

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Tuesday 13 May 2025 – Afternoon**

**GCSE (9–1) Combined Science B  
(Twenty First Century Science)**

**J260/01 Biology (Foundation Tier)**

**Time allowed: 1 hour 45 minutes  
plus your additional time allowance**

**YOU MUST HAVE:**

**a ruler (cm/mm)**

**YOU CAN USE:**

**a scientific or graphical calculator  
an HB pencil**

**Please write clearly in black ink.**

**Centre number**

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**Candidate number**

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**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**READ INSTRUCTIONS OVERLEAF**



## **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 95.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended response will be assessed in questions marked with an asterisk (\*).**

## **ADVICE**

**Read each question carefully before you start your answer.**

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**1 The health of most organisms is affected by disease.**

**(a) Complete the sentences to describe the relationship between health and disease.**

**Use words from the list.**

**absence**

**cause**

**communicable**

**genetic**

**presence**

**Good health is the \_\_\_\_\_ of disease.**

**All \_\_\_\_\_ diseases are spread by pathogens.**

**Some non-\_\_\_\_\_ diseases are due to inherited genes. [3]**

**(b) Common human infections are caused by pathogens.**

**Complete the table to describe which type of pathogen causes each infection.**

**Tick (✓) ONE box in each row. [4]**

| <b>Infection</b>      | <b>Type of pathogen</b> |               |                |              |
|-----------------------|-------------------------|---------------|----------------|--------------|
|                       | <b>Bacterium</b>        | <b>Fungus</b> | <b>Protist</b> | <b>Virus</b> |
| <b>Athlete's foot</b> |                         |               |                |              |
| <b>Influenza</b>      |                         |               |                |              |
| <b>Malaria</b>        |                         |               |                |              |
| <b>Salmonella</b>     |                         |               |                |              |

**(c) Plant infections are caused by pathogens.**

**(i) What infection does fungus cause? [1]**

**Tick (✓) ONE box.**

**Ash dieback**

☐

**Crown gall**

☐

**Tobacco Mosaic**

☐

**(ii) How is fungus spread between plants? [1]**

**Tick (✓) ONE box.**

**By sexual intercourse**

☐

**In contaminated food**

☐

**Spores carried by the wind**

☐

**2**

- (a) Complete the sentences to describe the role of hormones in the human endocrine system.**

**Put a ring around each correct option.**

**Hormones are secreted by**

**glands / neurons / the blood.**

**Hormones are transported by**

**glands / neurons / the blood.**

**Responses provided by the endocrine system are**

**faster / slower / the same speed**

**compared to the nervous system.**

**Responses provided by the endocrine system are**

**longer lasting / shorter lasting / the same length of time**

**compared to the nervous system. [4]**

- (b) Statements A to D explain how blood sugar level is controlled in the human body.

The statements are NOT in the correct order.

- A Blood sugar level increases after eating a sugary meal.
- B Blood sugar level falls.
- C Sugar is absorbed from the blood.
- D The pancreas secretes insulin.

Write the letters in the boxes to show the correct order of the statements. [3]

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- (c) Diabetes is a disease that affects our body's ability to keep blood sugar level constant. There are two main types of diabetes, type 1 and type 2.

Describe how TYPE 2 diabetes can be treated.

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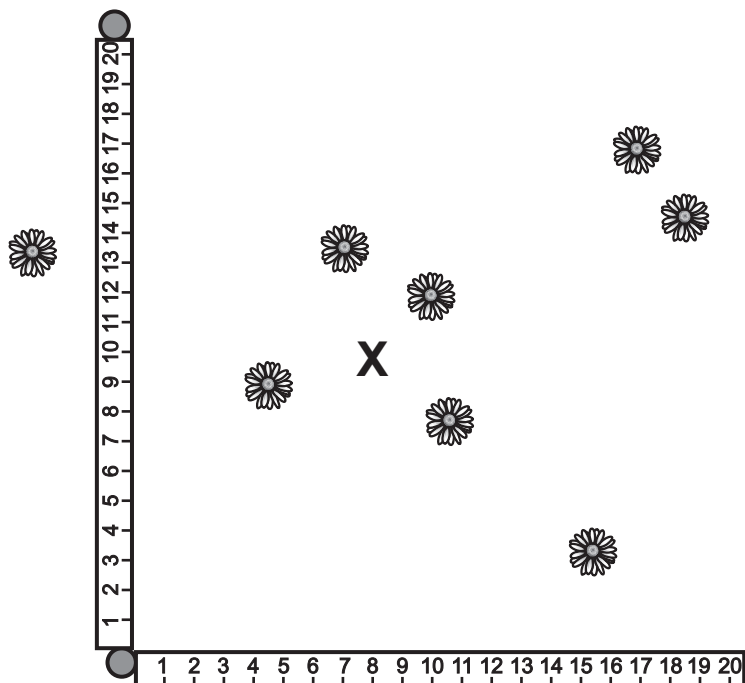
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[2]

- 3 A student estimates how many daisies are in a large garden.

They lay tape measures on the garden as shown in the diagram.



- (a) The student places a metal square at point X. They count the daisies in the square.

What is the scientific name for the metal square?

Tick (✓) ONE box. [1]

Identification key

☐

Quadrat

☐

Transect

☐

Tripod

☐

- (b) The student counts the number of daisies in a sample of five metal squares.

The table shows the results.

| Square | Number of daisies |
|--------|-------------------|
| 1      | 7                 |
| 2      | 5                 |
| 3      | 10                |
| 4      | 7                 |
| 5      | 9                 |

- (i) Calculate the mean number of daisies in the sample of five squares.

Mean = \_\_\_\_\_ [2]

- (ii) Write down the mode number of daisies in the sample.

Mode = \_\_\_\_\_ [1]

- (iii) Write down the median number of daisies in the sample.

Median = \_\_\_\_\_ [1]

- (iv) The student did NOT decide for themselves where to place the metal squares.  
Instead they used a random number generator to produce coordinates to decide where to place the squares.

Suggest ONE reason why this gave a better estimate of the daisy population size.

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[1]

(c)

- (i) The area of the garden is  $4400 \text{ m}^2$ .  
The area of the metal square is  $0.25 \text{ m}^2$ .

Calculate the estimated population size of daisies in the garden.

Use the equation:

$$\text{estimated population size} = \frac{\text{area of garden}}{\text{area of metal square}} \times \text{mean number of daisies in sample}$$

Use your answer from (b)(i).

Estimated population size = \_\_\_\_\_ [2]

(ii) This is the student's method:

1. Generate random coordinates to decide where to place the metal squares.
2. Use metal squares with an area of  $0.25\text{ m}^2$ .
3. Place five metal squares on the garden.
4. Count the daises in each metal square.

Suggest ONE way the student can improve their method to get an estimate that is closer to the true population size.

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[1]

(d) Population size can be affected by abiotic and biotic factors.

Complete the table to show if each factor is ABIOTIC or BIOTIC.

Tick (✓) ONE box in each row. [3]

| Factor            | Abiotic | Biotic |
|-------------------|---------|--------|
| Food availability |         |        |
| Light intensity   |         |        |
| Predators         |         |        |
| Temperature       |         |        |

**4 Genetically engineered crops were first introduced in the USA in 1994 with the Flavr Savr tomato. This genetically engineered tomato had a slower ripening process, which delayed rotting.**

**(a) How did scientists use genetic engineering to produce the Flavr Savr tomato? [1]**

**Tick (✓) ONE box.**

**They applied pesticides to the tomatoes.**

☐

**They modified the genome of the tomato.**

☐

**They used natural selection of the tomato.**

☐

**They used selective breeding of the tomato.**

☐

- (b) One benefit of this genetic engineering is that it delays rotting of the tomatoes.  
One risk is the disruption of food chains.**

**Explain ONE other benefit OR risk of growing these genetically engineered tomatoes.**

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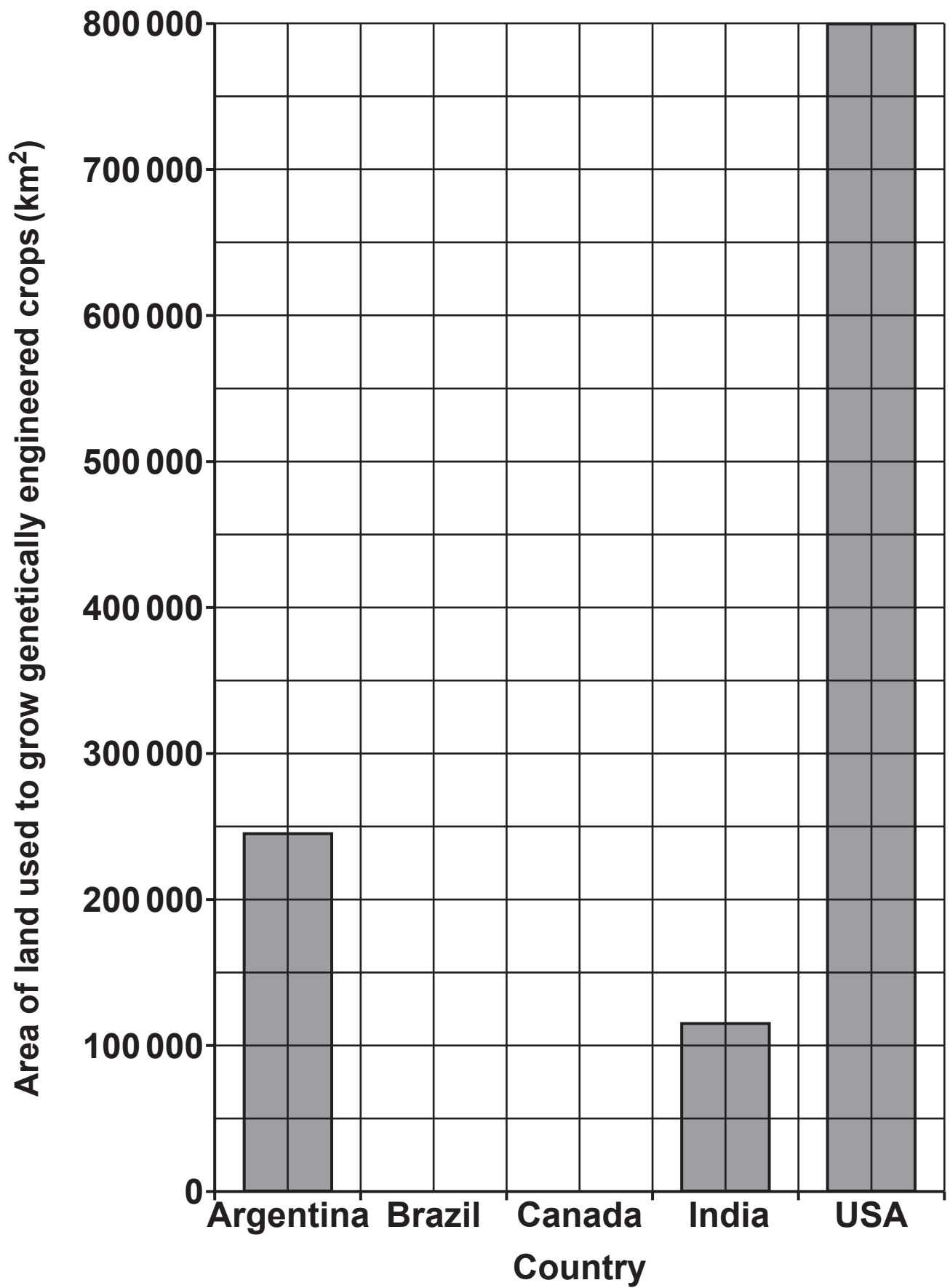
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**[2]**

- (c) The table shows which countries used the largest area of land to grow genetically engineered crops in 2015.

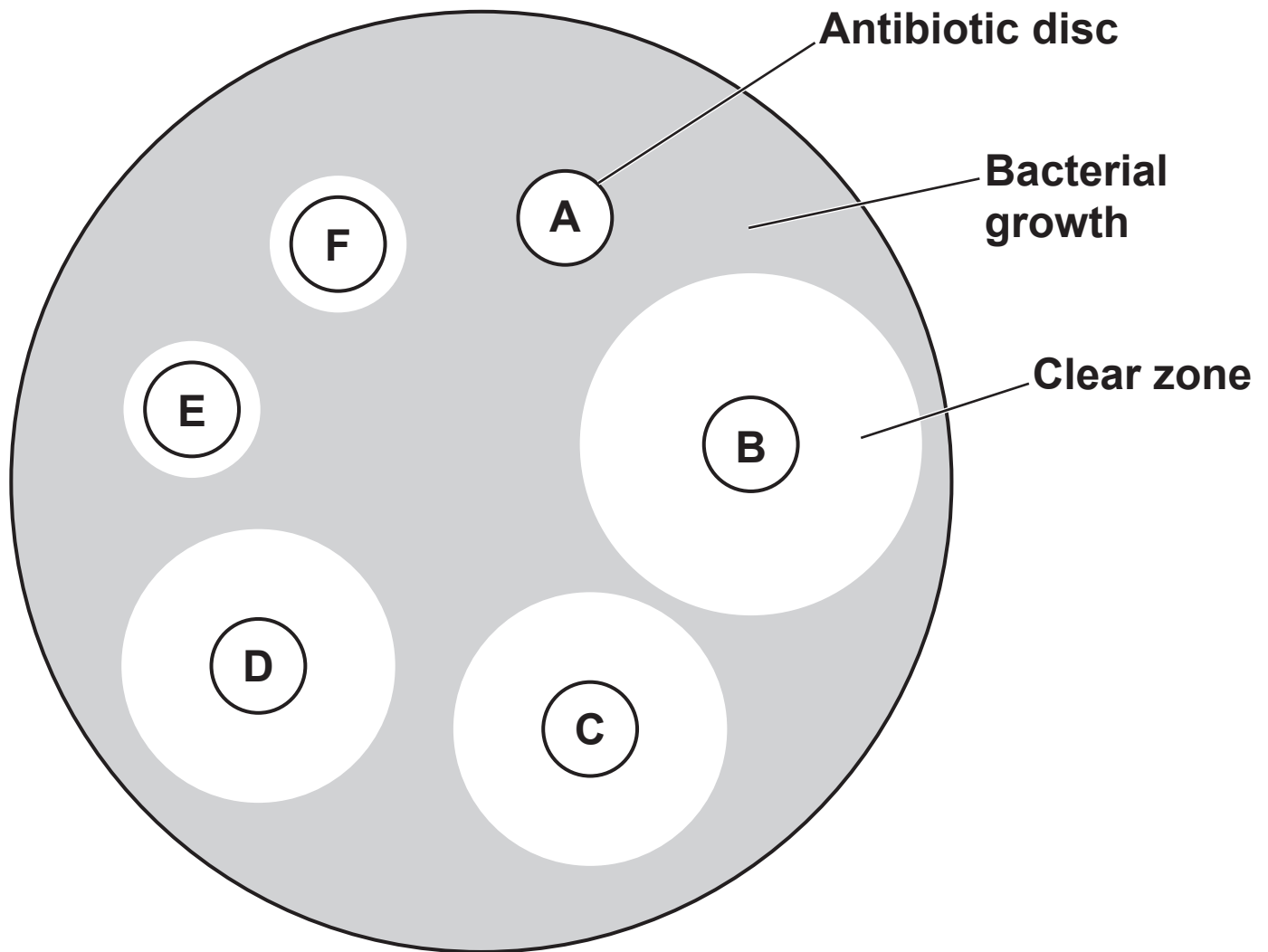
| Country   | Area of land used to grow genetically engineered crops (km <sup>2</sup> ) |
|-----------|---------------------------------------------------------------------------|
| Argentina | 245 000                                                                   |
| Brazil    | 440 000                                                                   |
| Canada    | 110 000                                                                   |
| India     | 115 000                                                                   |
| USA       | 800 000                                                                   |

Plot the results for BRAZIL and CANADA on the graph opposite. [2]



- 5 A scientist investigates the effect of six different antibiotics, A to F, on the growth of one type of bacteria.**

**The scientist grows the bacteria on agar with discs soaked in the six different antibiotics.**



The results are shown in the table.

| Antibiotic | Diameter of clear zone around disc (cm) |
|------------|-----------------------------------------|
| A          | 0                                       |
| B          | 5                                       |
| C          | 4                                       |
| D          | 4                                       |
| E          | 2                                       |
| F          | 2                                       |

- (a) Calculate the area of the clear zone around disc F.

Use the equation:  $\text{area} = 3.14 \times r^2$

Area = \_\_\_\_\_  $\text{cm}^2$  [3]

- (b) Explain which antibiotic is the best to treat an infection caused by these bacteria.

Antibiotic \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[2]

**(c) The scientist concludes that antibiotic A does NOT work.**

**(i) Suggest ONE reason why the scientist's conclusion may be CORRECT.**

\_\_\_\_\_ [1]  
\_\_\_\_\_

**(ii) Suggest ONE reason why the scientist's conclusion may be INCORRECT.**

\_\_\_\_\_ [1]  
\_\_\_\_\_

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6

(a) Tay-Sachs disease is inherited.

It is caused by an allele of a single gene.

A person will only have the disease if they inherit this allele from BOTH parents.

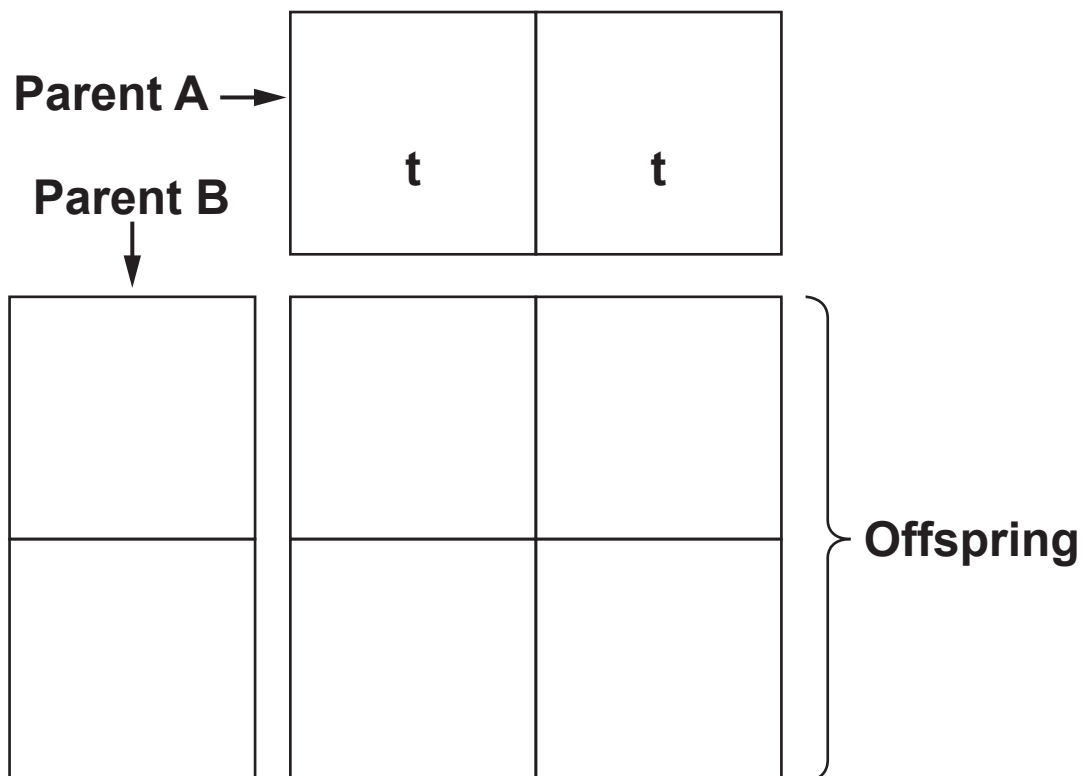
(i) Parent A has the disease and parent B is a carrier.

Complete the Punnett square to show the possible alleles of their offspring.

Use:

T to represent a normal allele

t to represent a Tay-Sachs disease allele. [2]



- (ii) Calculate the expected ratio of children with Tay-Sachs disease to children without the disease for these parents.

Give your answer in its simplest form.

Ratio = \_\_\_\_\_ : \_\_\_\_\_ [2]

- (iii) Calculate the probability that these parents will have a child with Tay-Sachs disease.

Probability = \_\_\_\_\_ [1]

- (iv) How would you describe the genotype of a person with Tay-Sachs disease?

Tick (✓) ONE box. [1]

Heterozygous dominant

☐

Heterozygous recessive

☐

Homozygous dominant

☐

Homozygous recessive

☐

- (b) Tay-Sachs disease damages nerve cells in the nervous system.
- (i) The Tay-Sachs allele codes for a functional protein that has an active site.

**What type of protein does the Tay-Sachs allele code for?**

**Tick (✓) ONE box. [1]**

**Carbohydrate**

☐

**DNA**

☐

**Enzyme**

☐

**Fat**

☐

- (ii) **Scientists want to use stem cells as a treatment for this disease.**

**Explain why stem cells could be used to treat this disease.**

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**[2]**

**(iii) Which statement is an ethical implication of using stem cells?**

**Tick (✓) ONE box. [1]**

**It is possible for viruses to be transferred with the stem cells leading to infection.**

☐

**Stem cells are taken from an embryo which is a potential future life.**

☐

**Stem cells could potentially become cancerous.**

☐

**The treatment may be rejected by the immune system.**

☐

**(iv) State TWO reasons why new medical treatments are tested on animals during their development.**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

**[2]**

**7**

- (a) Fossils can show how a species has evolved.**

**The diagram opposite shows fossils of some of the ancestors of the modern horse.**

**These fossils provide evidence of how the horse evolved.**

- (i) Describe ONE way in which this fossil evidence shows how the horse has evolved.**

\_\_\_\_\_ **[1]**

- (ii) Which TWO statements are LIMITATIONS of using these fossils as evidence of the evolution of the horse?**

**Use the diagram to help you decide.**

**Tick (✓) TWO boxes. [2]**

**There are no fossils older than 1 million years old.**

☐

**Each fossil is just one individual that might be different from others in the species.**

☐

**Fossils do NOT show all the features of the organism, such as hair colour.**

☐

**There are no differences between the fossils from different time periods.**

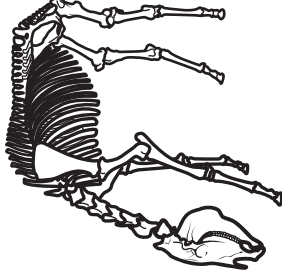
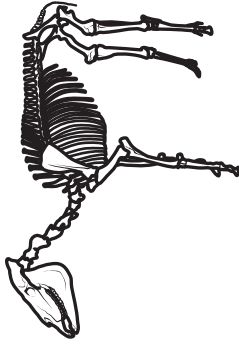
☐

**Fossils CANNOT be used to provide evidence for evolution.**

☐

40 million years ago      30 million years ago      10 million years ago      1 million years ago

**Skeleton**



**Close-up  
of leg  
bone**



**(b)\* Bed bugs are insects that can live in a mattress.**

**They can be killed with a type of poison called Permethrin.**

**Resistance to this poison is becoming more common in bed bugs. This is an example of evolution.**

**Explain why resistance to this poison is becoming more common in bed bugs due to evolution.**

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**[6]**

- (c) Scientists used to classify organisms based only on their visible features.  
Scientists now also use evidence from the cells of organisms.

Describe ONE piece of evidence from an organism's cells that could help a scientist to classify it.

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[1]

- (d) The evolutionary tree diagram opposite shows the evolutionary relationships between some organisms, by showing how later species evolved from earlier ones.

**Shark, salamander, lizard, armadillo and human are all species of animal.**

**A, B, C and D are also species of animal.**

- (i) Which species is the most closely related species to humans?

**Tick (✓) ONE box. [1]**

**Armadillo**

☐

**Lizard**

☐

**Salamander**

☐

**Shark**

☐

- (ii) Which species is a common ancestor of both sharks and humans?

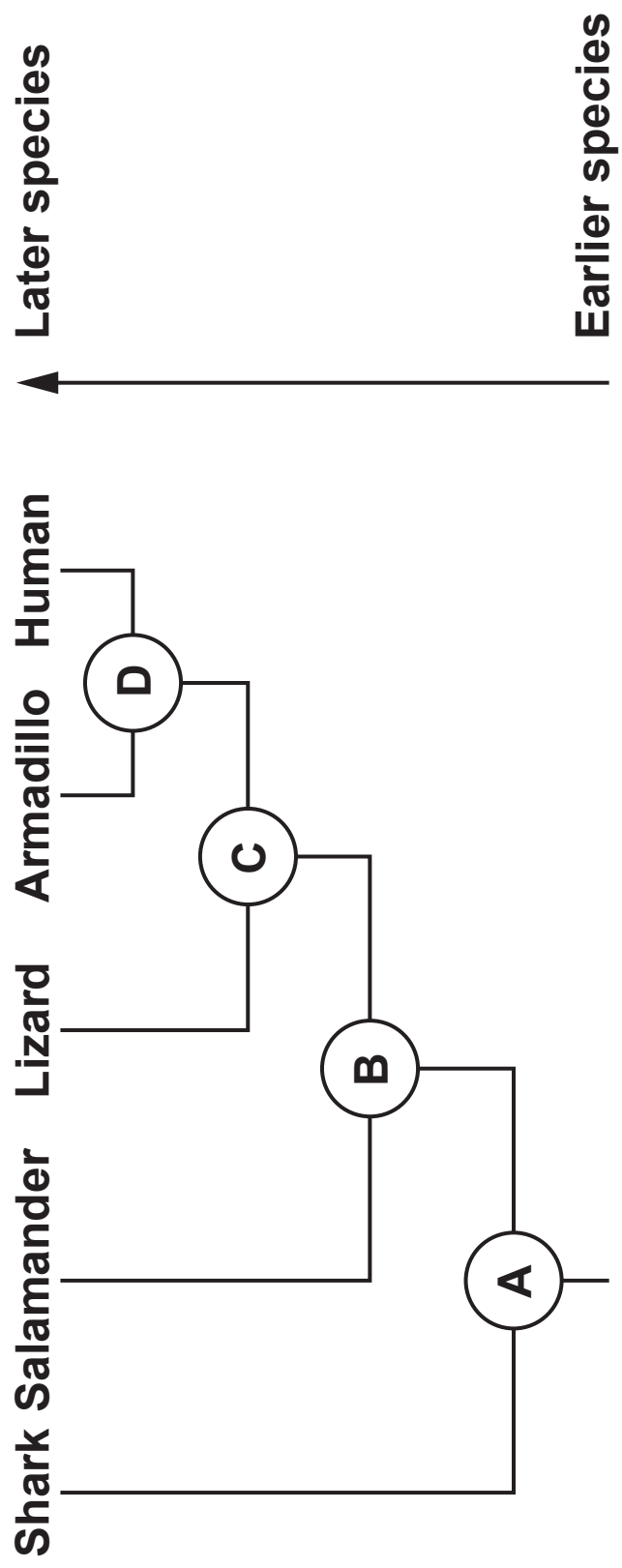
**Put a (ring) around the correct option. [1]**

**A**

**B**

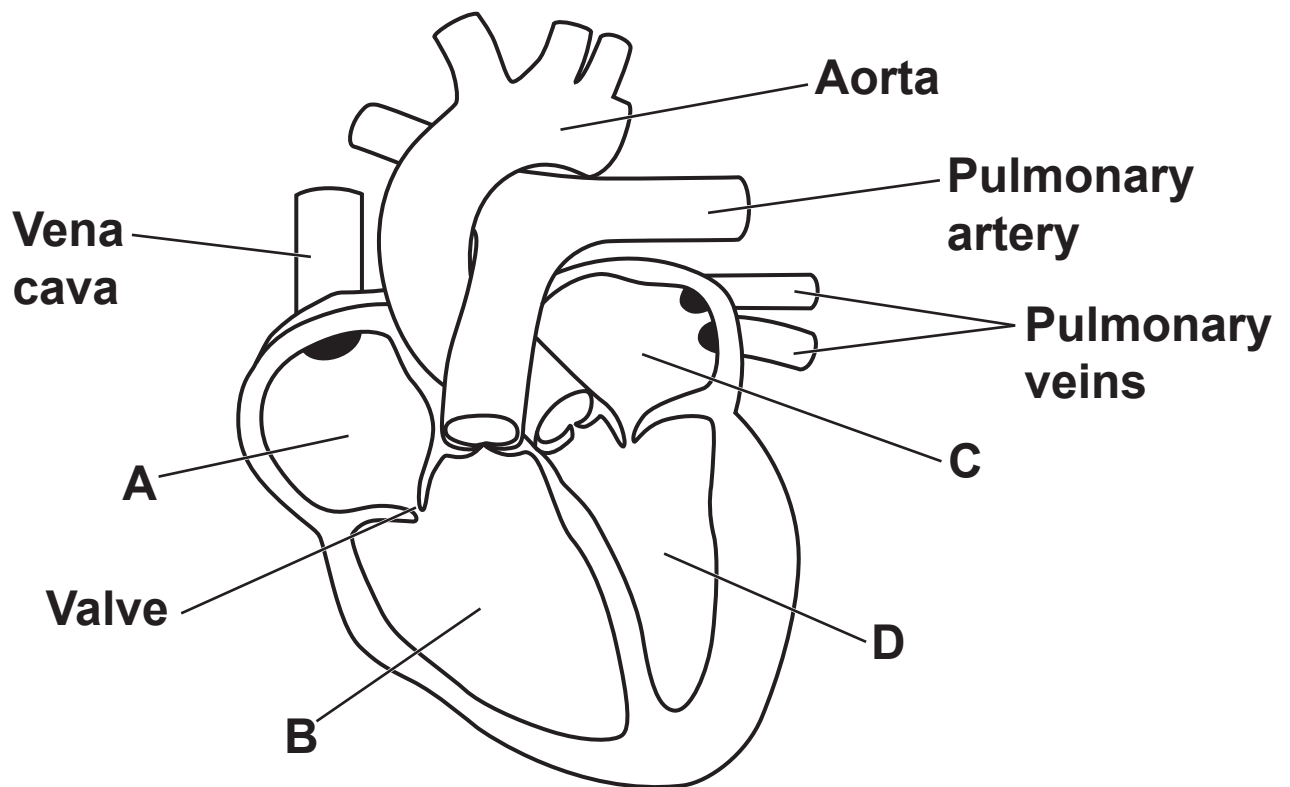
**C**

**D**



**8 The heart is an organ in the circulatory system.**

**The diagram shows the human heart.**



**(a) Which part of the heart pumps oxygenated blood to the body?**

**Tick (✓) ONE box. [1]**

**A**

☐

**B**

☐

**C**

☐

**D**

☐

**(b) Which blood vessel carries deoxygenated blood back to the heart?**

**Tick (✓) ONE box. [1]**

**Aorta**

☐

**Pulmonary artery**

☐

**Pulmonary vein**

☐

**Vena cava**

☐

**(c) Explain the function of the valves in the heart.**

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**[2]**

- (d) Arteries, capillaries and veins are blood vessels in the human circulatory system.
- (i) Complete the table by showing which feature each blood vessel has.

Tick (✓) ONE box in each row. [2]

| Feature                                 | Arteries | Capillaries | Veins |
|-----------------------------------------|----------|-------------|-------|
| The walls have a thick layer of muscle. |          |             |       |
| They have valves along their length.    |          |             |       |
| The walls are permeable.                |          |             |       |

- (ii) Explain how red blood cells and plasma are adapted to their functions in the blood.

Red blood cells \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Plasma \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[4]

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**9 There are two types of cell division, meiosis and mitosis.**

**(a) Complete the table opposite to show which type of cell division is described by each statement.**

**Tick (✓) ONE box in each row. [4]**

**(b) Cancer is the result of changes in cells.**

**(i) In which part of a cell do these changes occur?**

**Tick (✓) ONE box. [1]**

**Cell membrane**

☐

**Cell wall**

☐

**Cytoplasm**

☐

**DNA**

☐

**(ii) Describe how the changes lead to a single cell forming a tumour.**

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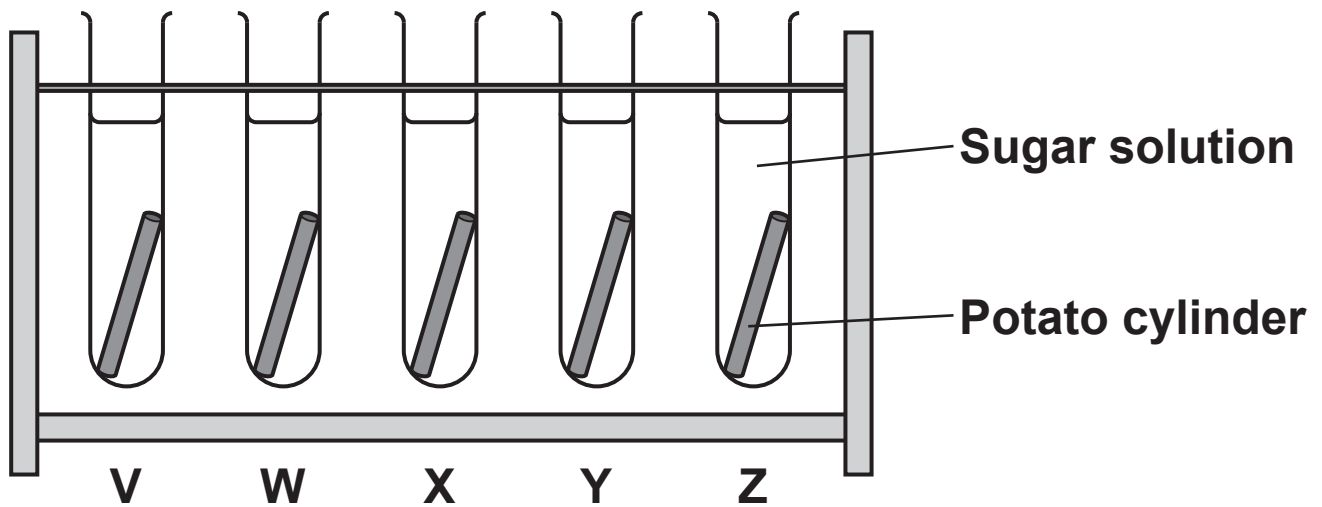
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**[2]**

| <b>Statement</b>                                                      | <b>Both types<br/>of cell<br/>division</b> | <b>Meiosis<br/>only</b> | <b>Mitosis<br/>only</b> | <b>Neither<br/>type of cell<br/>division</b> |
|-----------------------------------------------------------------------|--------------------------------------------|-------------------------|-------------------------|----------------------------------------------|
| <b>It involves two divisions to produce four new cells.</b>           |                                            |                         |                         |                                              |
| <b>It makes new cells for growth and repair of tissues in adults.</b> |                                            |                         |                         |                                              |
| <b>It produces cells with half the number of chromosomes.</b>         |                                            |                         |                         |                                              |
| <b>It produces gametes.</b>                                           |                                            |                         |                         |                                              |

- 10 A student investigates the effect of sugar concentration on osmosis.**  
**They use potato cylinders placed in sugar solutions of different concentrations.**



- (a) Statements A to E describe how the student does the investigation.**

**The statements are NOT in the correct order.**

- A Cut five potato cylinders.**
- B Calculate the change in mass.**
- C Measure the starting mass of the potato cylinders.**
- D Place the potato cylinders into each of the different sugar solutions for 24 hours.**
- E Remove and dry the potato cylinders, and measure their mass.**

**Write the letters in the boxes to show the correct order.**

**One has been done for you. [3]**

|          |  |  |  |  |
|----------|--|--|--|--|
| <b>A</b> |  |  |  |  |
|----------|--|--|--|--|

**(b)**

**(i) State ONE variable that the student should control in this investigation.**

\_\_\_\_\_ **[1]**

**(ii) Suggest why the student dries the potato cylinders before measuring their final mass.**

\_\_\_\_\_

\_\_\_\_\_ **[1]**

**(c) The table opposite shows the student's results.**

**(i) Calculate the change in mass for potato cylinders W and Y. [1]**

**(ii) The student uses the change in mass to conclude which sugar solution had the largest effect on the potato cylinders.**

**Suggest why the student CANNOT make a valid comparison between the potato cylinders using the change in mass.**

**Use the data in the table.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(iii) Suggest TWO ways in which the student could improve their method so they can make a valid comparison between potato cylinders.**

1 \_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_

[2]

| <b>Sugar solution</b> | <b>Mass of the potato cylinder at the start (g)</b> | <b>Mass of the potato cylinder after drying (g)</b> | <b>Change in mass (g)</b> |
|-----------------------|-----------------------------------------------------|-----------------------------------------------------|---------------------------|
| <b>V</b>              | <b>1.10</b>                                         | <b>1.21</b>                                         | <b>+ 0.11</b>             |
| <b>W</b>              | <b>1.36</b>                                         | <b>1.48</b>                                         |                           |
| <b>X</b>              | <b>1.42</b>                                         | <b>1.42</b>                                         | <b>0.00</b>               |
| <b>Y</b>              | <b>1.28</b>                                         | <b>1.18</b>                                         |                           |
| <b>Z</b>              | <b>1.35</b>                                         | <b>1.12</b>                                         | <b>-0.23</b>              |

**(d)**

- (i) Explain why some of the potato cylinders decreased in mass.**

**Use ideas about osmosis.**

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**[2]**

- (ii) The potato cylinder placed in sugar solution X did NOT change in mass.**

**Suggest ONE reason why this might have happened.**

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**[1]**

**END OF QUESTION PAPER**

**EXTRA ANSWER SPACE**

**If you need extra space use these lined pages. You must write the question numbers clearly in the margin.**

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