OCR
Oxford Cambridge and RSA

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

J257/04 Depth in Biology (Higher Tier)

Monday 11 June 2018 – Morning

Time allowed: 1 hour 45 minutes

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

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

J257704

First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

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Answer **all** the questions.

1 Nina is learning about substances absorbed by plants. She finds out that plants absorb nitrate ions from the soil.

(a) Explain why nitrate ions are essential for plant growth and survival.

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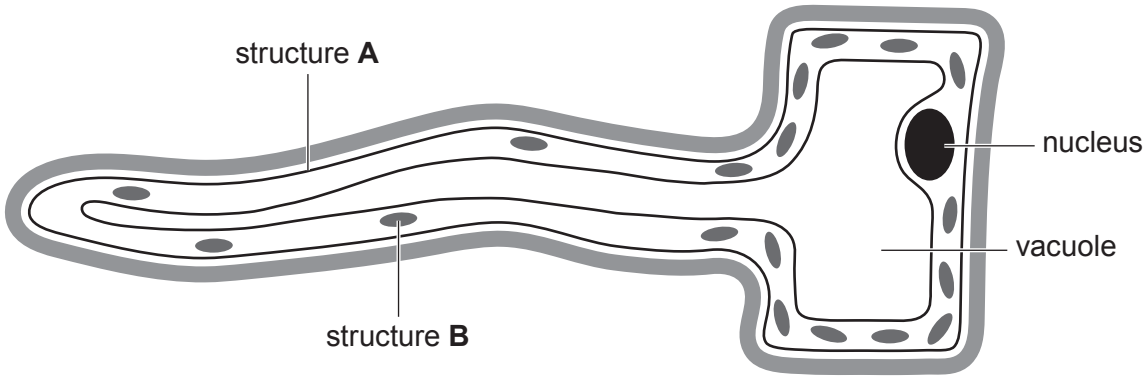
..... **[2]**

(b) Nitrate ions are absorbed into a plant root through root hair cells.

Nina finds this diagram of a root hair cell.



(i) State the names of structures **A** and **B**.

A .....

B .....

[2]

(ii) Explain the roles of **A** and **B** in transporting nitrate ions into the root hair cell.

A .....

.....

B .....

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[2]

(iii) The shape of the root hair cell is an adaptation.

Explain how this adaptation helps the root hair cell to absorb nitrate ions more effectively.

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

(c) The root hair cells also absorb water from the soil.

Complete the sentences below to describe how water is transported through a plant.

Choose the correct words from the list.

Each word may be used once, more than once or not at all.

diffusion **flowers** **meristem** **osmosis**

phloem **stomata** **xylem**

Water is transported from the soil into the root cells by .....

Water is pulled from roots to leaves through the ..... tissue

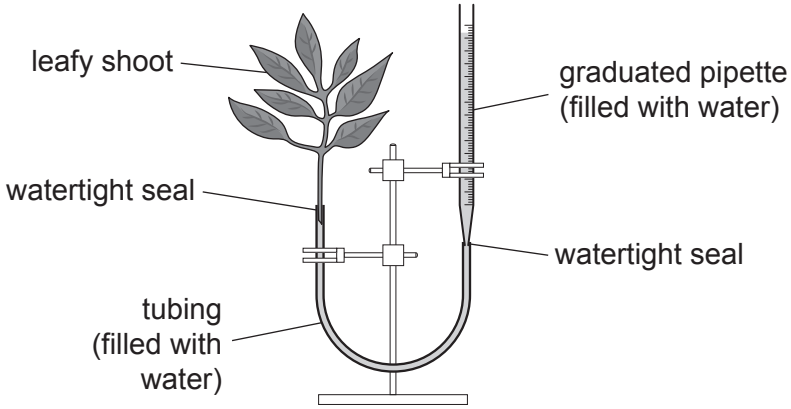
in the plant stem.

Water molecules are lost from the leaves into the atmosphere because of

..... through open ..... . **[4]**

(d)* Nina wants to investigate how changing the light intensity affects the rate of water uptake by a leafy shoot.

She sets up a leafy shoot in a simple potometer as shown in the diagram.



Nina has access to other apparatus including:

fan **glass tank filled with water** **lamp** **metre ruler**

small heater **stopwatch** **thermometer**

She does **not** have to use all the apparatus.

Describe the experimental procedure Nina should follow and how she should process her results.

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

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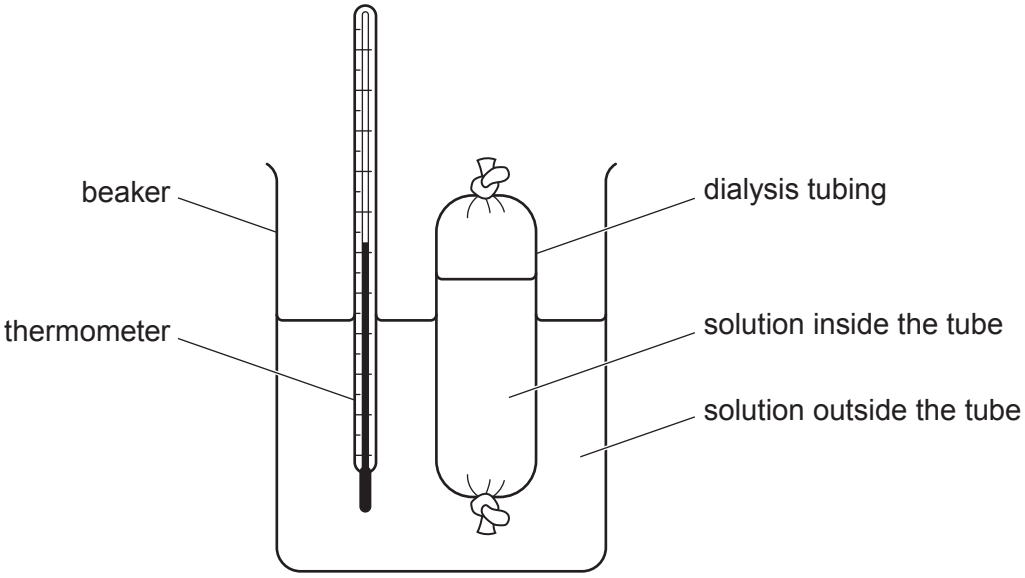
2 Eve sets up three experiments using dialysis tubing.

Dialysis tubing is a partially-permeable membrane.

Each experiment is set up as shown in the diagram:



(a) What is the purpose of the thermometer?

Tick (✓) **one** box.

To control the temperature.	☐
To record the temperature.	☐
To measure the temperature.	☐
To stir the solution.	☐

[1]

(b) Eve wants to do each of her three experiments at exactly 30 °C.

Describe how Eve could ensure the temperatures of the solutions in each experiment are kept at exactly 30 °C.

.....

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

Eve sets up the solutions as shown in **Table 2.1**.

Amylase is an enzyme.

Experiment	Solution inside the tube	Solution outside the tube
1	starch + tap water	tap water
2	glucose + tap water	tap water
3	starch + amylase + tap water	tap water

Table 2.1

After 3 minutes she removes a small sample of each solution.

(c) Describe how she could test each sample for the presence of glucose.

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

(d) She also uses iodine solution to test each sample for the presence of starch.

Her results are shown in **Table 2.2**.

Experiment	Sample from inside the tube		Sample from outside the tube	
	Test for starch	Test for glucose	Test for starch	Test for glucose
1	positive	negative	negative	negative
2	negative	positive	negative	positive
3	positive	positive	negative	positive

Table 2.2

(i) What conclusions can you make from Eve's results?

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..... **[4]**

(ii) Eve repeats experiment 3, but this time she boils the amylase before using it.

Write a testable prediction for this repeat of experiment 3.

Explain the science behind your prediction.

Prediction .....

.....

Explanation .....

.....

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

(e) Eve sets up one more experiment as shown in **Table 2.3**.

Experiment	Solution inside the tube	Solution outside the tube
4	starch + tap water	tap water + iodine solution

Table 2.3

The molecules of iodine in the iodine solution are smaller than molecules of glucose.

Eve watches this experiment for 5 minutes.

Describe and explain the changes she is likely to observe during the 5 minutes.

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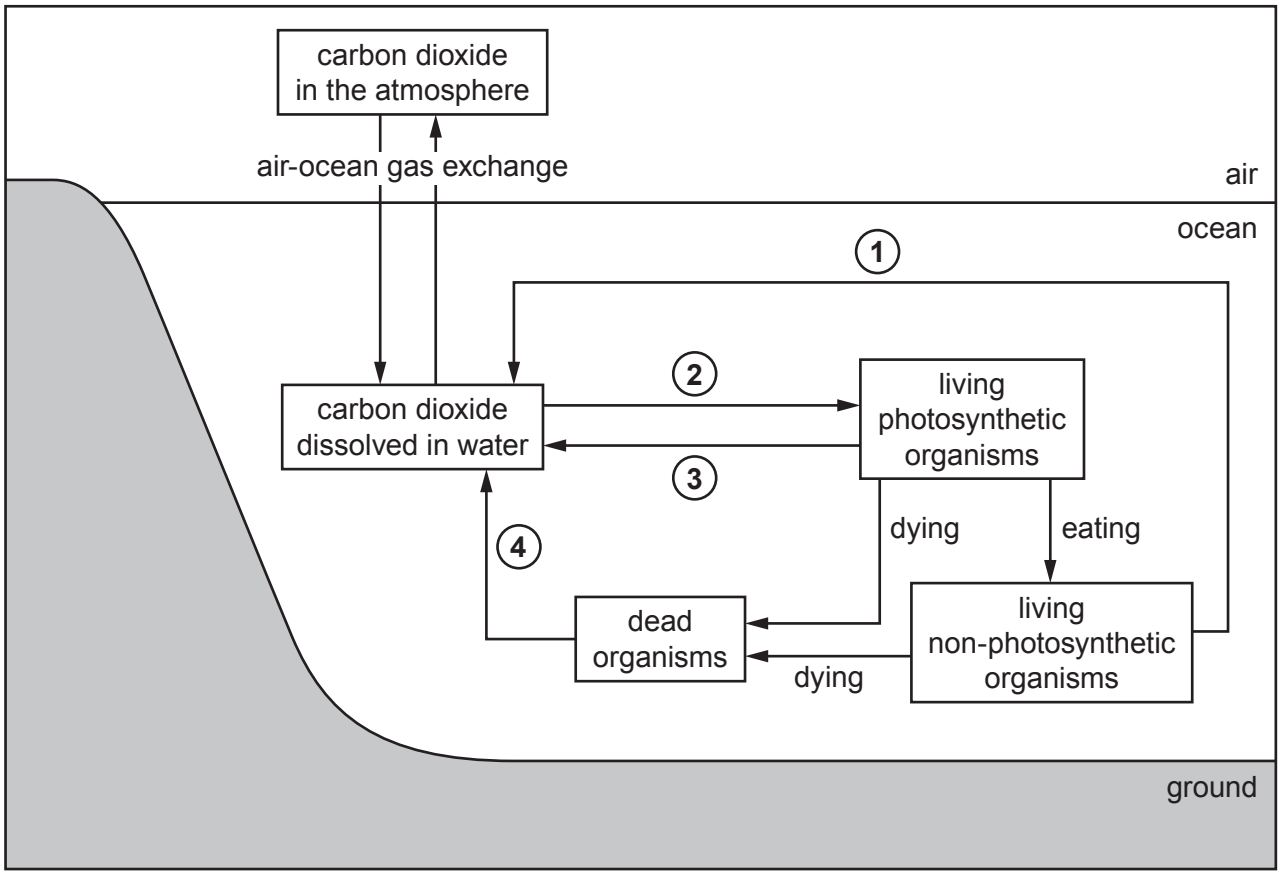
..... **[4]**

3 Oceans cover two thirds of the Earth's surface and absorb one third of the carbon dioxide created by human activities.

Oceans play a very important part in cycling carbon.

(a) The diagram shows the parts of the carbon cycle that take place in the ocean.



(i) Write down the names of the processes that have been labelled **1**, **2**, **3** and **4** in the diagram.

1 .....

2 .....

3 .....

4 ..... **[3]**

(ii) Explain the roles of microorganisms in the ocean carbon cycle shown in the diagram.

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

(iii) The processes shown in the diagram cycle carbon relatively quickly.

Carbon in the ocean is also cycled back to the atmosphere very slowly via another set of processes.

Describe these other processes and explain why this way of cycling carbon is very slow.

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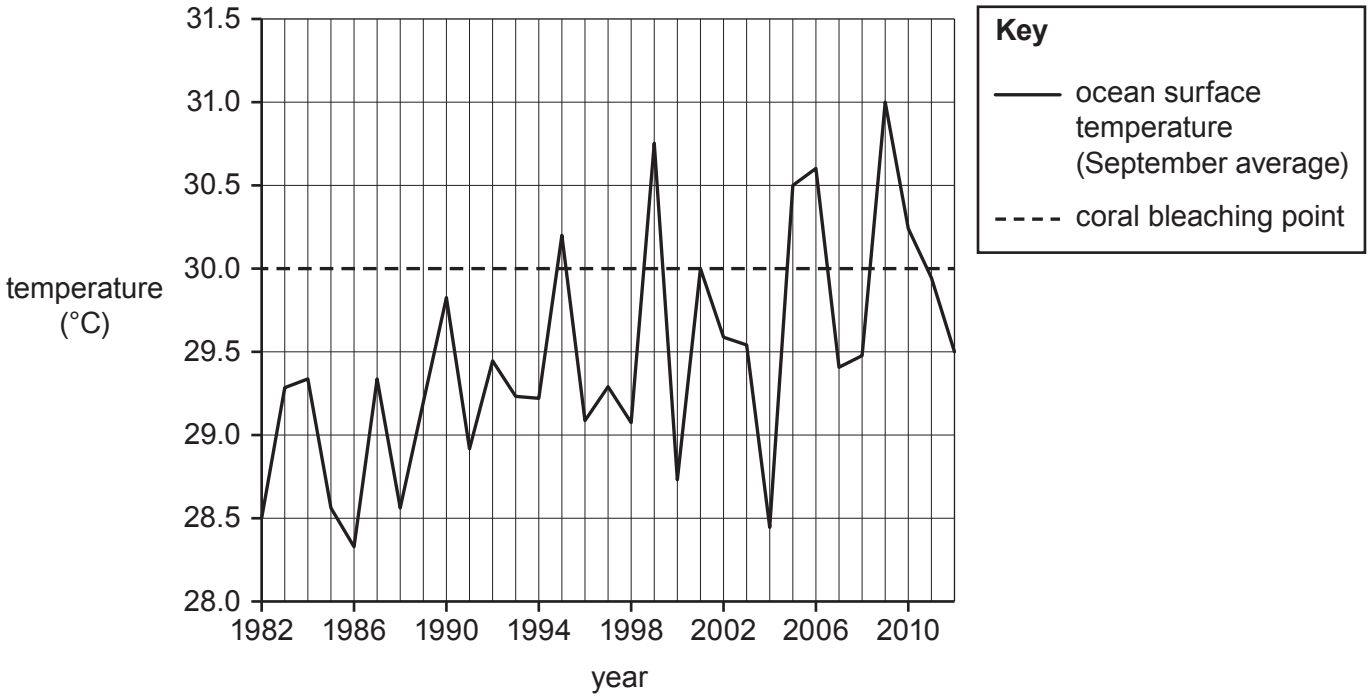
..... **[2]**

(b) Human activities are increasing the amount of carbon dioxide in the atmosphere. Carbon dioxide is a greenhouse gas.

Scientists are concerned about the effects that changes in temperature can have on coral reefs in the ocean.

If the ocean temperature rises above 30.0 °C, the coral starts to die and turns white. This temperature is called the 'coral bleaching point'.

The graph shows the ocean surface temperature around the Cayman Islands between 1982 and 2012.



(i) The graph shows an overall increase in ocean surface temperature from 1982 to 2012.

Describe **two other** patterns that are visible in the ocean surface temperature data on the graph.

1 .....

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2 .....

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

(ii) Scientists say long-term studies are needed when investigating the effects of climate change.

Use evidence from the graph to justify the scientists' view.

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

(iii) Calculate the **overall rate** of change in the ocean surface temperature from 1982 to 2012.

Overall rate of change = ... °C per year **[2]**

(iv) Predict how the line on the graph may have looked in the five years after 2012, **and** explain what this would have meant for coral in the Cayman Islands.

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

4 Plants can be infected by diseases caused by pathogens.

The plant disease ash dieback was first recorded in the early 1990s in Poland.

Since then, many thousands of trees in northern Europe have become infected.

Ash dieback was first found in eastern parts of Great Britain (GB) in 2012, and has been spreading across the country ever since.

(a) Suggest **two** ways in which ash dieback could have been spread from mainland Europe to Great Britain.

1 .....

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2 .....

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

(b) The British outbreak of ash dieback started in woodland in Norfolk.

Much of the woodland has died, but one ash tree has shown tolerance to the disease. This tree was named 'Betty' by scientists. Tolerant trees have also been found in mainland Europe.

(i) Explain how scientists could use selective breeding to produce ash trees with improved tolerance.

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

(ii) New woodland could be planted using cuttings from Betty.

Explain why this could be a **disadvantage** during a future outbreak of plant disease.

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

(iii) Explain how gene technology could be used to produce ash trees with improved tolerance.

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..... **[4]**

(c) Amir works in a laboratory. His job is to identify pathogens that cause plant diseases.

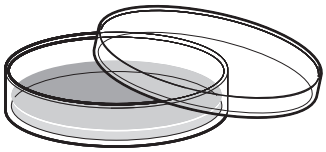
Amir has a sample of one species of bacteria from an infected plant.

He wants to test the effectiveness of different antibiotics against this species of bacteria.

Amir must start by transferring bacteria from the sample bottle into four Petri dishes containing agar jelly.

He needs to set up four identical dishes of this species of bacteria.

glass bottle containing the sample of bacteria



Petri dish containing agar jelly

He intends to pour some of the liquid from the glass bottle into each Petri dish.

(i) Write down **two** ways he could improve his method and explain why each is an improvement.

Improvement 1 .....

.....

Explanation .....

.....

Improvement 2 .....

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Explanation .....

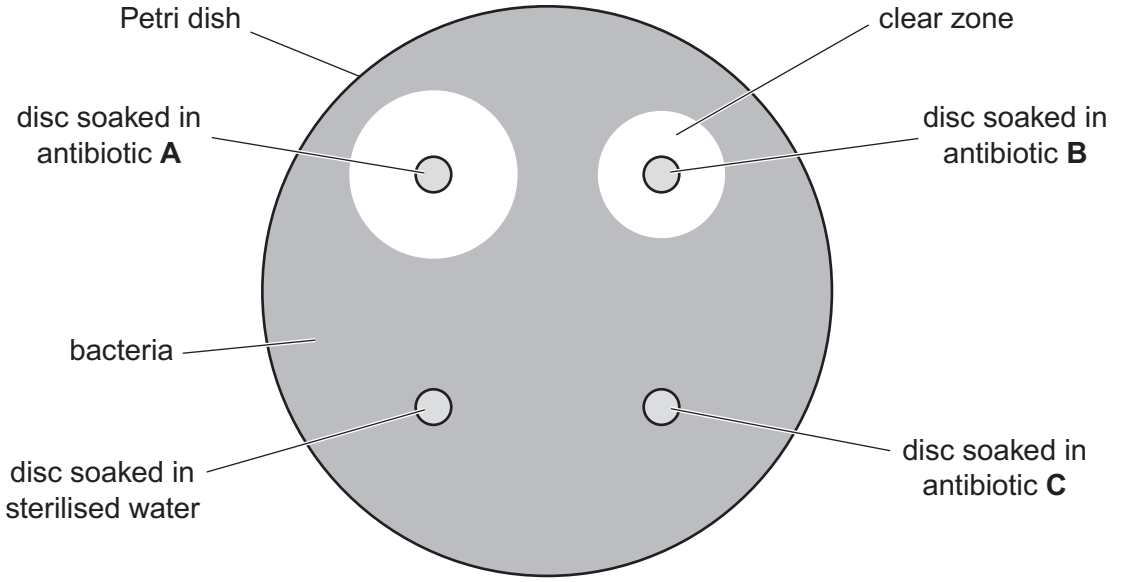
..... **[4]**

After transferring bacteria from the sample to the four Petri dishes, Amir adds four different paper discs to each dish.

The paper discs have been soaked in different solutions.

Amir places the dishes in an incubator overnight.
The bacteria grow to cover the surface of the agar jelly.

The diagram shows what Amir sees on one of the dishes after it has been incubated.



not to scale

(ii) The diameter of the clear zone around the disc soaked in antibiotic **A** is 23 mm.

Calculate the area of this clear zone.

Use the equation: area of clear zone = $3.14 \times r^2$.

Give your answer to **3** significant figures.

Area of clear zone = ... mm^2 **[3]**

(iii) **Table 4.1** shows Amir's results for all four dishes.

Disc soaked in	Area of clear zone (mm^2)			
	Petri dish 1	**Petri dish 2**	**Petri dish 3**	**Petri dish 4**
Antibiotic **A**		363	346	346
Antibiotic **B**	227	254	227	214
Antibiotic **C**	0	0	0	0
Sterilised water	0	0	0	0

Table 4.1

Suggest **two** possible explanations for the results for antibiotic **C**.

1 .....

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2 .....

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

(d) **Table 4.2** gives information about plant cells and pathogens.

Cell type	Mean diameter (μm)	Mean diameter (m)
Plant cell		8×10^{-5}
Bacterium	2	
Virus	0.25	

Table 4.2

(i) Give the mean diameter of the plant cell in μm.

Mean diameter = ... μm **[1]**

(ii) Give the mean diameter of the bacterium in m.

Give your answer in standard form.

Mean diameter = ... m **[1]**

(iii) Give the mean diameter of the plant cell, in m, to the nearest order of magnitude.

Mean diameter = ... m **[2]**

(iv) Show that the sizes of the bacterium and the virus are the same order of magnitude.

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

5 The human body responds to changes so that it can maintain a constant internal environment.

(a) Many of these responses involve muscles as effectors.

Muscles are made of cells.

Explain why muscle cells have more mitochondria than most other types of cell in the body.

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

(b)* When temperature receptors in the skin and hypothalamus detect a drop in temperature, the hormone adrenaline is released from the adrenal gland.

Explain how the release of adrenaline could help the body to raise its core temperature back to normal.

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

(c) The sensitivity of cells to the hormone adrenaline is increased by the hormone thyroxine.

(i) Explain how the production of thyroxine is regulated by negative feedback.

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

(ii) Hormones stimulate cells by binding to receptors on the cell surface. These receptors are protein molecules.

Suggest how the hormone thyroxine could cause a cell to become more sensitive to the hormone adrenaline.

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..... **[4]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).