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|---------------------|--|------------------|--|
| Surname             |  | Other Names      |  |
| Centre Number       |  | Candidate Number |  |
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General Certificate of Secondary Education  
June 2006



**BIOLOGY (SPECIFICATION B)  
Foundation Tier**

**3411/F**  
**F**

Wednesday 7 June 2006 1.30 pm to 3.45 pm

|  |
|--|
| <p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>a ruler</li> </ul> <p>You may use a calculator.</p> |
|--|

Time allowed: 2 hours 15 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 135.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

| For Examiner's Use  |      |        |      |
|---------------------|------|--------|------|
| Number              | Mark | Number | Mark |
| 1                   |      | 14     |      |
| 2                   |      | 15     |      |
| 3                   |      | 16     |      |
| 4                   |      | 17     |      |
| 5                   |      | 18     |      |
| 6                   |      | 19     |      |
| 7                   |      | 20     |      |
| 8                   |      | 21     |      |
| 9                   |      | 22     |      |
| 10                  |      |        |      |
| 11                  |      |        |      |
| 12                  |      |        |      |
| 13                  |      |        |      |
| Total (Column 1) →  |      |        |      |
| Total (Column 2) →  |      |        |      |
| TOTAL               |      |        |      |
| Examiner's Initials |      |        |      |

Answer **all** questions in the spaces provided.

- 1 Complete the table to show which organ of the human body carries out each function.

Choose your answers from the list in the box.

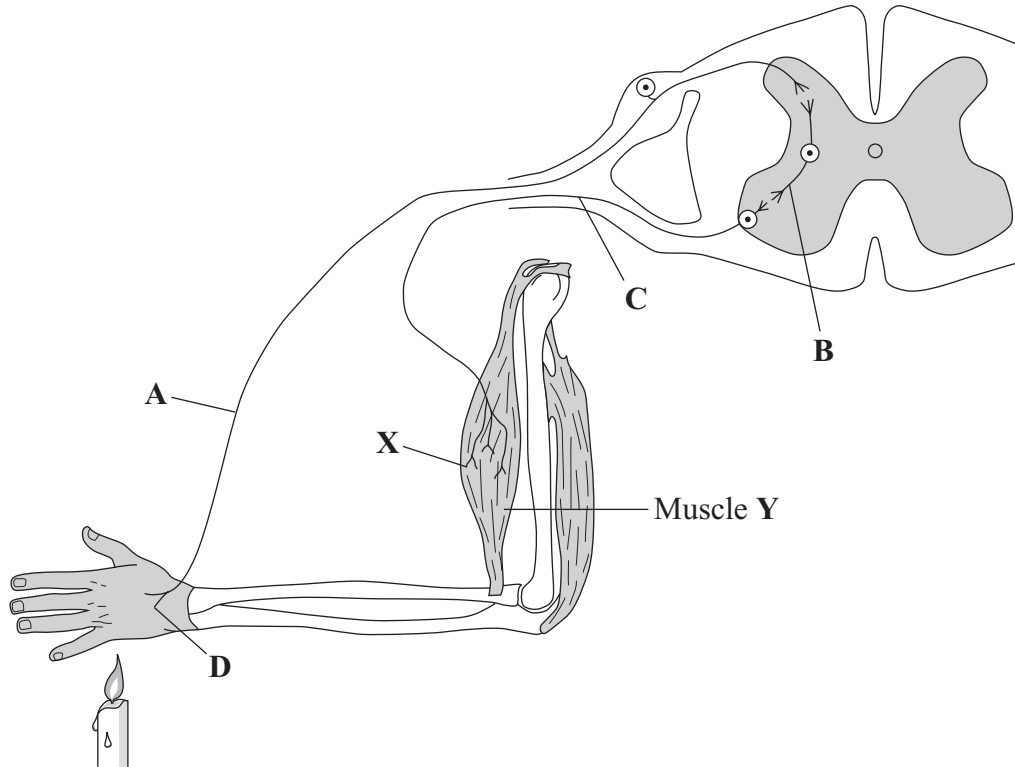
**brain    eye    heart    liver    ovary    pancreas    stomach**

| <b>Function</b>             | <b>Organ</b> |
|-----------------------------|--------------|
| Pumps blood around the body |              |
| Releases eggs               |              |
| Detects light               |              |
| Produces hydrochloric acid  |              |
| Produces insulin            |              |

(5 marks)

5

2 The diagram shows the parts of the nervous system which act when the hand touches a hot object.



(a) Which letter, A to D, shows:

- (i) the sensory neurone; .....
- (ii) the motor neurone; .....
- (iii) the receptor? .....

(3 marks)

(b) What happens to muscle Y when impulses arrive at point X?

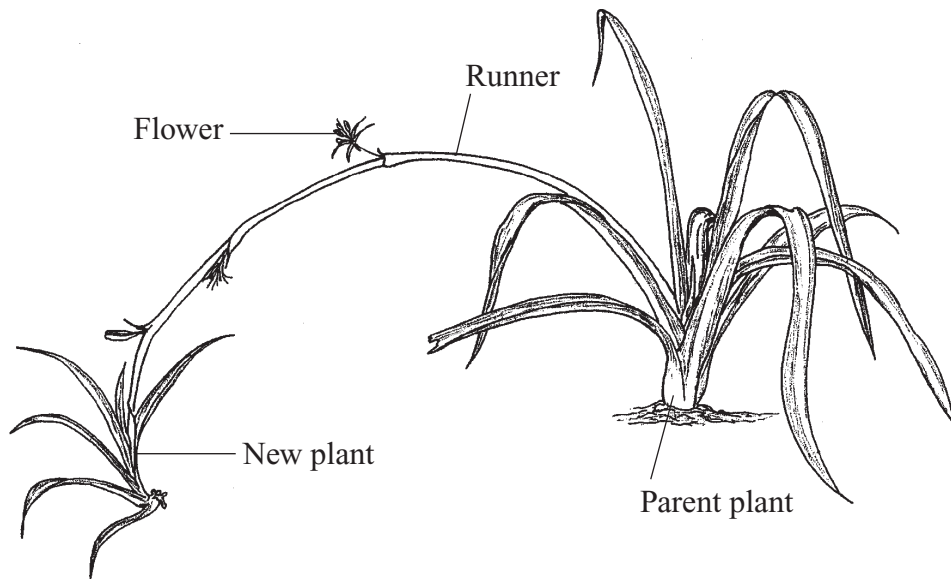
.....  
(1 mark)

(c) Moving the hand away from the hot object is a reflex action. What is a reflex action?

.....  
.....  
.....  
.....

(2 marks)

3 The diagram shows a house plant.



Complete the sentences about reproduction in this plant. Choose the correct words from the box.

|                |                  |                  |                 |
|----------------|------------------|------------------|-----------------|
| <b>asexual</b> | <b>clones</b>    | <b>different</b> | <b>families</b> |
| <b>gametes</b> | <b>identical</b> | <b>sexual</b>    |                 |

This plant reproduces in two different ways:

**EITHER** New plants may grow from the ends of the runners. Many new plants can form in this way. This is an example of ..... reproduction. All the offspring plants will be genetically ..... . Scientists call groups of offspring produced in this way .....

**OR** In the flowers, male and female ..... will fuse together and grow into seeds. This is an example of ..... reproduction. All the offspring plants grown from the seeds will be genetically .....

(6 marks)

- 4 The table gives information about urine and sweat produced by a person on two different days. On one day the weather was cold and on the other it was hot. The person did the same amount of exercise, and ate and drank the same, on each day.

|   | Cold day | Hot day |
|---|----------|---------|
| Volume of sweat in $\text{dm}^3$                          | 0.62     | 1.22    |
| Volume of urine in $\text{dm}^3$                          | 1.50     | 0.90    |
| Concentration of salt in urine in grams per $\text{dm}^3$ | 9.50     | 12.80   |

- (a) (i) The person sweats more on the hot day.

Why is this helpful?

.....  
 .....  
 (1 mark)

- (ii) Why is the volume of urine lower on the hot day?

.....  
 .....  
 (1 mark)

- (b) The person took in the same amount of salt in food and drink on both days.

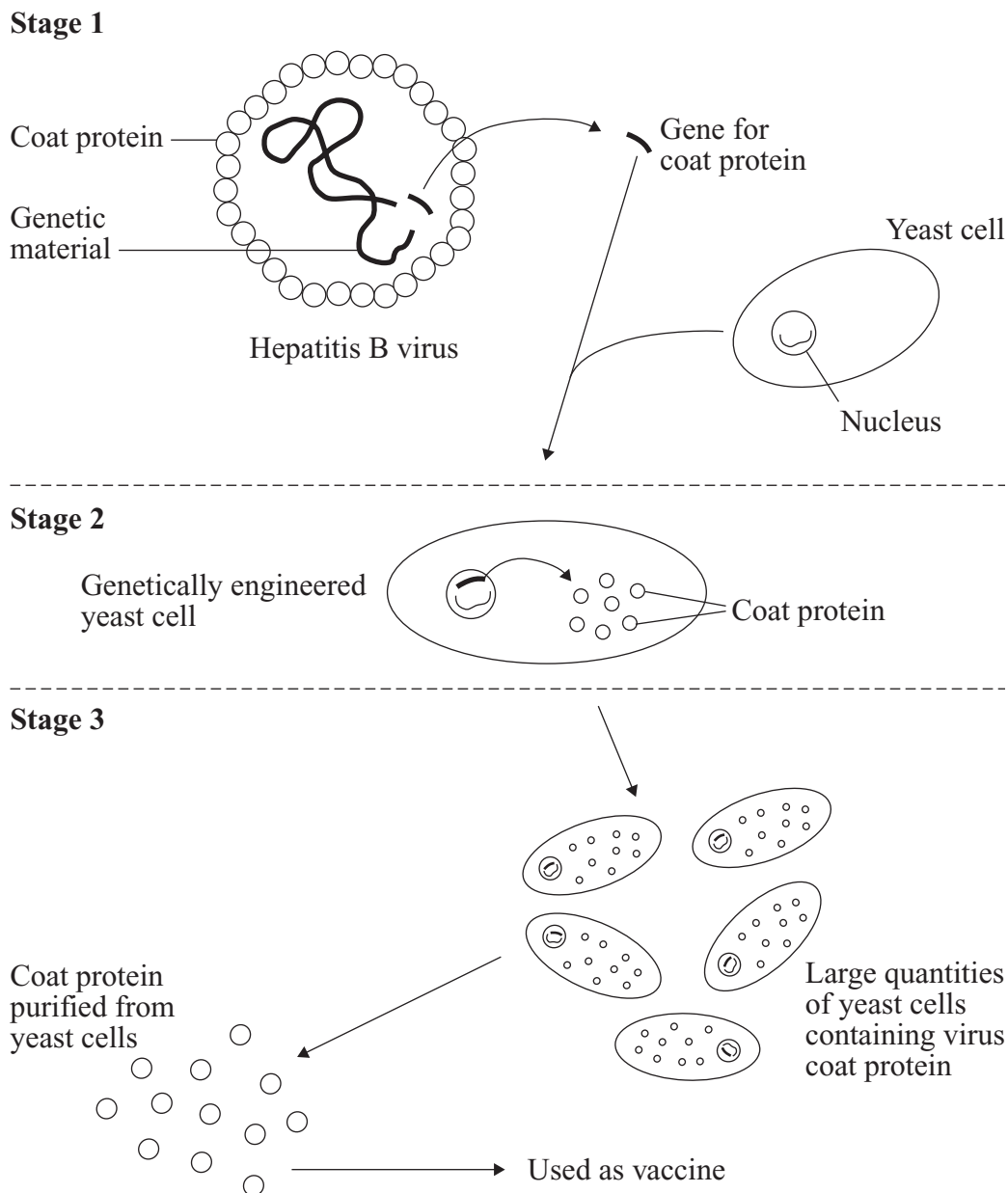
Why is the salt concentration of the urine higher on the hot day?

.....  
 .....  
 (1 mark)

- (c) Give **one** other way by which a large amount of water is lost from the human body each day.

.....  
 .....  
 (1 mark)

- 5 Hepatitis B is a dangerous human disease. It is caused by a virus. The diagram shows how a vaccine against hepatitis B can be made by genetic engineering.



- (a) Use the diagram to answer the following questions.

- (i) What part of the virus is put into the yeast cell at **Stage 1**?

.....  
(1 mark)

- (ii) What part of the virus is produced by the yeast cell at **Stage 2**?

.....  
(1 mark)

(b) In each of parts (i), (ii) and (iii), draw a ring around **one** answer.

A vaccine is injected into a person. The vaccine helps fight the disease.

(i) Which cells respond to the vaccine?

**platelets**

**red blood cells**

**white blood cells**

(1 mark)

(ii) Which substance is produced by the cells in part (b)(i)?

**antibiotics**

**antibodies**

**mucus**

(1 mark)

(iii) Following vaccination, the hepatitis B virus may enter the body again. If this happens, the substance in part (b)(ii) will be produced

**at the same rate.**

**more rapidly.**

**more slowly.**

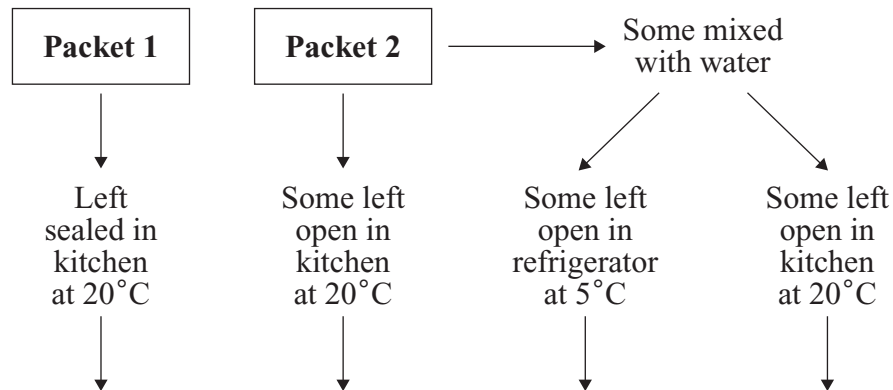
(1 mark)

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| <b>5</b> |

**Turn over for the next question**

**Turn over ►**

6 Two packets of dry, powdered soup were treated as shown in the flow chart.



Results:

|               |          |          |          |       |
|---------------|----------|----------|----------|-------|
| After 5 days  | No mould | No mould | No mould | Mould |
| After 10 days | No mould | No mould | Mould    | Mould |

(a) What **two** conditions are needed to help the mould grow quickly?

1 .....

2 .....

(2 marks)

(b) In each of parts (i), (ii) and (iii), complete the sentences by drawing a ring around **one** answer.

(i) **Packet 1** did not go mouldy because the packet kept out mould spores and

**carbon dioxide.**      **nitrogen.**      **oxygen.**

(1 mark)

(ii) This gas is needed by the mould for

**nutrition.**      **photosynthesis.**      **respiration.**

(1 mark)

(iii) In the refrigerator, this process occurs

**at the same rate.**      **more quickly.**      **more slowly.**

(1 mark)



7 Complete the sentences by choosing the correct words from the box.

|                  |                       |                 |                 |                |
|------------------|-----------------------|-----------------|-----------------|----------------|
| <b>diffusion</b> | <b>high</b>           | <b>low</b>      | <b>membrane</b> | <b>nucleus</b> |
| <b>osmosis</b>   | <b>photosynthesis</b> | <b>respires</b> | <b>wall</b>     | <b>wilts</b>   |

Oxygen enters cells by the process of ..... . This is the movement of molecules from where they are at a ..... concentration to where they are at a ..... concentration.

Water molecules pass from a dilute solution into a concentrated solution through the partially permeable cell ..... . This process is called .....

A plant ..... if the cells are short of water.

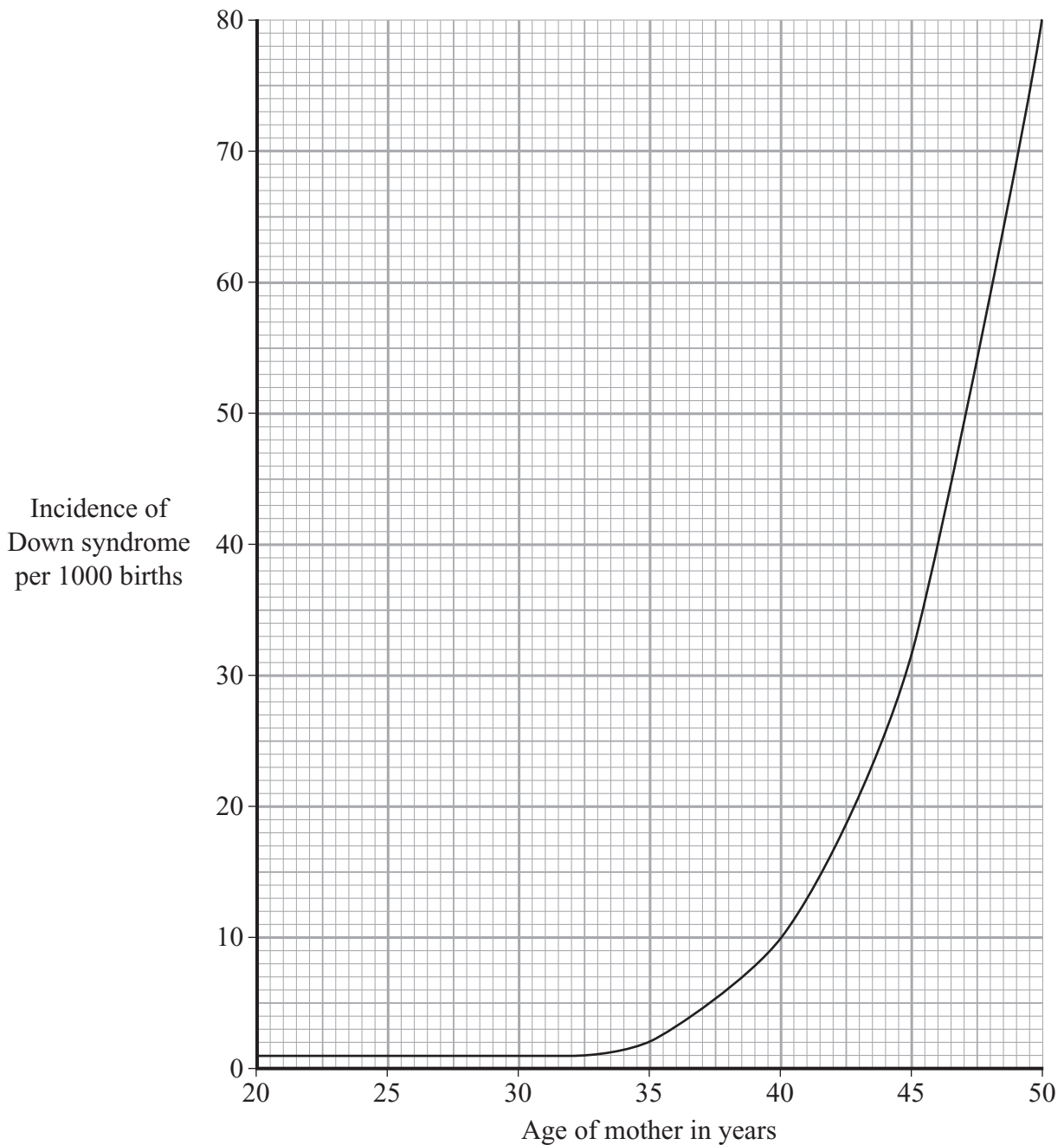
(6 marks)

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| <b>6</b> |

**Turn over for the next question**

**Turn over ►**

- 8 The chance of having a Down syndrome baby depends on the age of the mother. This is shown in the graph.



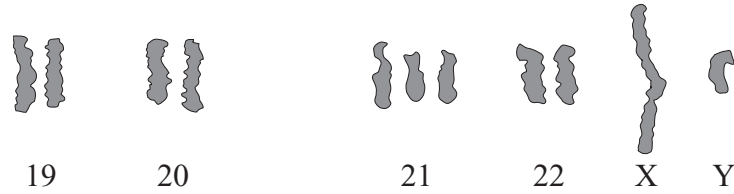
- (a) What is the chance of having a Down syndrome baby for mothers aged:

(i) 40 years; ..... per 1000 births  
(1 mark)

(ii) 45 years? ..... per 1000 births  
(1 mark)

- (b) **Diagram 1** shows some of the chromosomes from one cell of a baby with Down syndrome.  
**Diagram 2** shows the same chromosomes from one cell of an unaffected baby.

**Diagram 1 (Down Syndrome)**



**Diagram 2 (Unaffected)**



- (i) Describe **one** way in which the chromosomes in the Down syndrome baby are different from those in the unaffected baby.

.....  
 (2 marks)

- (ii) What is the sex of these babies? Give evidence from the diagrams for your answer.

.....  
 (1 mark)

- (c) What substance, found in a chromosome, controls inherited characteristics?

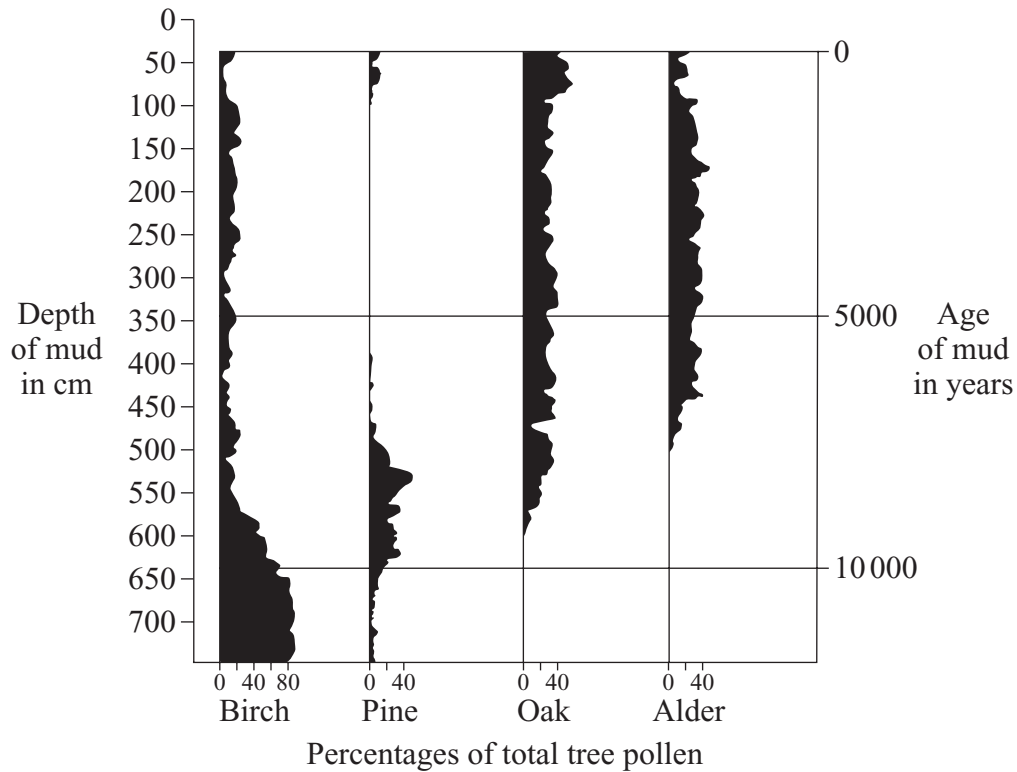
Draw a ring around **one** answer.

**carbohydrate**                      **DNA**                      **enzyme**

(1 mark)

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- 9 Pollen grains from trees which grew long ago can be found buried in the mud at the bottom of lakes. The diagram shows the percentages of pollen grains from different tree species which were found at different depths in the mud at the bottom of a lake.



- (a) The pollen from trees which grew a long time ago is found deeper in the mud than pollen from trees which grew more recently.

Explain why.

.....

.....

.....

.....

(2 marks)

(b) In each of parts (i) and (ii), draw a ring around **one** answer.

(i) Which species of tree was most common 10 000 years ago?

**birch**                  **pine**                  **oak**                  **alder**

(1 mark)

(ii) How many years ago were pine trees the most common?

**700**                  **2 300**                  **8 200**                  **11 200**

(1 mark)

(c) Trees like birch and pine require less water to grow than oaks and alders. Use the pollen data to suggest:

(i) what the climate was like 9000 years ago;

.....  
.....

(1 mark)

(ii) what the climate was like 5000 years ago.

.....  
.....

(1 mark)

**6**

**Turn over for the next question**

**Turn over ►**

10 The table gives some information about the 100 metres and 10 000 metres running races.

|   | 100 metres | 10 000 metres |
|---|------------|---------------|
| Speed of top athlete in kilometres per hour | 37         | 21.5          |
| Total energy used in kilojoules             | 200        | 3000          |
| Energy used per metre in kilojoules         |            | 0.3           |

- (a) (i) In the 10 000 metres race, the athlete used energy at the rate of 0.3 kilojoules per metre.  
Use the following formula to calculate the energy used per metre in the 100 metre race.

$$\text{Energy used per metre} = \frac{\text{Total energy used}}{\text{Distance}}$$

Show clearly how you work out your answer.

.....  
 ..... kilojoules  
 (2 marks)

- (ii) Use information from the table to explain what caused the difference in the amount of energy used per metre for the two races.

.....  
 (1 mark)

- (b) At the end of each race, the athlete continues to breathe heavily. This helps the athlete to take in extra oxygen to break down the waste produced in anaerobic respiration.

- (i) What do scientists call this extra oxygen requirement?

Draw a ring around **one** answer.

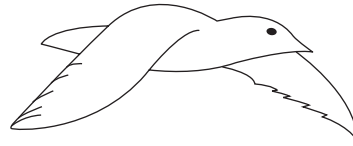
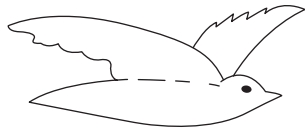
**oxygen debt**                      **oxygen deficit**                      **oxygen shortage**  
 (1 mark)

- (ii) What is the waste product of anaerobic respiration in a human?

Draw a ring around **one** answer.

**alcohol**                      **glucose**                      **lactic acid**  
 (1 mark)

11 Birds are adapted for flight.



(a) Draw a line from each adaptation in birds to its function.

**Adaptation**

**Function**

flight feathers

reduce mass but retain strength

honey-combed bones

reduce air resistance

streamlined body shapes

provide a large surface area

(3 marks)

(b) Explain how the wings lift the bird upwards.

.....  
.....  
.....  
.....

(2 marks)

5

Turn over ►

- 12 (a) Complete the sentences about the treatment of kidney failure.  
Use words from the box.

|                 |                  |                |
|-----------------|------------------|----------------|
| <b>dialysis</b> | <b>membranes</b> | <b>osmosis</b> |
| <b>urea</b>     | <b>urine</b>     | <b>walls</b>   |

If someone has kidney failure they may be treated either by using a  
 ..... machine or transplanting a healthy kidney. When treated by a  
 machine, the person's blood flows between partially permeable .....  
 Waste ..... passes out of the blood into the fluid in the machine.  
 (3 marks)

- (b) Precautions need to be taken when transplanting a kidney.  
 Some treatments help to avoid problems.  
 Explain how each of the following treatments overcomes a problem.

**Treatment 1**

The bone marrow of the recipient is treated with radiation.

.....  
 .....

**Treatment 2**

The donor kidney should be of a similar 'tissue-type' to the recipient.

.....  
 .....

(2 marks)

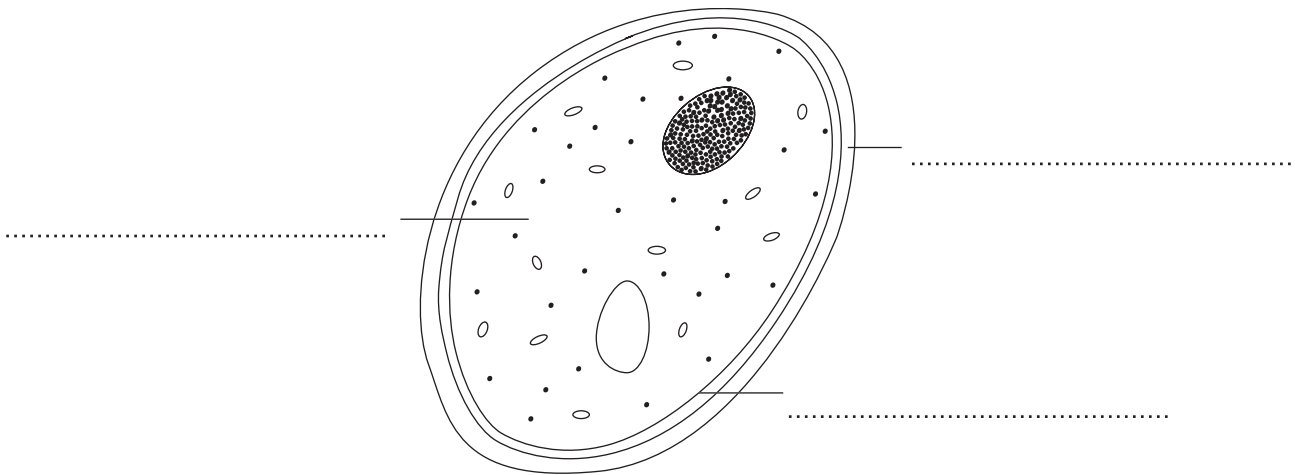
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13 Yeast is a fungus.

- (a) The diagram shows a yeast cell.  
Label the yeast cell. Use words from the box.

|               |           |             |
|---------------|-----------|-------------|
| cell membrane | cell wall | chloroplast |
| cytoplasm     | nucleus   | vacuole     |



(3 marks)

- (b) Yeast can be used to make bread dough from flour, water and sugar.  
The mixture should be kept at about 30°C so the dough can rise.  
The dough will **not** rise at 5°C or 50°C.

Explain why the dough will **not** rise at:

(i) 5°C .....

.....

(1 mark)

(ii) 50°C .....

.....

.....

(2 marks)

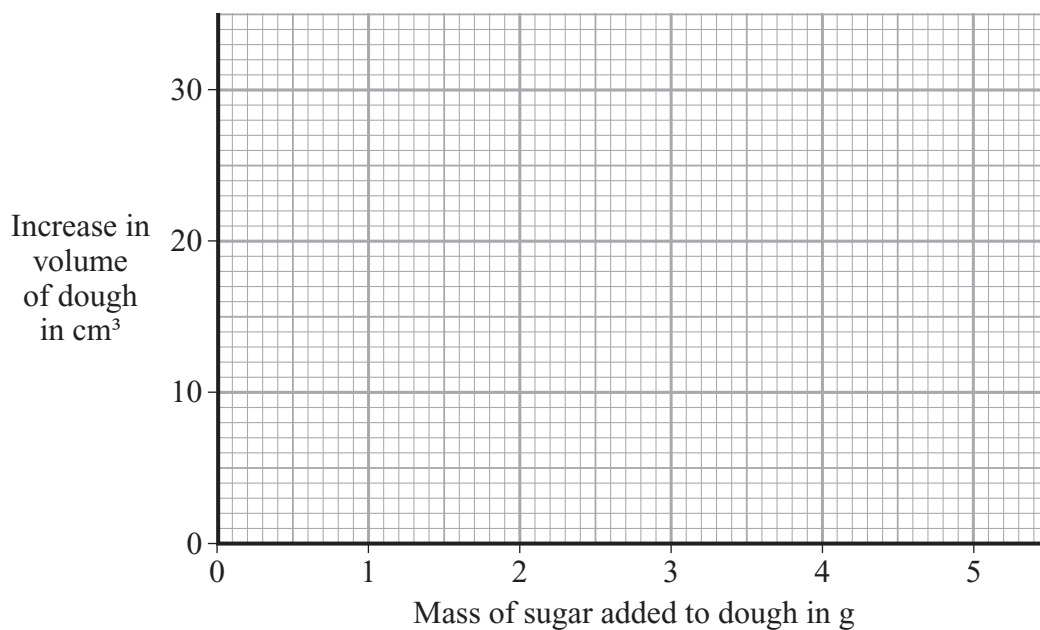
Question 13 continues on the next page

Turn over ►

- (c) In an experiment, some pupils mixed water, flour and yeast together. They divided the mixture into six equal amounts and then mixed different masses of sugar into each portion. They put the dough into different measuring cylinders and kept them at 30°C for thirty minutes. They measured the increase in the volume of the dough.

|  |   |   |    |    |    |    |
|--|---|---|----|----|----|----|
| Mass of sugar added to dough in g              | 0 | 1 | 2  | 3  | 4  | 5  |
| Increase in volume of dough in cm <sup>3</sup> | 1 | 4 | 10 | 18 | 26 | 20 |

- (i) Use the grid to draw a graph of the results.



(3 marks)

- (ii) What caused the volume of the dough to increase?

.....

(1 mark)

- (iii) The pupils thought that some of the yeast cells died when 5 g of sugar was added to the dough.

What evidence in the data supports this idea?

.....  
.....  
*(1 mark)*

- (iv) Suggest why some of the yeast cells died when 5 g of sugar was used.

.....  
.....  
*(1 mark)*

- (v) After rising, the dough is baked. The bread becomes 'light'.

What happens to make the bread 'light'?

.....  
.....  
.....  
.....  
*(2 marks)*

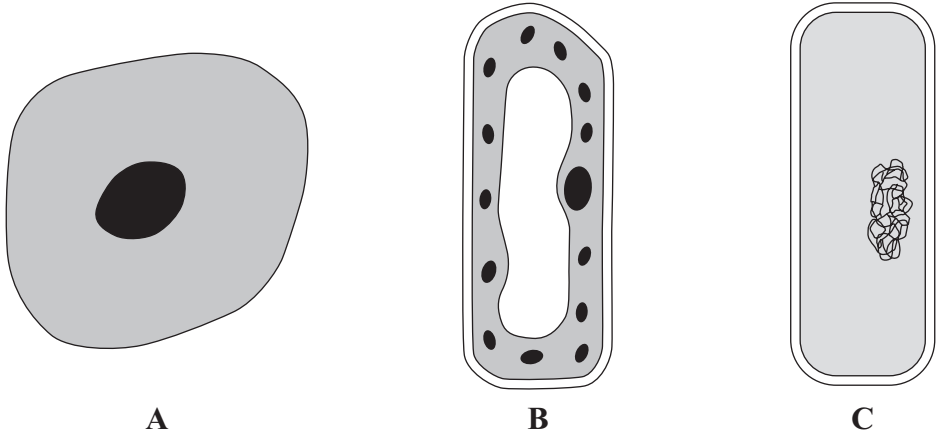
- (d) Yeast can be used for making bread. State **one** other use of yeast.

.....  
*(1 mark)*

**Turn over for the next question**

14 Tuberculosis (TB) is a disease caused by a bacterium.

(a) The diagram shows three types of cell.



(not to scale)

(i) Which cell, **A**, **B** or **C**, is a bacterium? .....  
(1 mark)

(ii) Describe **one** feature you can see in the diagram which helps you to identify this cell as a bacterium.  
.....  
(1 mark)

(b) TB is spread by coughs and sneezes. It is more common when people live together in crowded conditions. TB usually affects the lungs first, although other organs may later become infected.

(i) Why is TB more likely to spread when people live in crowded conditions?  
.....  
.....  
(1 mark)

(ii) Why does TB affect the lungs first?  
.....  
.....  
(1 mark)

(iii) How could TB later spread to other regions of the body?  
.....  
.....  
(1 mark)

- (c) The human body has several natural defences against bacteria. Some of these prevent bacteria from entering the body. Others act once the bacteria have entered.

Give **two** ways in which the body stops bacteria from entering.

1 .....

2 .....

(2 marks)

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**Turn over for the next question**

**Turn over ►**

**15** A slice of bread contains 300 kilojoules of energy.  
A typical teenage girl needs 10 200 kilojoules of energy each day.

- (a) A girl eats only bread and drinks only water for one day.  
How many slices of bread must she eat to supply her energy needs for the day?

Show clearly how you work out your final answer.

.....

.....

..... slices of bread  
(2 marks)

- (b) Most of the carbohydrate in bread is starch.

- (i) Name **one** part of the digestive system where starch is digested.

.....  
(1 mark)

- (ii) Name the enzyme which digests starch.

.....  
(1 mark)

- (iii) Name **one** product of starch digestion.

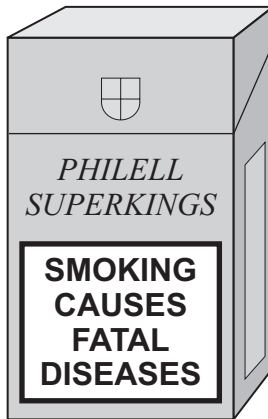
.....  
(1 mark)

- (iv) Name **one** part of the digestive system where the products of starch digestion are absorbed into the blood.

.....  
(1 mark)

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16 The following warning was printed on a packet of cigarettes.



Explain how cigarette smoking can cause fatal diseases.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(5 marks)

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Turn over ►

- 17 The table shows gas production by a plant at different light intensities and at two different concentrations of carbon dioxide.

| Light intensity in arbitrary units | Rate of gas production at 20 °C in cm <sup>3</sup> per hour |                       |
|------------------------------------|---|-----------------------|
|                                    | at 0.03 % carbon dioxide                                    | at 1 % carbon dioxide |
| 0                                  | 0.00  | 0.00                  |
| 10                                 | 0.27  | 0.30                  |
| 20                                 | 0.44  | 0.60                  |
| 30                                 | 0.54  | 0.80                  |
| 40                                 | 0.60  | 0.89                  |
| 50                                 | 0.60  | 0.95                  |

- (a) (i) Name the gas which was produced by the plant.

.....  
(1 mark)

- (ii) Name the process which produced this gas.

.....  
(1 mark)

- (b) The data obtained with 0.03 % carbon dioxide are plotted on the graph on the opposite page.

Draw a graph of the data obtained with 1 % carbon dioxide. Draw this on the same graph paper.

(3 marks)

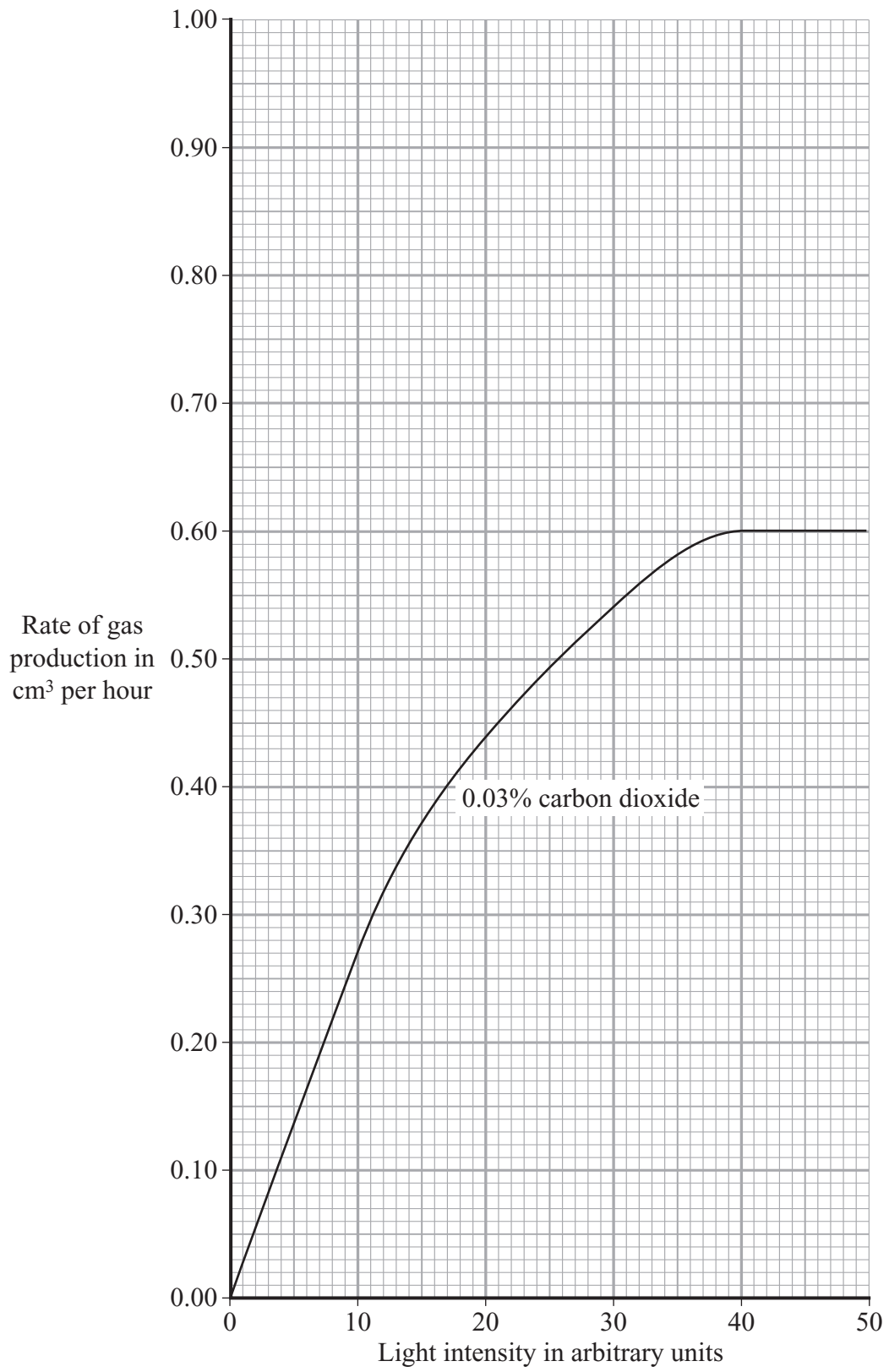
- (c) Give **two** environmental factors which might have limited the rate of gas production at 50 units of light intensity and 0.03 % carbon dioxide.

1 .....

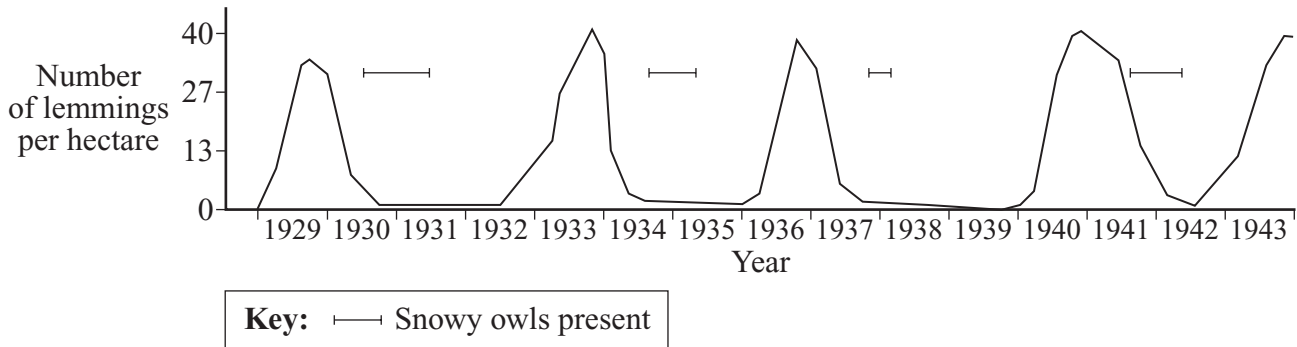
2 .....

(2 marks)





18 The lemming is a small mammal which eats plants. The snowy owl is a predator. The graph shows changes in the population of lemmings in one area of northern Canada.



(a) What is a *predator*?

.....  
 .....  
 (2 marks)

(b) It is unlikely that the snowy owls caused the decreases in the lemming population. What evidence from the graph supports this?

.....  
 .....  
 (1 mark)

(c) Suggest what environmental conditions might have caused the sudden decreases in the lemming population.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 (3 marks)

**19** Explain how the burning of fossil fuels can harm the environment.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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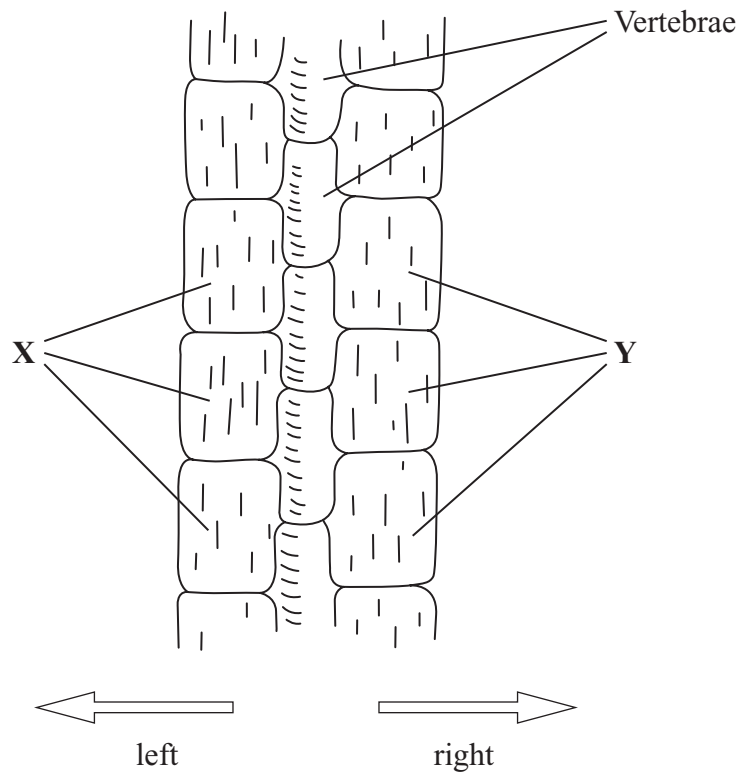
(5 marks)

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| <b>5</b> |

**Turn over for the next question**

**Turn over ▶**

20 The diagram shows the arrangement of bones and muscles in part of the body of a fish.



(a) To make the fish move forwards muscles **X** and **Y** create movements in the body. Suggest how muscles **X** and **Y** move the backbone left and right.

.....

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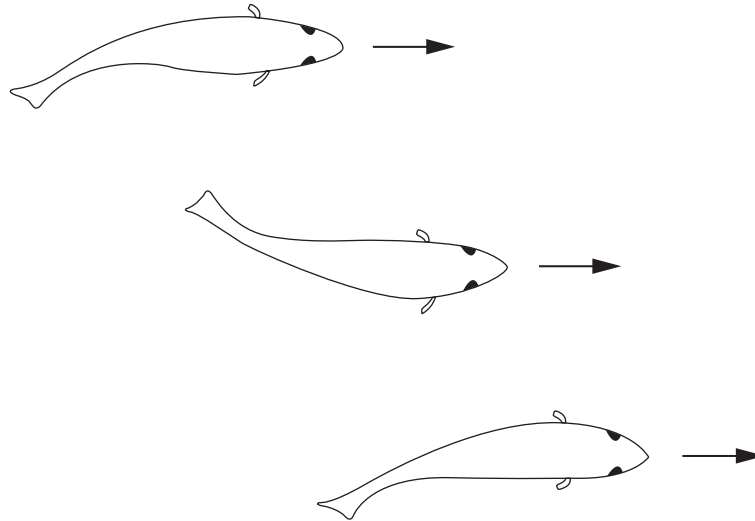
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(3 marks)

(b) The diagram below shows the position of the body of a fish as it moves forward.



Describe how the tail fin and muscles move the fish forwards.

.....

.....

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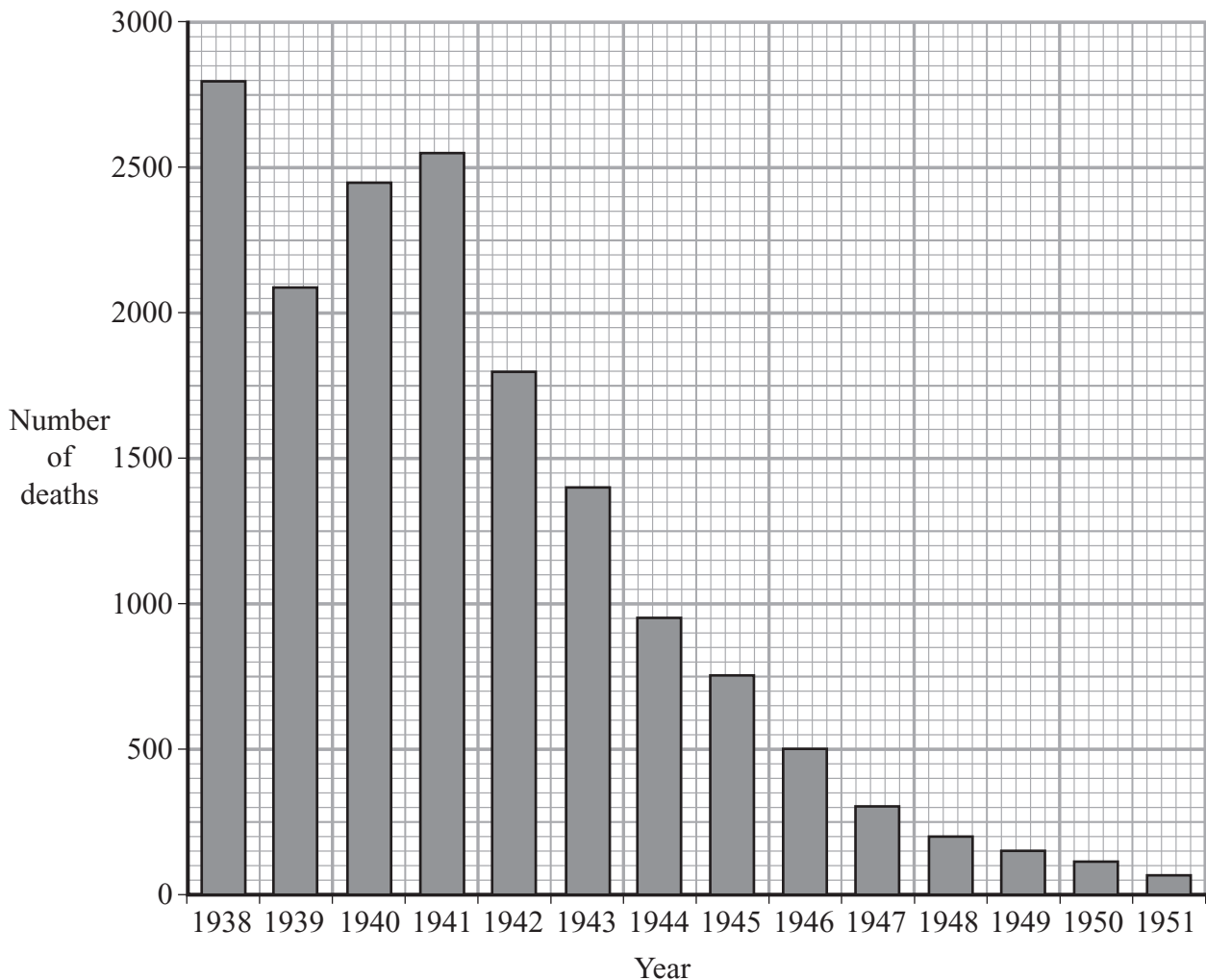
(3 marks)

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**Turn over for the next question**

**Turn over ▶**

- 21 The chart shows the number of people, in England, that died from the disease diphtheria between 1938 and 1951.



- (a) (i) How many people died from diphtheria in England in 1941?

.....  
(1 mark)

- (ii) In what year was the number of deaths half that of 1938?

.....  
(1 mark)

- (b) Both vaccination and antibiotics can be used to destroy the microorganism that causes diphtheria.

What type of microorganism is most likely to cause diphtheria?

.....  
(1 mark)

- (c) One of the early symptoms of diphtheria in children is a headache.

What type of drug can be used to get rid of a headache?

.....  
(1 mark)

- (d) Treatments such as vaccinations can be used to protect children from diphtheria. Treatments can provide either active immunity or passive immunity.

Compare active and passive immunity as ways of protecting a child from diseases such as diphtheria.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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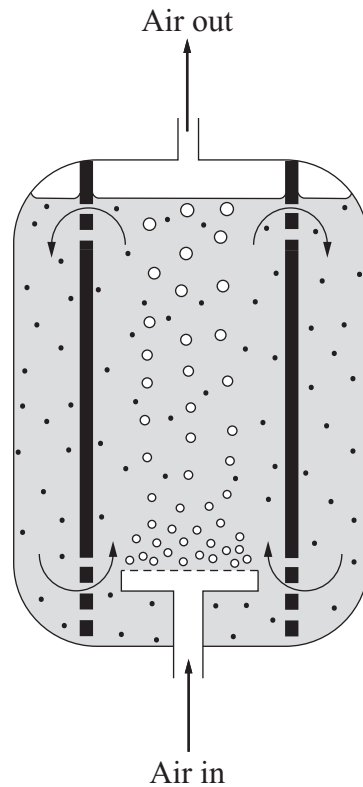
(4 marks)

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| <b>8</b> |

**Turn over for the next question**

**Turn over ►**

22 The diagram shows a fermenter used to make useful products from microorganisms.



In this type of fermenter air is pumped in at the bottom.

(a) Suggest **two** reasons why air needs to be pumped into the mixture in this fermenter.

1 .....

2 .....

(2 marks)

(b) The mixture in the fermenter can become hot enough to kill the microorganisms.

(i) At what temperature is this most likely to happen normally?  
Choose from the list. Draw a ring around your answer.

20°C

37°C

40°C

60°C

(1 mark)

(ii) Explain why the mixture gets hot.

.....

.....

(1 mark)



(iii) Suggest how the heat could be removed in order to keep the microorganisms alive.

.....  
.....

*(1 mark)*

(c) Antibiotics, such as penicillin, can be made in a fermenter, by growing a mould.

Name the mould that is used to produce penicillin.

.....

*(1 mark)*

|          |
|----------|
|          |
| <b>6</b> |

**END OF QUESTIONS**

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