OCR
Oxford Cambridge and RSA

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# Wednesday 24 May 2017 – Afternoon

## GCSE GATEWAY SCIENCE
## BIOLOGY B

**B731/02** Biology modules B1, B2, B3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

**OCR supplied materials:**
None

**Other materials required:**
- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour 15 minutes

* B 7 3 1 0 2 *

* 6 6 7 7 7 1 8 4 3 0 *

| Candidate forename | | Candidate surname | |
|---|---|---|---|

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

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should 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 FOR CANDIDATES**

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

## SECTION A – Module B1

**1** The table shows information about the contents of two types of sausage.

All the figures are for **100 g** of the sausages.

| | **Pork sausages**  | **Vegetarian sausages**  |
|---|---|---|
| energy in kJ | 1200 | 740 |
| protein in g | 10 | 9 |
| fat in g | 22 | 8 |
| carbohydrate in g | 10 | 13 |

**(a)** A boy has a mass of 50 kg.

**(i)** Calculate his estimated average daily requirement (EAR) for protein.

Use this formula to work out your answer.

**EAR in g = 0.6 × body mass in kg**

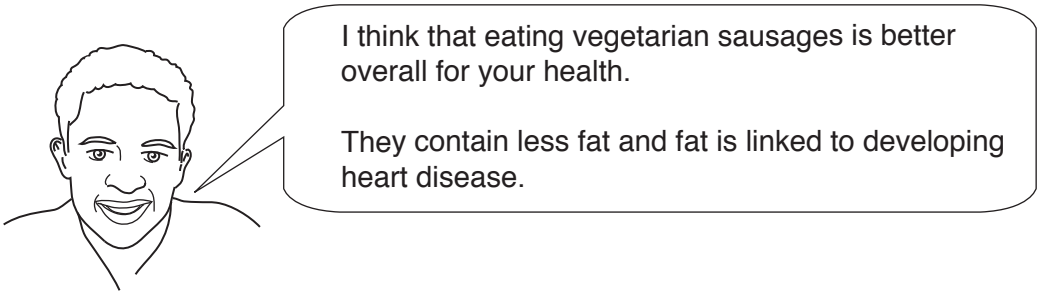
EAR = ..... g **[1]**

**(ii)** The boy ate 150 g of the pork sausages.

What percentage of his EAR would this provide?

answer = ..... % **[2]**

**(b)** Another boy makes two comments about eating vegetarian sausages rather than pork sausages.




For each of the boy's comments write about whether it contains scientific **facts** or just **opinion**.

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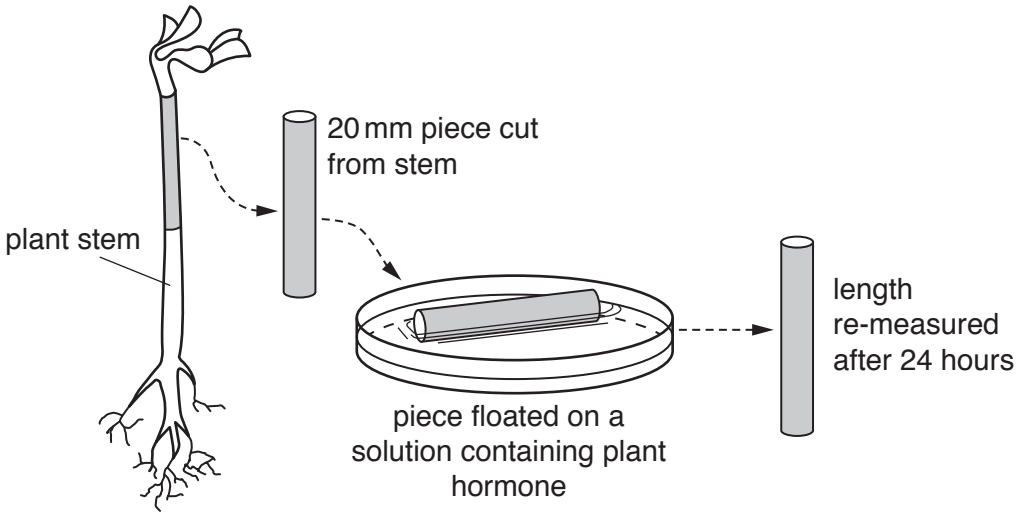
..... **[2]**

**2** Growth in plants is controlled by chemicals called plant hormones.

Students want to measure the effect of a plant hormone on the growth of plant stems.

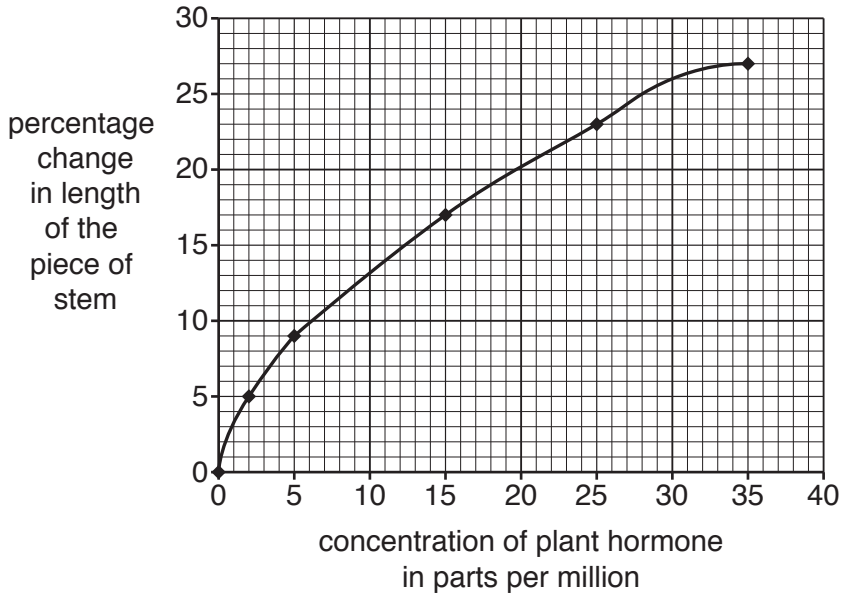
The diagram shows their method.




They repeated the experiment with different concentrations of plant hormones.

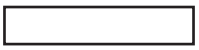
After 24 hours they worked out the percentage change in length of the stem.

The graph shows their results.



**5**

The diagram shows a piece of stem that has been floating in a plant hormone solution.



Explain the effect of the plant hormone on the pieces of stem and work out the concentration of plant hormone that **this** piece of stem was floating in.

*The quality of written communication will be assessed in your answer to this question.*

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

**3** Read this article about a disease that occurs in South America.

**Doctors concerned about spread of disease**

Zika is a disease that is caused by a virus.

It is spread by mosquitoes.

In most people the disease is quite mild.
However, there is evidence that in pregnant women it can slow the growth of the baby's brain.

The disease cannot be treated by antibiotics.

Scientists are trying to develop a vaccine for the zika virus.

**(a)** What name is given to the role of the **mosquito** in the spread of this disease?

Put a (ring) around the correct answer.

**antiviral** **pathogen** **protozoa** **vector**

**[1]**

**(b)** Scientists are making a vaccine against this virus.

Explain what the vaccine is likely to contain and how it will work.

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

**(c)** When scientists develop new medicines they test the medicine in trials using placebos.

What is a **placebo** and why is it used?

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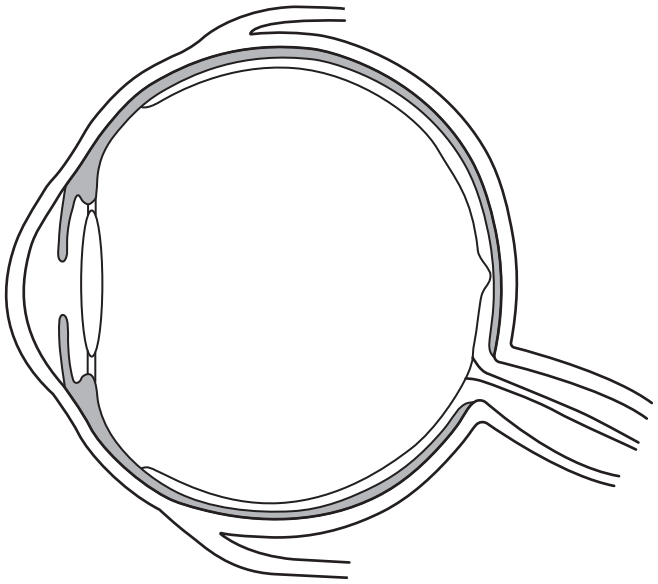
**4** The diagram shows a section through the human eye.



**(a)** Label the diagram with an **X** to show the part of the eye that controls how much light enters the eye. **[1]**

**(b)** Some humans and animals have an inherited condition called cornea plana.

It causes the cornea to be less curved than normal.

This can lead to long-sight in humans.

Explain why cornea plana causes long-sight in humans.

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

**(c)** Scientists performed an experiment on mice to try and work out how cornea plana is inherited.

They mated together two mice who had normal vision.

There were nine offspring and three had cornea plana.

Complete these sentences about the inheritance of cornea plana.

Cornea plana is caused by a change to a gene.

A change in a gene is called a ..... .

The allele that is produced is ..... to the normal allele.

The two parent mice must be ..... for the allele for cornea plana. **[3]**

**5** There are different types of fitness and various tests that can be used to measure them.

The table gives some information about these tests.

| Type of fitness | Example of test used |
|---|---|
| ..... | how fast a person can run zig-zagging between cones |
| ..... | how far a person can stand from a wall and bend forward to touch the wall with their knees |
| strength | how much force a person can exert when gripping a machine with their right hand |
| speed | how fast a person can sprint 60 metres |

**(a)** Complete the table by adding the two missing types of fitness. Use words from this list.

**agility** **flexibility** **stamina**

**[1]**

**(b)** Suggest **one** disadvantage of describing a person's **strength** by using the method in the table.

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

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## SECTION B – Module B2

**6** Nitrogen is an element found in living organisms.

Read this article about nitrogen and plants.

### Nitrogen – the farmers' friend

Plants are surrounded by plenty of nitrogen gas in the air but cannot use it.

The main way they get nitrogen is from the soil.

Plants need nitrogen for growth.

When farmers harvest their crops they often dig the remains of the plant into the soil.

The decomposition of the plant remains will provide nitrates for next year's crop.

**(a)** Why is nitrogen needed for plant growth?

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

**(b)** Explain how the decomposition of dead plants in the soil provides nitrates for next year's crop.

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

**(c)** The table shows the amount of nitrogen which entered crops in three different countries in one year.

| | **Amount of nitrogen entering crops in millions of tons per year** | | |
|---|---|---|---|
| **Source of nitrogen** | **Australia** | **India** | **USA** |
| fixed by bacteria in root nodules | 13.9 | 1.6 | 11.3 |
| other sources | 3.5 | 2.0 | 8.7 |
| total | 17.4 | 3.6 | 20.0 |

**(i)** The percentage of nitrogen entering crops due to bacteria in root nodules is **79.9**% in Australia and **56.5**% in USA.

Calculate the percentage of nitrogen entering crops in India that is due to bacteria in root nodules.

answer ..... % **[2]**

**(ii)** Which country grows the **lowest** proportion of peas or beans as crops?

Explain your answer.

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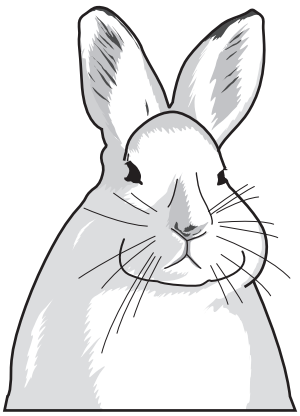
**7** Snowshoe hares live in northern Canada where there is snow on the ground for much of the year.

Jackrabbits live in the hot deserts of Mexico.



snowshoe hare

jackrabbit

**(a)** The snowshoe hare and jackrabbit have different coloured fur for camouflage in their different habitats.

Explain one **other** way they are adapted to their habitats seen in the pictures.

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

**(b)** Snowshoe hares are preyed on by animals called lynx.
Scientists have made observations to explain why snowshoe hares have white fur.

Here are their observations.

**A** Hares are all born with slightly different coloured fur.

**B** Lynx are trying to find food and hares are trying not to be eaten.

**C** The hares with the fur colour best suited to the conditions survive.

**D** The hares that survive pass on their genes for fur colour.

Charles Darwin made observations about natural selection.

Match the scientists' observations to Charles Darwin's observations by writing the correct letter **A**, **B**, **C** and **D** in the table.

| Charles Darwin's observation | Scientists' observation |
|---|---|
| survival of the fittest | |
| competition for resources | |
| inheritance of successful adaptations | |
| presence of natural variation | |

**[2]**

**(c)** Scientists think that increasing levels of carbon dioxide pollution may affect the survival of snowshoe hares.

In 2015 the scientists collected data about the survival of the hares.

They have also predicted how the hares will survive in the future.

Their results are shown in the table.

| Year | 2015 | 2050 | 2080 |
|---|---|---|---|
| percentage chance of a hare surviving one year | 9.3 | 8.2 | 7.0 |

Write about how carbon dioxide pollution can change the hare's habitat and why the hares could become **extinct** if the scientists' predictions are correct.

*The quality of written communication will be assessed in your answer to this question.*

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**8** The diagram shows two types of ladybird.

**7 spotted ladybird**
*Coccinella septempunetata*

**Harlequin ladybird**
*Harmonia axyridis*

**(a)** All ladybirds are arthropods.

Put a tick (✓) next to the correct comparison of the classification of the two types of ladybirds.

They are classified in …

… the **same** class, genus and species. ☐

… a **different** class, genus and species. ☐

… the **same** class and genus but **different** species ☐

… the **same** class but **different** genus and species ☐

**[1]**

**(b)** Ladybirds may get their common name from the fact that they can fly.

The Ancient Greeks might have classified ladybirds in the same group as birds.

**(i)** What name is given to the type of classification system used by the Ancient Greeks?

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

**(ii)** Give **one** reason why this type of system is not used now.

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

**(c)** Harry has been looking at the ladybirds on a bush in his garden.

He knows that there are three main types of ladybird living in the area.

The three main types of ladybird can have different numbers of spots on their body.

| Type of ladybird | Number of spots on the body |
|---|---|
| harlequin | 15–21 |
| eyed | 15 |
| 7 spotted | 7 |

Harry is talking to two of his friends.

**Harry**
The mean (average) on the bush is 15 spots per ladybird so they must all be eyed ladybirds.

**Tom**
If that mean is correct then there could still be an equal spread of all three types of ladybird on the bush.

**Sam**
That mean shows that there could be some 7 spotted ladybirds on the bush but not many of them.

Which friend's answer is correct?

Explain your answer.

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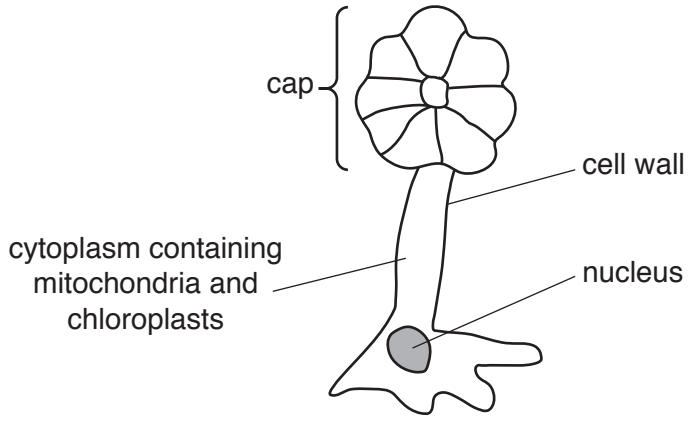
## SECTION C – Module B3

**9** **(a)** *Acetabularia* is a unicellular organism that lives in the sea.

It has rather an unusual shape.




**(i)** Write down **two** features shown in the diagram of *Acetabularia* that tell you that it is **not** a bacterium.

1 .....

2 .....

**[2]**

**(ii)** *Acetabularia* is one of the largest unicellular organisms.

To be larger, organisms need to be multicellular.

What is an advantage of being larger and multicellular?

Put a tick (✓) next to the **correct** answer.

| | |
|---|---|
| Some genes can be lost from some cells. | ☐ |
| Both aerobic and anaerobic respiration can occur. | ☐ |
| Cells are able to differentiate and specialise. | ☐ |
| Organisms are able to clone themselves. | ☐ |

**[1]**

**(iii)** To become multicellular, specialised organ systems may be needed.

Write down **one** of these systems and explain why it is needed.

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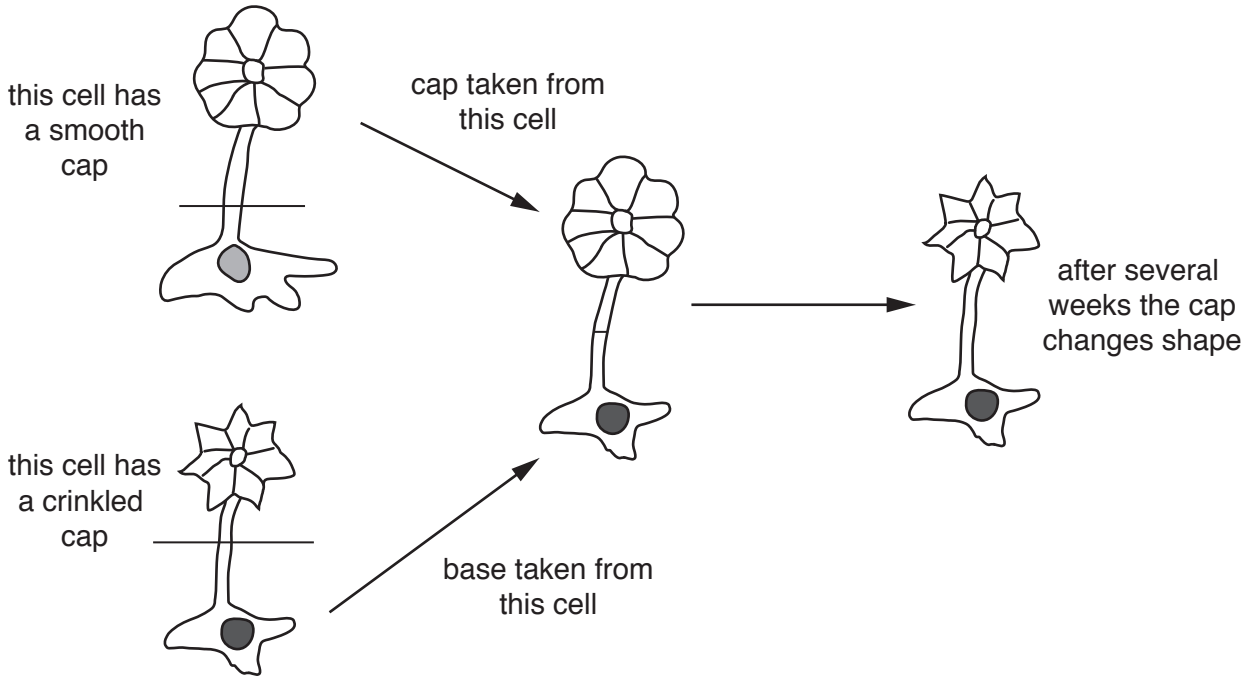
..... **[1]**

**(b)** A scientist did an experiment with two types of *Acetabularia*.

The two types of *Acetabularia* had different shaped caps.

The diagram shows the scientists experiment.




The shape of the cap depends on which **proteins** are made by the cell.

Explain how the nucleus codes for proteins that are made elsewhere in the cell and suggest why it took several weeks for the cap to change shape.

*The quality of written communication will be assessed in your answer to this question.*

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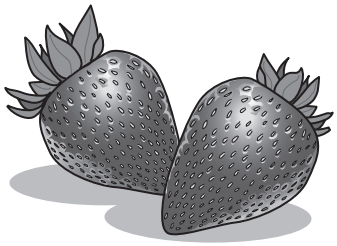
**10** A farmer is choosing which strawberry plants to grow.

He reads an advert in his farming magazine.

## Buy strawberry plants from us!



We have been selectively breeding strawberry plants for many years.

This produced a plant with very sweet tasting strawberries.

All the plants we now sell are clones of this plant.

We guarantee that none of the plants we sell are genetically modified.

**(a)** The strawberry plants sold by the company are all clones.

Write about the **disadvantages** of a farmer only growing this one type of strawberry plant.

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

**(b)** The plant company say that none of their plants are genetically modified.

Suggest **two** reasons why the company wants to let people know this.

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

**11** A student answered two questions in a biology test.

Both his answers contain mistakes.

Explain the student's mistakes in each answer.

**(a)** Question one: Write down three examples of proteins.

Student's answer: amino acids, collagen, insulin

Student's mistake .....

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

**(b)** Question two: How do enzymes work?

Student's answer: An enzyme is like a key that fits into a substrate's active site.

Student's mistake .....

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

**12** The table shows some information about three types of mammal.

| Mammal | Metabolic rate | Surface area of one red blood cell in arbitrary units | Volume of one red blood cell in arbitrary units | Surface area to volume ratio of red blood cells |
|---|---|---|---|---|
| Mouse | 1.0 | 91 | 52 | 1.75 |
| Rabbit | 1.5 | 114 | 70 | 1.63 |
| Shrew | 7.5 | 60 | 24 | |

**(a)** The units for the metabolic rate are $cm^3$ of oxygen consumed in one hour per gram of animal.

**(i)** Suggest why the oxygen consumed is given as **per gram of animal**?

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

**(ii)** Explain why oxygen consumption can be used as a measure of metabolic rate.

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

**(b) (i)** Calculate the surface area to volume ratio of red blood cells for the shrew.

answer = ..... **[1]**

**(ii)** Explain how the shrew manages to maintain its metabolic rate.

Use your calculation in part **(b)(i)** and information from the table in your answer.

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

**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).