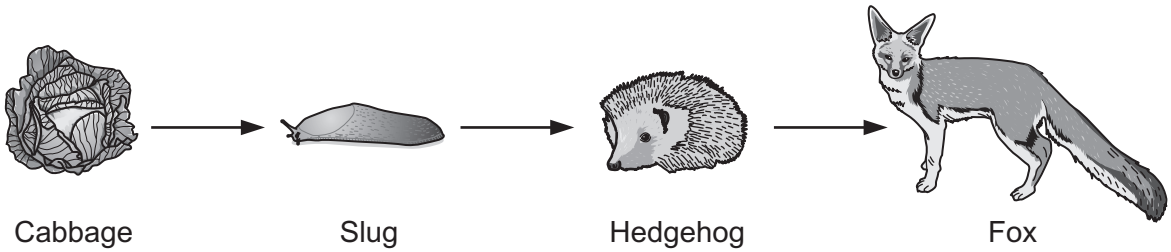
..... **[3]**

2 Hedgehogs are found all over Great Britain.

(a) Here is a food chain that includes hedgehogs:



Cabbage → Slug → Hedgehog → Fox

(i) Which organism in the food chain is a producer?

..... **[1]**

(ii) Which organism in the food chain is a primary consumer?

..... **[1]**

(iii) Foxes can be considered pests and are sometimes killed by humans.

Explain why killing foxes could cause the size of the **slug** population to decrease.

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..... **[3]**

(b) The table shows the size of the hedgehog population in Great Britain.

(i) Describe the change in hedgehog population size shown in the table.

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..... **[2]**

(ii) Assume the trend in the change in population continues.

Which of these is the best prediction of the hedgehog population in 2025?

Put a (ring) around the correct answer.

2.44 million **0.88 million** **0.85 million** **0.01 million**

[1]

(iii) In the countryside, hedgehogs live and hide from predators underneath hedges.

Since 1955, many hedges have been removed by farmers.

Explain how this could have caused the data in the table.

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..... **[2]**

(c) People who live in some towns have created 'hedgehog highways'.

These are small holes in garden fences that hedgehogs can fit through, but foxes cannot.

Suggest how this could cause an increase in the hedgehog population size in these towns.

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..... **[2]**

3 Hormones and nerve impulses help to control the human body.

(a) Which of these statements are **true** for hormones, nerve impulses or both?

Tick (✓) **one** box in each row.

	Only true for hormones	**Only true for nerve impulses**	**True for both**
Are secreted by glands			
Travel along neurons			
Travel in the blood			
Usually cause slower, longer-lasting responses			

[4]

(b) Explain how hormones can be used as a contraceptive to prevent pregnancy.

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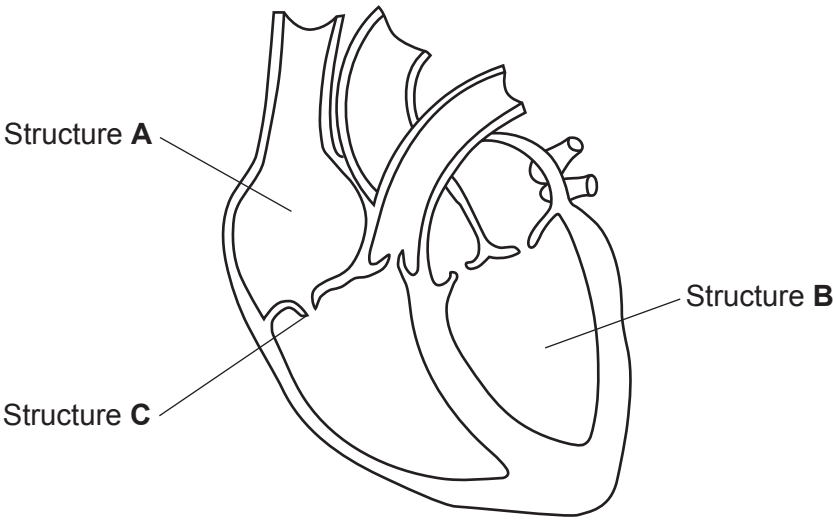
..... **[3]**

4 The heart, blood vessels and blood make up the circulatory system.

(a) The diagram shows a human heart.



Draw lines to connect each **structure** with its correct **name**.

Structure	Name
A	Atrium
B	Valve
C	Ventricle

[2]

(b) Which diagram correctly describes the route followed by blood through the circulatory system?

Tick (✓) **one** box.

Heart → Heart → Body → Lungs ☐

Heart → Lungs → Body → Heart ☐

Heart → Lungs → Heart → Body ☐

[1]

(c) We feel a pulse in our arteries when our heart beats.

Describe how to use your fingers to measure a person's pulse rate in beats per minute.

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..... **[2]**

(d) Exercise affects pulse rate differently in a fit person and an unfit person.

Charlie wants to use pulse rate to test the fitness levels of person **A** and person **B**.

Charlie uses this method:

- Person **A** and person **B** pedal as hard as they can on an exercise bike for 5 minutes.
- Their pulse rates are measured every minute.

Suggest **three** factors that should be the **same** about person **A** and person **B** to make the results valid.

1 .....

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2 .....

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3 .....

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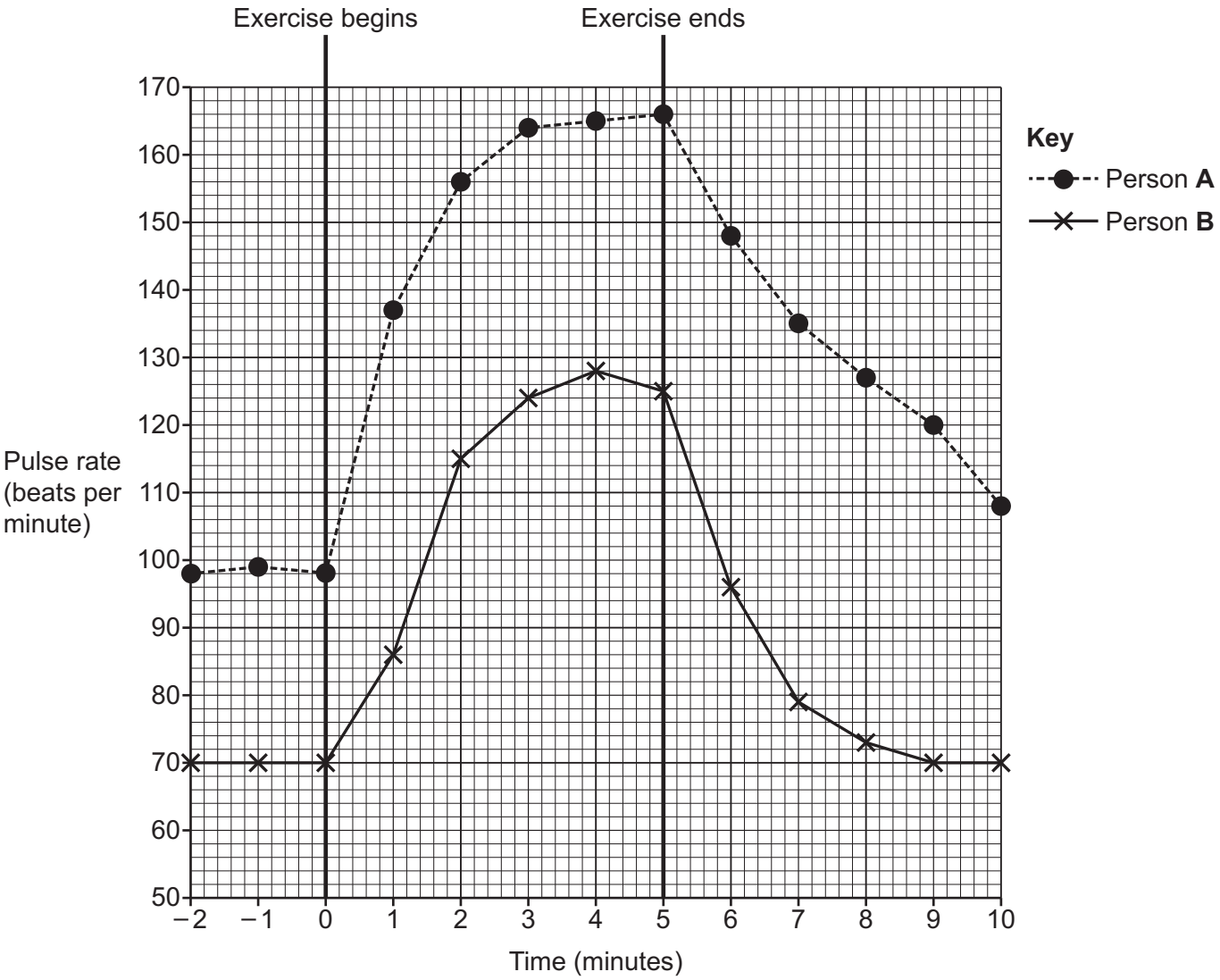
[3]

(e) The graph shows the results.

Person **A** and person **B** are resting from time = –2 until exercise begins at time = 0.



(i) What was person **B**'s resting pulse rate?

Resting pulse rate = ... beats per minute **[1]**

(ii) How long after exercise ends did it take for person **B**'s pulse rate to return to its resting value?

Time = ... minutes **[1]**

(iii) By how many beats per minute did person **B**'s pulse rate increase from their resting pulse rate to their highest recorded pulse rate?

Increase = ... beats per minute **[2]**

(iv) Charlie concludes that person **B** is fitter than person **A**.

Describe **three** reasons why Charlie is correct.
Use evidence from the graph.

1 .....

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2 .....

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3 .....

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[3]

5 Wheat and sunflowers are important food crops.

(a) The population of the world is 8 billion people.

3.2 billion people eat food made from wheat as a major part of their diet.

What percentage of the world's population is this?

Answer = ... % **[2]**

(b) Parts of the world where crops are grown are getting warmer and drier because of climate change.

A gene called HB4 enables plants to grow in warmer, drier conditions.

Sunflowers have this gene.

(i) Which statement explains what a gene is?

Tick (✓) **one** box.

A characteristic of an organism.	☐
A section of DNA that contains instructions.	☐
Part of a cell that contains chromosomes.	☐
The entire genetic material of an organism.	☐

[1]

(ii) Cells need genes to make which substances?

Put a (ring) around the correct answer.

carbohydrates **fats** **mineral ions** **proteins**

[1]

(iii) Wheat does **not** grow well in warmer, drier conditions.

Scientists have transferred the HB4 gene from sunflowers into wheat.

Describe the effects on the wheat of modifying it in this way.

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..... **[2]**

(iv) Which term describes the process scientists used to transfer the gene from sunflowers to wheat?

Tick (✓) **one** box.

- Genetic engineering ☐
- Natural selection ☐
- Selective breeding ☐
- Translocation ☐

[1]

(v)* Some people support the growing of this modified wheat and some people do not.

Explain why.

Include in your answer:
- benefits of growing the modified wheat
- risks and objections related to growing the modified wheat.

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..... **[6]**

6 Plants take in substances to help them stay alive.

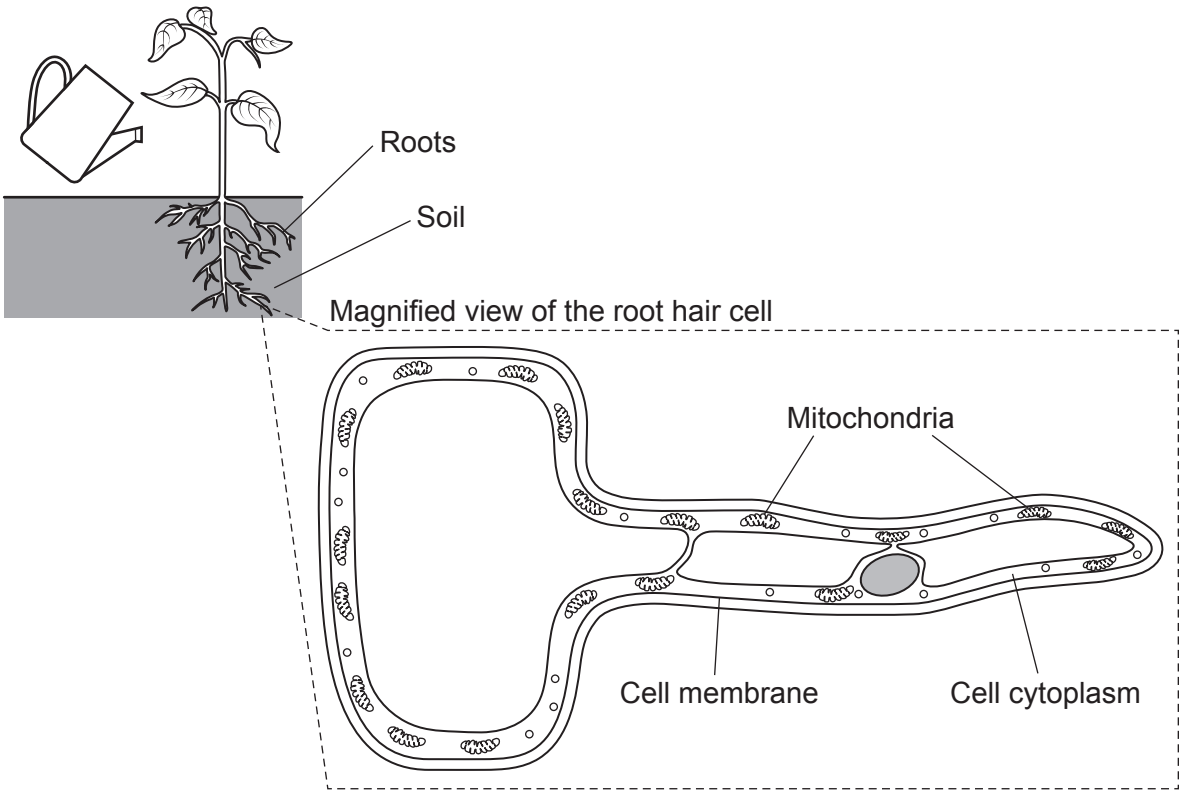
(a) Draw a line from each **substance** to its **use** in plants.

Substance	Use
Carbon dioxide	Cellular respiration
Nitrogen (from nitrate mineral ions)	Making proteins
Oxygen	Photosynthesis

[2]

(b) A student waters a plant with a mixture of fertiliser and water.

Some substances in the mixture are taken into the plant through the cell membrane of a root hair cell.



(i) Which term best describes the cell membrane of the root hair cell?

Tick (✓) **one** box.

Fully-permeable ☐

Non-permeable ☐

Partially-permeable ☐

[1]

(ii) The shape of the root hair cell from the plant extends out into the soil.

Explain why this shape is helpful to the plant after the student waters it.

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..... **[2]**

(iii) The plant takes in water for photosynthesis.

Complete the sentences to explain how water is taken into the root hair cell.

Use words from the list.

active transport	**air**	**cell cytoplasm**
diffusion	**osmosis**	**soil**

The concentration of water molecules is higher in the ..... than

in the ..... .

Water molecules move through the cell membrane due to the process of

..... , which is a type of ..... .

[4]

(iv) ATP is made during cellular respiration.
ATP is used to move nitrate mineral ions from the fertiliser mixture through the cell membrane into the root hair cell.

Explain why the root hair cell from the plant contains lots of mitochondria.

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..... **[3]**

(c) The student cuts the tip off one of the plant's roots.

This removes a tissue called meristem.

Explain why this root will **not** be able to grow or produce any more specialised cells without its meristem.

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..... **[3]**

7 Aerobic and anaerobic cellular respiration take place in human body cells.

(a) Put **one** tick (✓) in each row of the table to describe aerobic and anaerobic respiration in **animal** cells such as human body cells.

	Only aerobic	**Only anaerobic**	**Both aerobic and anaerobic**	**Neither aerobic nor anaerobic**
Is exothermic				
Produces lactic acid				
Requires glucose				
Requires oxygen				

[4]

(b) Complete the sentence about ATP production in respiration.

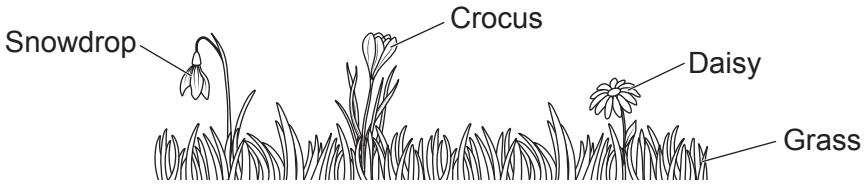
Use words from the list.

more than	**less than**	**equal to**

The amount of ATP produced per molecule of reactant in aerobic respiration is

..... the amount of ATP produced per molecule of reactant in anaerobic respiration. **[1]**

8 The diagram shows some different species of flowers that grow in a field.



A student wants to estimate the total number of snowdrops in the field.

They collect data from six small squares of the field.

Small square	1	2	3	4	5	6
Number of snowdrops	5	8	2	9	0	6

(a)* Describe a method to collect the data in the table.

Include:
- the apparatus needed
- how to use the apparatus on the field
- how to avoid bias in the data.

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..... **[6]**

(b) Use the student's data to calculate the mean number of snowdrops per small square.

Mean number of snowdrops per small square = ... **[2]**

(c) The area of the field is 600 m^2.
The area of each small square is 0.25 m^2.

Calculate the number of small squares that fit in the field.

Number of small squares that fit in the field = ... **[2]**

(d) Estimate the total number of snowdrops in the field.

Use the equation:

total number of snowdrops in the field = mean number of snowdrops per small square × number of small squares that fit in the field

Total number of snowdrops in the field = ... **[1]**

(e) Suggest **one** reason why we can only **estimate** the number of snowdrops in the field from the student's data.

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..... **[1]**

(f) The student thinks their estimate is **not** very close to the true number of snowdrops in the field.

Suggest **one** way to improve the data collection to get a better estimate of the number of snowdrops in the field.

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..... **[1]**

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.