Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430UD0-1

S25-3430UD0-1

TUESDAY, 13 MAY 2025 – AFTERNOON

SCIENCE (Double Award)
Unit 4 – BIOLOGY 2
HIGHER TIER

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**6**	
3.	**7**	
4.	**8**	
5.	**12**	
6.	**7**	
7.	**11**	
Total	**60**	

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01

ADDITIONAL MATERIALS

A calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **5**(a) is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions

1. Red kites (*Milvus milvus*) are birds of prey. Red kites live in woodland and build their nests in tall trees. **Image 1** shows a red kite.

Image 1

(a) State the Genus of the red kite. [1]

.....

(b) In 1903, red kites were almost extinct in the UK. There were only three breeding pairs left, all of which were in Wales. Due to conservation efforts, numbers of red kites increased and by 2022 it was estimated that there were 2100 breeding pairs in the UK.

(i) State what is meant by the term **extinct**. [1]

.....

.....

(ii) State **one** reason why it is important to conserve species. [1]

.....

.....

(iii) State **two** methods by which endangered species could be conserved. [2]

I. .....

II. .....

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(iv) Use the information given and the equation below to calculate the percentage increase in breeding pairs of red kites in the UK from 1903 to 2022. [2]

$$\text{Percentage increase in breeding pairs} = \frac{\text{number of breeding pairs in 2022} - \text{number of breeding pairs in 1903}}{\text{number of breeding pairs in 1903}} \times 100$$

Percentage increase in breeding pairs = ...

(v) Suggest **two** reasons why this increase is unlikely to continue in future years. [2]

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II. .....

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9

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2. (a) A class of year 11 students investigated the following hypothesis:

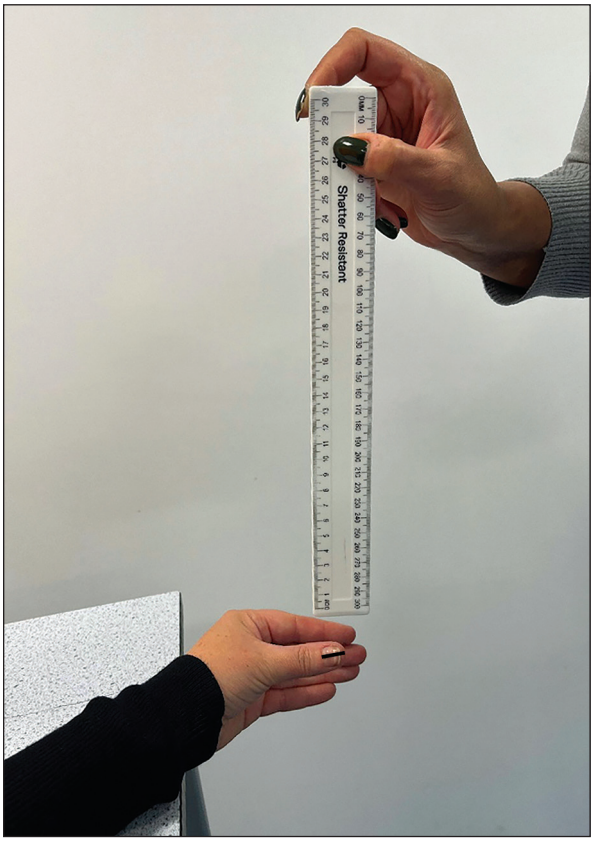
'Reactions become faster with age'.

They tested three teachers and three year 11 students.

They used the following method:

- Mark a pencil line down the length of the thumb nail of the person to be tested, as shown in **Image 2.1**.
- Ask the person to place their forearm over the edge of the table.
- Hold a 30 cm ruler just above their hand.
- Drop the ruler without warning. The person then catches the ruler as quickly as possible.
- Record the catch distance by noting where the pencil line on the thumb meets the ruler.
- Repeat four more times.
- Calculate the mean catch distance and convert this to a reaction time in milliseconds (ms) using a conversion graph.

Image 2.1



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

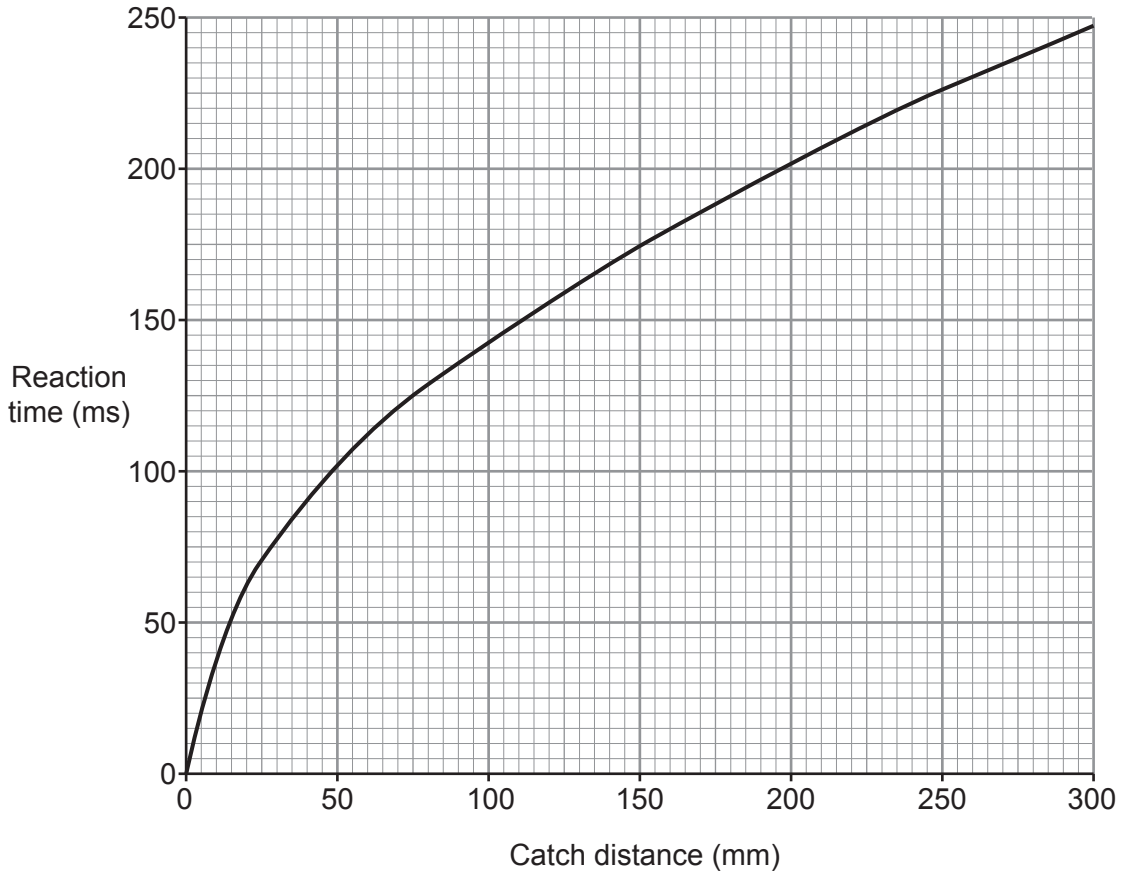
Table 2.2

Student	Mean catch distance (mm)	Reaction time (ms)
Amir	125	160
Ieuan	135	165
Rhian	160	180

Teacher	Mean catch distance (mm)	Reaction time (ms)
Mrs Williams	90	135
Mr Jones	170	.....
Mrs Davies	250	225

Graph 2.3 converts a catch distance into a reaction time.

Graph 2.3



(i) Use **Graph 2.3** to convert the mean catch distance to a reaction time for Mr Jones.
Write your answer in Table 2.2. [1]

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(ii) Evaluate the extent to which the results in **Table 2.2** support the hypothesis on **page 5**. [2]

Evidence that supports the hypothesis:

.....

.....

Evidence that does not support the hypothesis:

.....

.....

(iii) One of the teachers said that this was not a fair test.
State **one** variable that should have been controlled. [1]

.....

(b) (i) State the effect that drinking alcohol would have on reaction times. [1]

.....

.....

(ii) State **one** long-term effect that drinking alcohol will have on physical health. [1]

.....

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3. Woodlice are useful invertebrates in garden compost as they feed on decaying vegetable matter. **Image 3** shows the common rough woodlouse (*Porcellio scaber*).

Image 3

(a) State what is meant by the term **invertebrate**. [1]

.....

.....

(b) Paul wanted to estimate the population of woodlice in his garden, which has an area of 185 m^2. He used the following method:

1. Collect as many woodlice as possible from the garden in 10 minutes. Record the number.
2. Mark each woodlouse captured with a spot of white paint.
3. Return the woodlice to the area they were collected from.
4. After 30 minutes, return to the same area of the garden and collect as many woodlice as possible in 10 minutes.
5. Record the total number of woodlice collected in the second sample and how many of these were marked.

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Paul collected and marked 61 woodlice in the first sample. In the second sample, 70 were collected, 14 of which had been marked in the first sample.

(i) Use the following equation to estimate the population size of the woodlice in the garden. [2]

$$\text{Population size} = \frac{\text{number in 1st sample x number in 2nd sample}}{\text{number in 2nd sample which had been marked in the 1st sample}}$$

Population size = ...

(ii) Calculate the number of woodlice per m^2. [2]

Answer = ... woodlice per m^2

(iii) Paul showed his method to his teacher, who said that it would not produce accurate results.
Suggest **one** inaccuracy in this method and how this could be improved. [2]

Inaccuracy	Improvement
.....	.....
.....	.....

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4. Huntington's disease is a genetic condition that stops the brain functioning properly. Symptoms usually start at around 40 years of age and progress over time. There is no cure for Huntington's disease.

(a) Huntington's disease is caused by a dominant allele.
State what is meant by the terms:

I. dominant; [1]

.....

.....

II. allele. [1]

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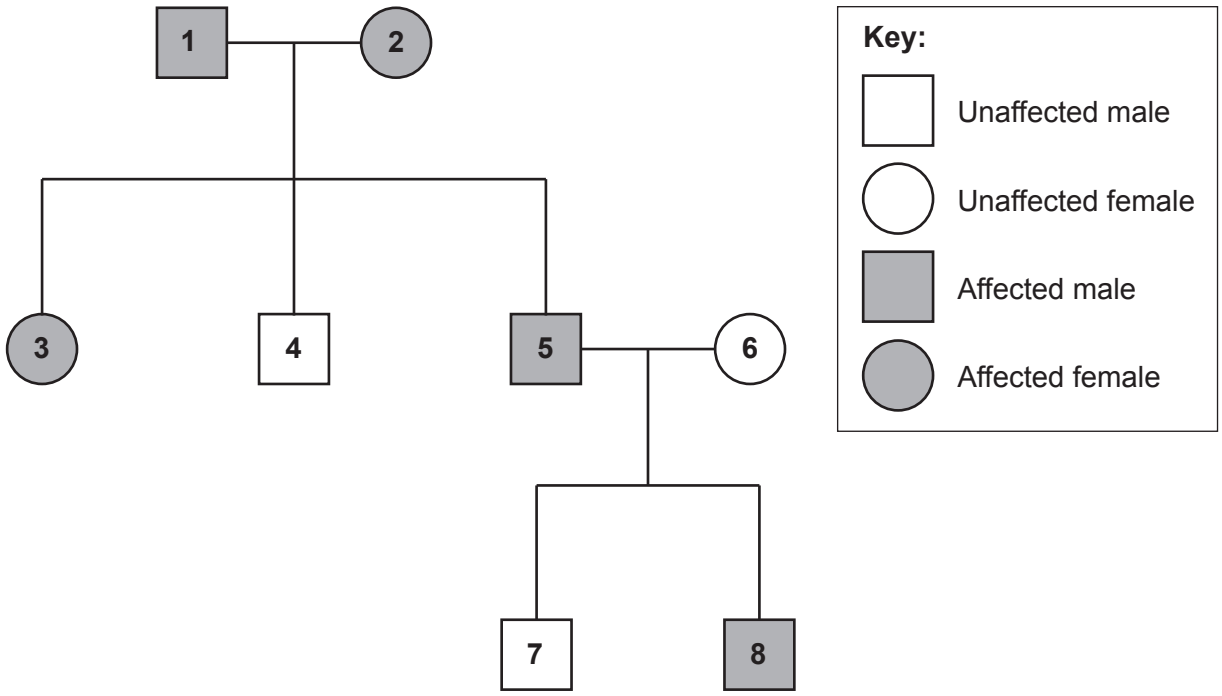
(b) The family tree shown in **Image 4** shows the inheritance of Huntington's disease.

Image 4



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(i) Explain why individual **4** in **Image 4** provides evidence that Huntington's disease is caused by a dominant allele. [1]

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(ii) **Complete the genetic cross** to show how individuals **5** and **6** in **Image 4** could produce offspring **7** and **8**.

Use **H** to represent the dominant allele and **h** the recessive allele. [3]

Parent phenotype affected × unaffected

Parent genotype ..... × .....

(c) It is possible to determine if an individual has Huntington's disease before symptoms appear. This involves taking a blood sample and preparing a DNA profile from it, which can then be analysed.

Briefly describe the main stages involved in producing a DNA profile. [2]

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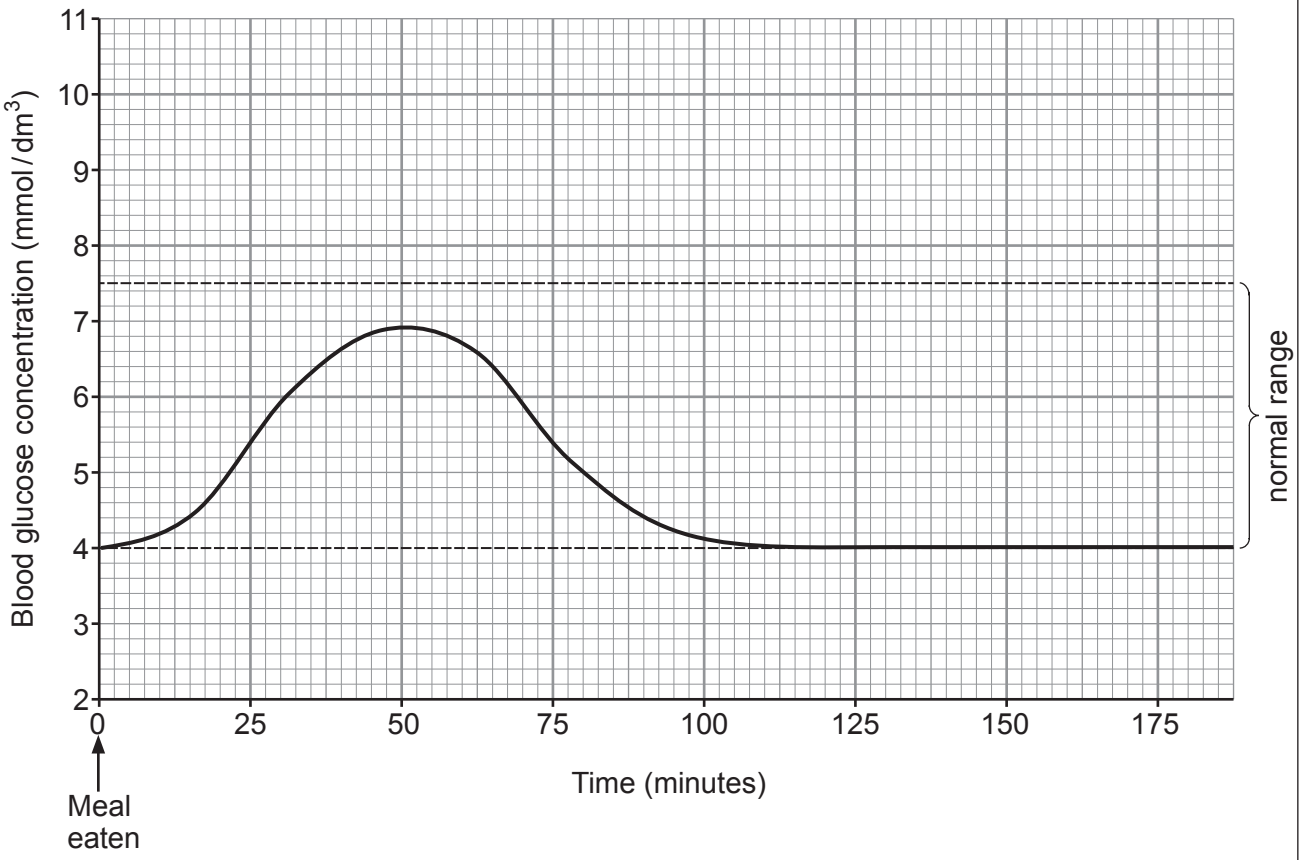
5. **Graph 5.1** shows the changes in Rhys' blood glucose concentration after eating a meal. It also shows the normal range of blood glucose levels.

Graph 5.1



(a) Use **Graph 5.1** to describe the changes in blood glucose concentration after eating a meal. Use your knowledge of the control of blood glucose to explain the changes.

[6 QER]

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(b) Seren has diabetes.

On **Graph 5.1 draw a line** to predict the changes in her blood glucose concentration if she had eaten the same meal, at the same time as Rhys. [1]

Question continued overleaf

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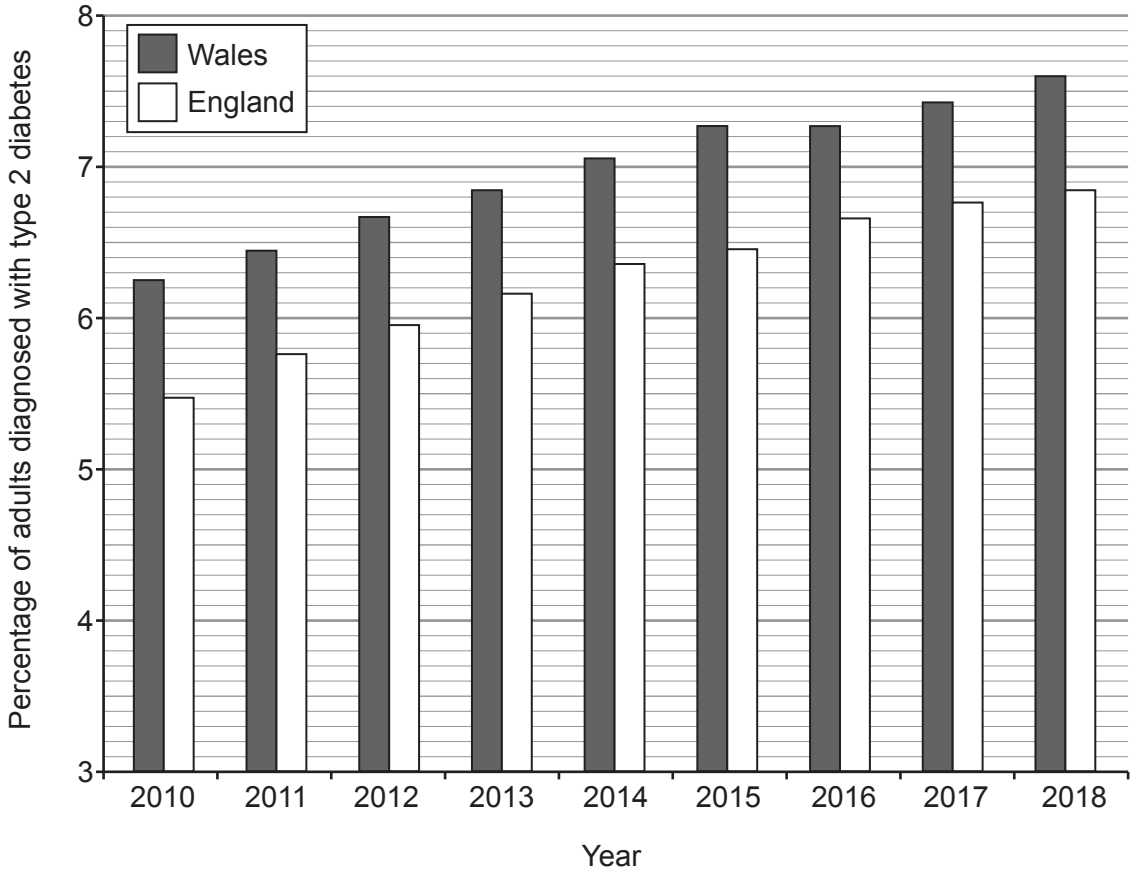
(c) In 2020 the following headline appeared on the BBC news website.

‘Type 2 diabetes ‘urgent public health crisis’ in Wales’

Graph 5.2 shows the percentage of adults diagnosed with type 2 diabetes from 2010–2018 in Wales and in England.

Graph 5.2



(i) Use **Graph 5.2** to compare the percentage of adults diagnosed with type 2 diabetes in England with those in Wales between 2010 and 2018. [2]

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(ii) In 2016, NHS England launched a Diabetes Prevention Programme. The aim was to prevent or slow the development of type 2 diabetes in adults in England.

Use **Graph 5.2** to conclude whether the prevention programme was successful. [1]

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(iii) In 2019, the Welsh Government launched their 'Healthy Weight: Healthy Wales' campaign. The aim was to significantly reduce the obesity levels in Wales by 2030.

Explain why the Welsh Government believed a reduction in obesity levels would help tackle the 'urgent public health crisis' in Wales. [1]

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(iv) State **two** methods of treating diabetes. [1]

I. .....

II. .....

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6. Tomatoes produce an enzyme that causes them to ripen and soften. The production of this enzyme is controlled by a gene called the 'PG gene'. Tomatoes ripening and softening too quickly can lead to high levels of food wastage in supermarkets and homes.

- The Flavr Savr tomato was the first genetically modified food to be granted a licence for human consumption.
- The PG gene in the Flavr Savr tomato has been modified. This modification slows down ripening.

(a) A section of the PG gene is shown in **Image 6**.

Image 6

T A G A C C

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(i) **Complete Image 6** to show the sequence of complementary base pairs that would be found in this part of the DNA molecule. [1]

(ii) Explain how the PG gene codes for the production of the enzyme. [3]

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(b) (i) State **one** concern people may have about the use of genetically modified plants for human consumption. [1]

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(ii) Suggest **two** advantages of the use of genetic modification to slow the ripening process in tomatoes. [2]

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7. (a) In 2010, an earthquake on the island of Haiti led to an outbreak of cholera. There were 800 000 cases recorded and 1.25% of those infected died. Cholera is caused by the bacterium *Vibrio cholerae*. Antibiotics can be used to treat cholera.

(i) Calculate the number of people infected with cholera who died following the earthquake in Haiti. [2]

Number of people infected with cholera who died = ...

(ii) *Vibrio cholerae* has shown resistance to several antibiotics.

State what is meant by the term **antibiotic resistance**. [1]

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(iii) Explain how antibiotic resistance in *Vibrio cholerae* evolved and became more widespread. [4]

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(b) Following the earthquake, a vaccine was widely distributed to help reduce the spread of cholera.

(i) Explain how the vaccine provides immunity against cholera. [3]

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(ii) The vaccine is administered in two doses. The second is taken two weeks after the first and provides protection against cholera for three years. If individuals only have one dose, they are still protected against cholera but for a shorter time.

Explain why two doses of the vaccine provides longer-term immunity to cholera. [1]

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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