OXFORD
INTERNATIONAL
AQA EXAMINATIONS

OXFORD AQA INTERNATIONAL A-LEVEL
BIOLOGY
(9610)

PAPER 4

Specimen 2018 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a pencil
- a ruler with millimetre measurements
- a calculator

Instructions
- use black ink or ball-point pen
- answer **all** questions
- show all your working.

Information
- The marks for questions are shown in brackets
- The maximum mark for this paper is 75 marks

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

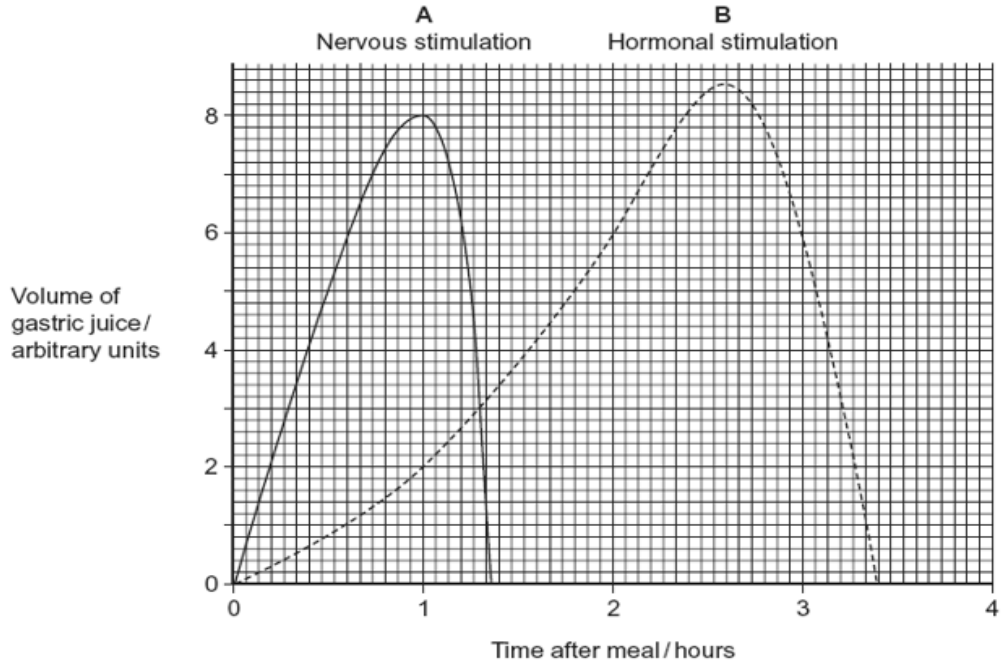
Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

Answer **all** questions in the spaces provided

1 Cells in the stomach wall release gastric juice after a meal. **Figure 1** shows how the volumes of gastric juice produced by nervous stimulation and by hormonal stimulation change after a meal.

Figure 1



0 1 . 1 Describe the evidence from **Figure 1** that curve **A** represents the volume of gastric juice produced by nervous stimulation.

[2 marks]

0 1 . 2 Complete **Table 1** to show the percentage of gastric juice produced by nervous stimulation at the times shown.

[1 mark]

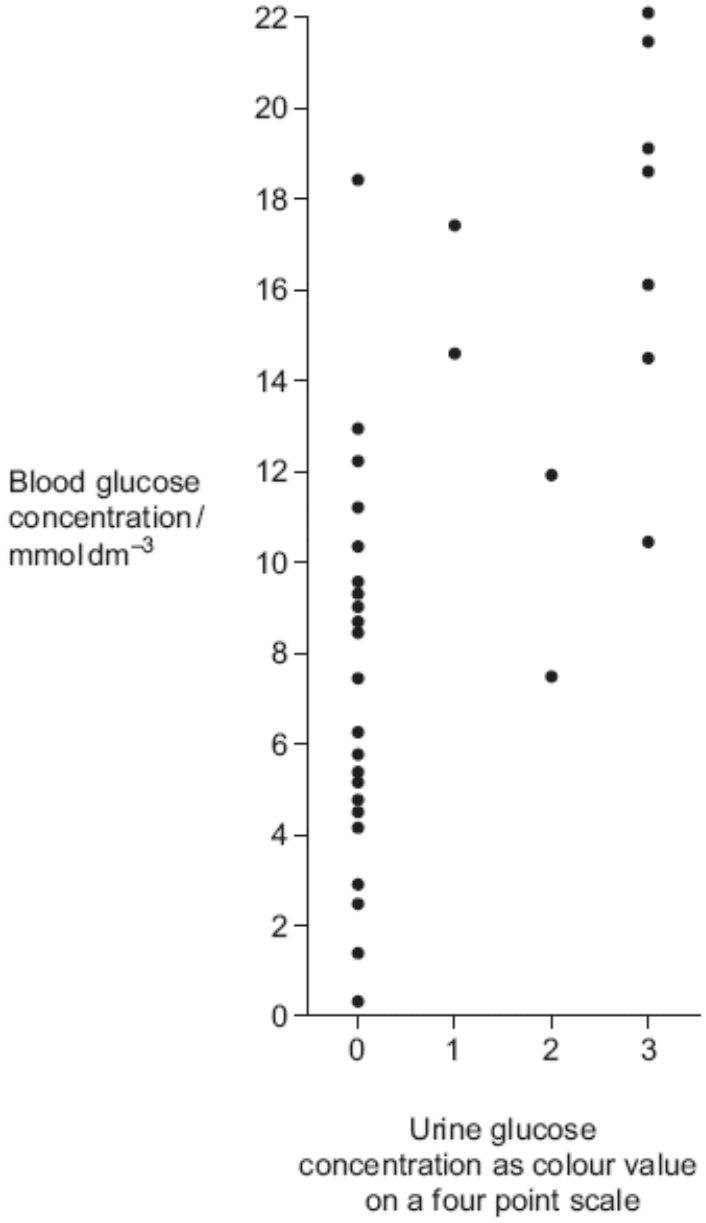
Table 1

	Time after meal / hours		
	1	**2**	**3**
Percentage of gastric juice produced by nervous stimulation			

Turn over for the next question

2 Technicians in a hospital laboratory tested urine and blood samples from a girl with diabetes at intervals over a one-year period. Each time the technicians tested her urine, they also measured her blood glucose concentration. Their results are shown in **Figure 2**.

Figure 2



0 2 . 1 The girl who took part in this investigation was being successfully treated with insulin. **Figure 2** shows that on some occasions, the concentration of glucose in her blood was very high. Suggest why.

[2 marks]

0 2 . 2 Use **Figure 2** to evaluate the use of the urine test as a measure of blood glucose concentration.

[3 marks]

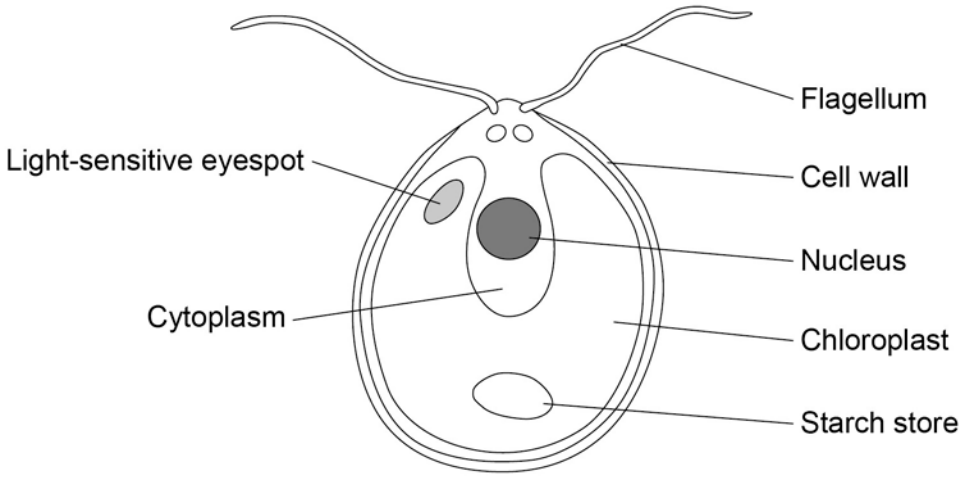
0 2 . 3 Diabetic people who do not control their blood glucose concentration may become unconscious and go into a coma. A doctor may inject a diabetic person who is in a coma with glucagon. Explain how the glucagon would affect the person's blood glucose concentration.

[3 marks]

Turn over for the next question

3 The diagram shows a single-celled organism called *Chlamydomonas*.

Figure 3



0 3 . 1 *Chlamydomonas* lives in fresh-water ponds. It uses its flagella to swim towards light of moderate intensity but away from very bright light. Using information in **Figure 3**, explain the advantage of this behaviour.

[2 marks]

0 3 . 2 A *Chlamydomonas* cell has two flagella. These flagella contain a single sort of protein. A flagellum consists of a bundle of 242 filaments. Each filament consists of 7500 protein molecules. Each protein molecule contains 900 amino acid units.

What would be the minimum number of nucleotides in the coding region of the mRNA used to synthesise this protein?

[2 marks]

0 3 . 3 In an investigation, a culture of *Chlamydomonas* was treated in a way that caused them to lose their flagella without any other damage to the cells. The flagella grew back to their original length in 60 minutes.

How many amino acid molecules would be incorporated into each growing flagellum per minute? Show your working.

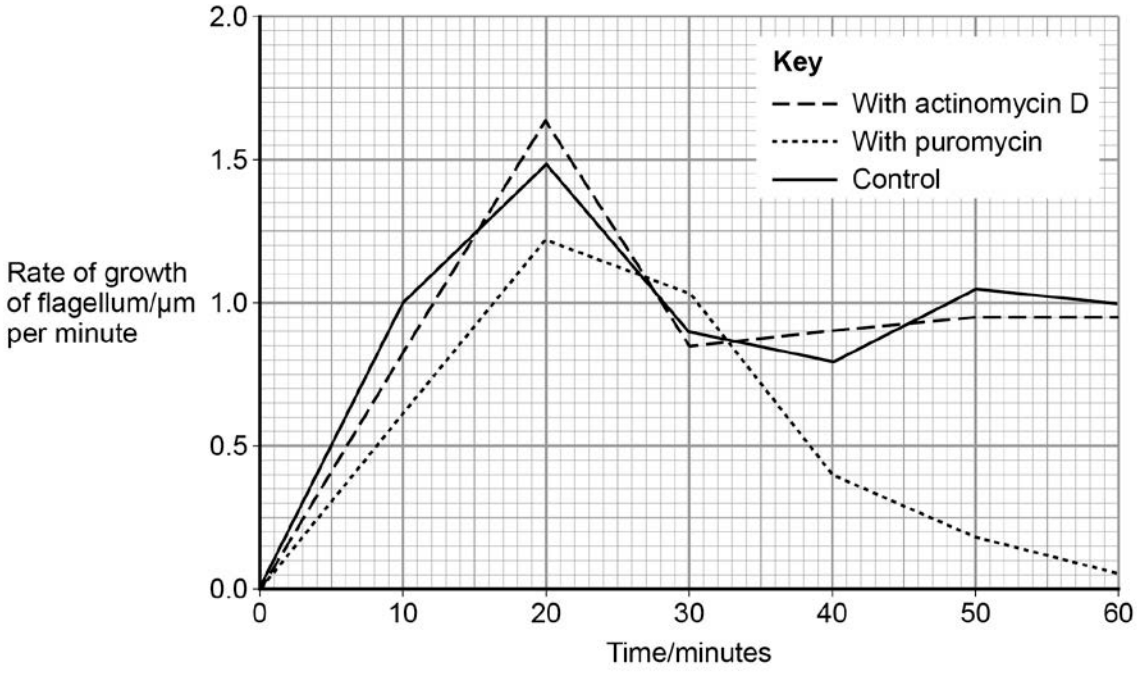
[2 marks]

The researchers investigated the rate at which the flagella grew in three different media.

1. A medium containing actinomycin D, which prevents transcription by binding to the guanine in DNA
2. A medium containing puromycin, which prevents translation by attaching to ribosomes
3. A control medium

The results are shown below in **Figure 4.**

Figure 4



0 3 . 4 Describe how the rate of growth was affected by puromycin.

[2 marks]

0 3 . 5 The researchers concluded

1. that the cells used mRNA that is already present in the cytoplasm for the regrowth of the flagella;

2. that some of the regrowth uses protein molecules already present in the cell.

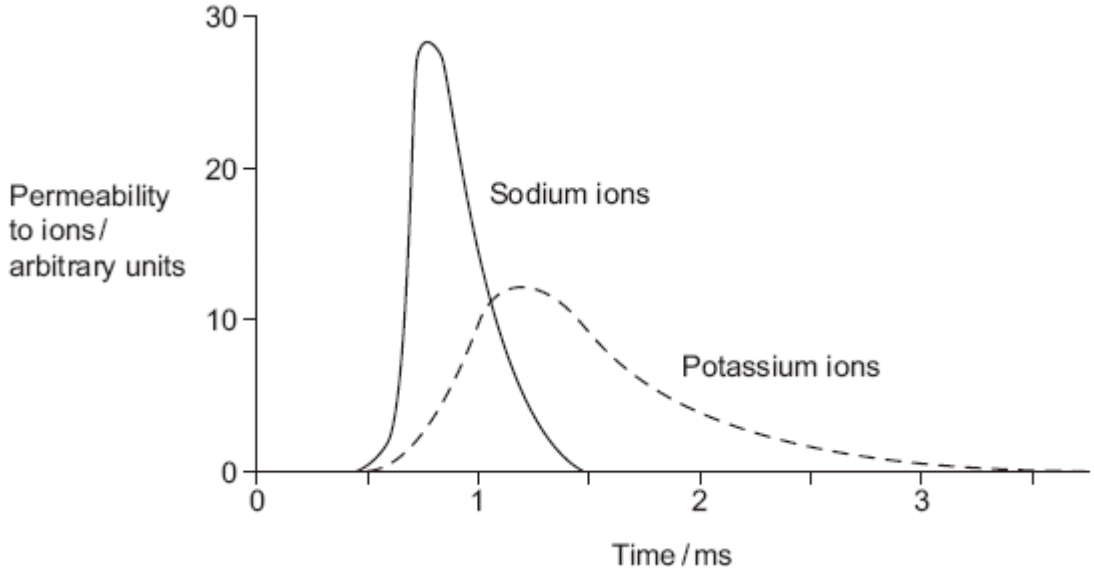
Explain the evidence for each of these conclusions.

[2 marks]

Turn over for the next question

4 During an action potential, the permeability of the cell-surface membrane of an axon changes. **Figure 5** below shows changes in permeability of the membrane to sodium ions (Na^+) and to potassium ions (K^+) during a single action potential

Figure 5



0 4 . 1 Explain the shape of the curve for sodium ions between 0.5 ms and 0.7ms.

[3 marks]

0 4 . 2 During an action potential, the membrane potential rises to +40 mV and then falls. Use information from **Figure 5** to explain the fall in membrane potential.

[3 marks]

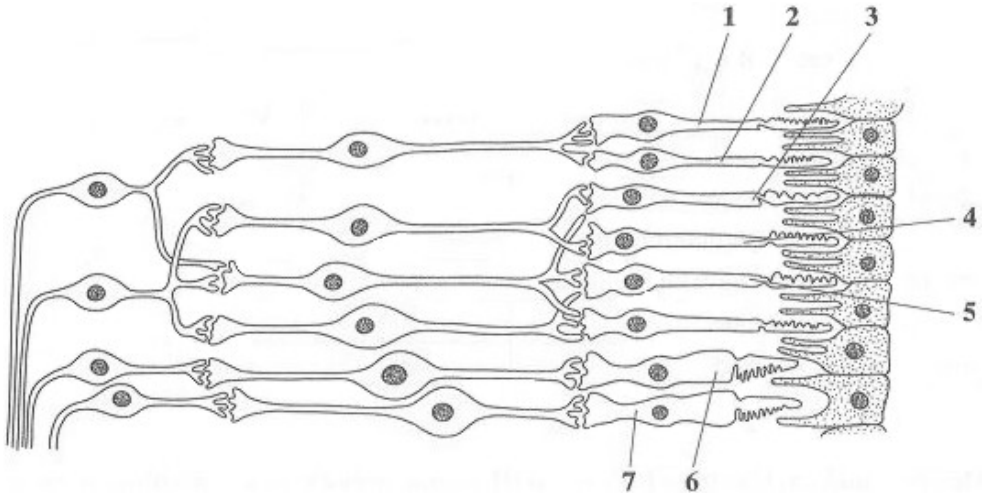
0 4 . 3 After exercise, some ATP is used to re-establish the resting potential in axons.
Explain how the resting potential is re-established.

[3 marks]

Turn over for the next question

5 **Figure 6** below shows part of the retina in a human eye.

Figure 6



0 5 . 1 When light falls on cells **1** and **2**, only one spot of light is seen. But, when light falls on cells **2** and **3**, two spots of light are seen.

[1 mark]

0 5 . 2 When one unit of light energy falls on cell **3**, no light is seen. But, when one unit of light energy falls on cell **3**, one unit falls on cell **4** and one unit falls on cell **5**, light is seen.

[3 marks]

0 5 . 3 Cells of the same type as cells **6** and **7** are found in large numbers at the fovea. This results in colour vision with high visual acuity.

Explain what causes vision using the fovea to be in colour?

[1 mark]

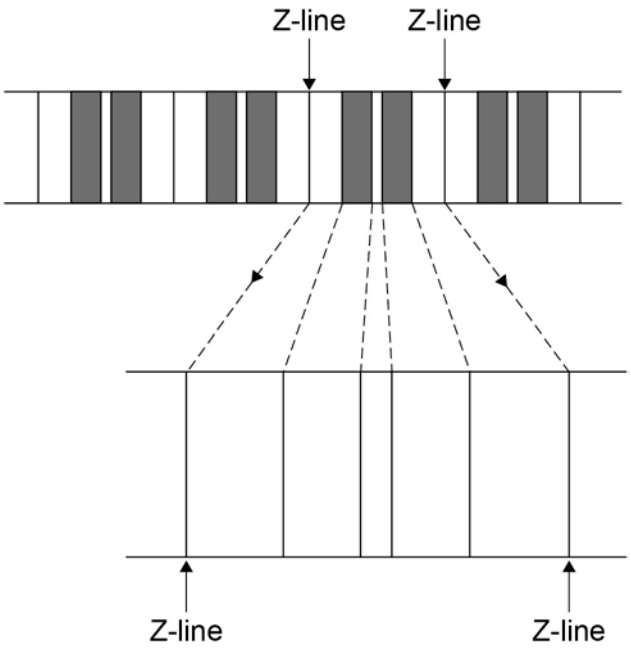
0 5 . 4 Explain what causes vision using the fovea to have high visual acuity?

[2 marks]

Turn over for the next question

6 **Figure 7** shows part of a single myofibril from a skeletal muscle fibre as it appears under an optical microscope.

Figure 7



0 6 . 1 Complete **Figure 7** to show the arrangement of actin and myosin filaments in this part of the myofibril as they would appear under an electron microscope. Label the actin and myosin filaments.

[2 marks]

0 6 . 2 Why are the details you have drawn in **Figure 7** visible under the electron microscope but not under the optical microscope?

[1 mark]

0 6 . 3 The myofibril in **Figure 7** is magnified × 8000. A muscle fibre is 40 µm in diameter. Calculate the number of myofibrils which would fit side by side across the diameter of the muscle fibre. Show your working.

[2 marks]

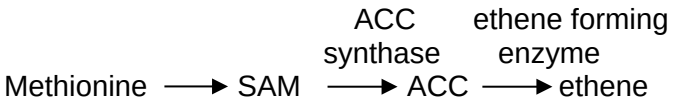
Turn over for the next question

0 7 . 1 Ethene is a plant growth substance. Give **two** ways in which plant growth substances are different from animal hormones.

[2 marks]

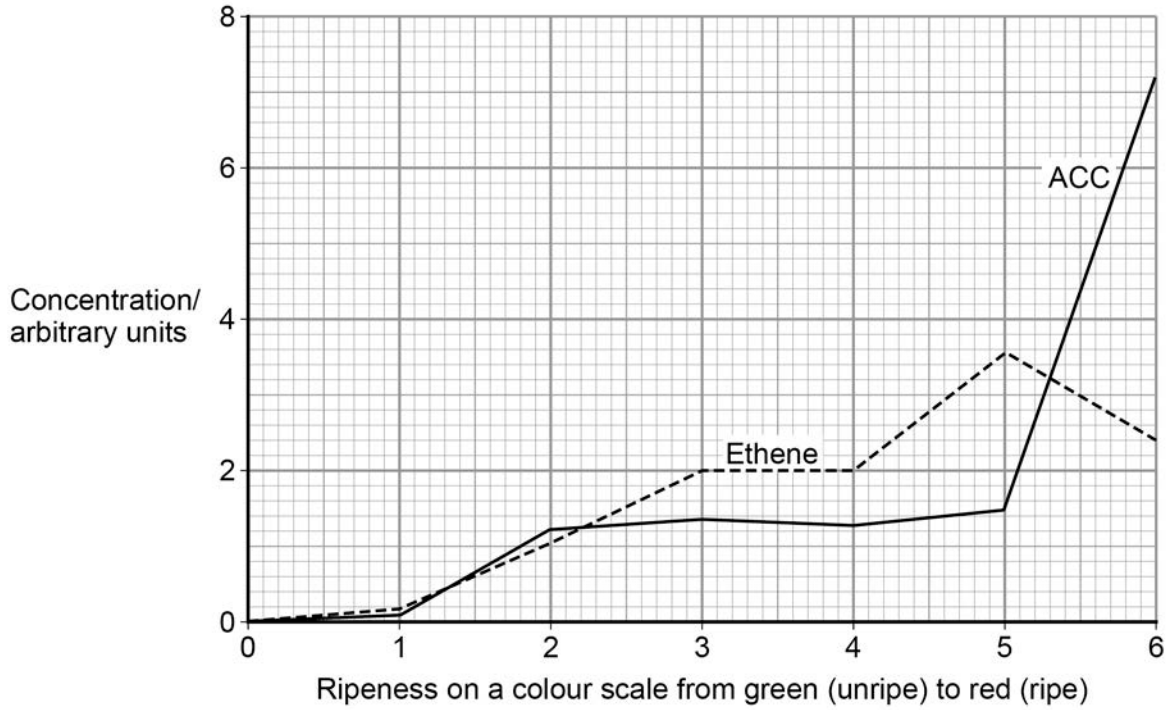
Figure 8 shows some steps in the pathway by which ethene is synthesised in ripening fruit.

Figure 8



Scientists investigated the concentration of ACC and ethene in ripening tomato fruit. **Figure 9** below shows their results.

Figure 9



0 7 . 2 Describe how the concentration of ACC changes as the tomatoes ripen.

[2 marks]

The scientists suggested that the availability of ACC in unripe tomatoes regulates ethene production.

0 7 . 3 Use the data in **Figure 9** to evaluate this conclusion.

[3 marks]

0 7 . 4 Describe how the scientists could test the suggestion that ACC limits ethane production.

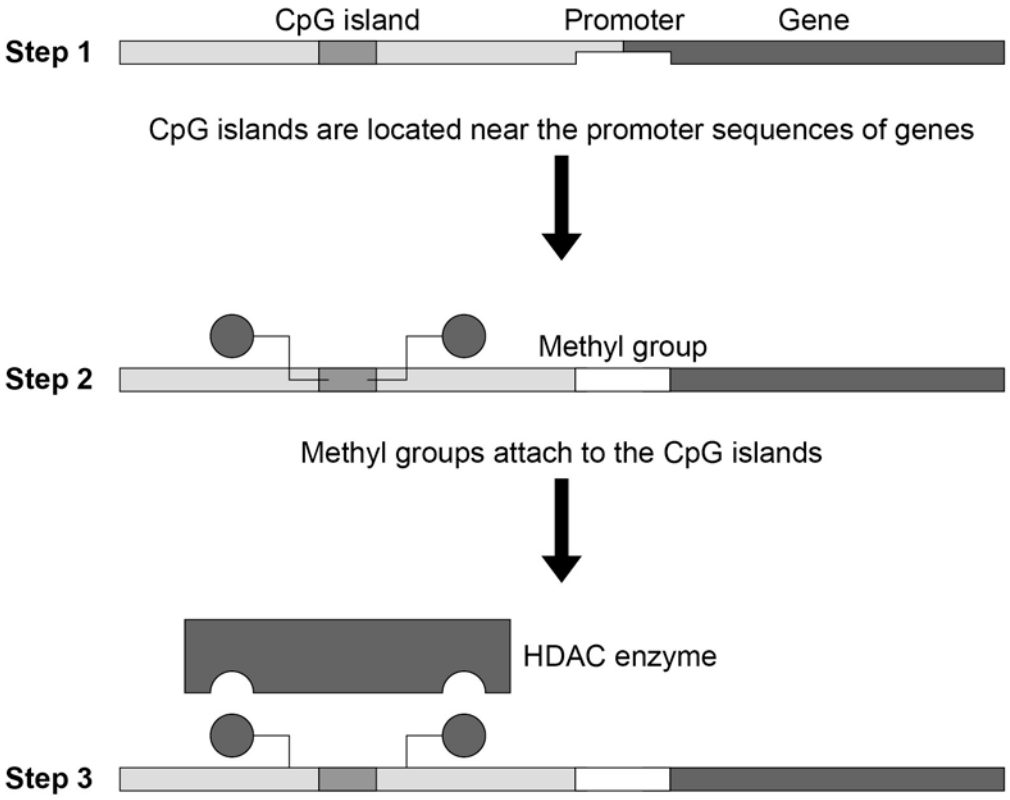
[2 marks]

0 7 . 5 Describe the evidence from **Figure 9** that the activity of ethene forming enzyme decreases as the tomato ripens.

[1 mark]

8 **Figure 10** shows one way in which methylation of DNA prevents the translation of a particular gene
A CpG island (step 1) consists of a number of cytosine-phosphate-guanine sequences.

Figure 10



The enzyme HDAC binds, compresses the shape of the DNA and prevents the gene from being transcribed.

0 8 . 1 Describe the difference between a cytosine-phosphate-guanine sequence and a cytosine-guanine base pair.

[3 marks]

0 8 . 2 Explain why the enzyme HDAC only binds to the methylated CpG islands (step 3).

[3 marks]

0 8 . 3 Explain why tumour suppressor genes may prevent cancer.

[1 mark]

0 8 . 4 Use **Figure 10** to explain why HDAC inhibitors may be useful in treating cancer.

[3 marks]

9

In the USA, members of the public found many frogs with deformed legs. Scientists investigated this. They collected samples of the frogs. They wanted to get reliable data.

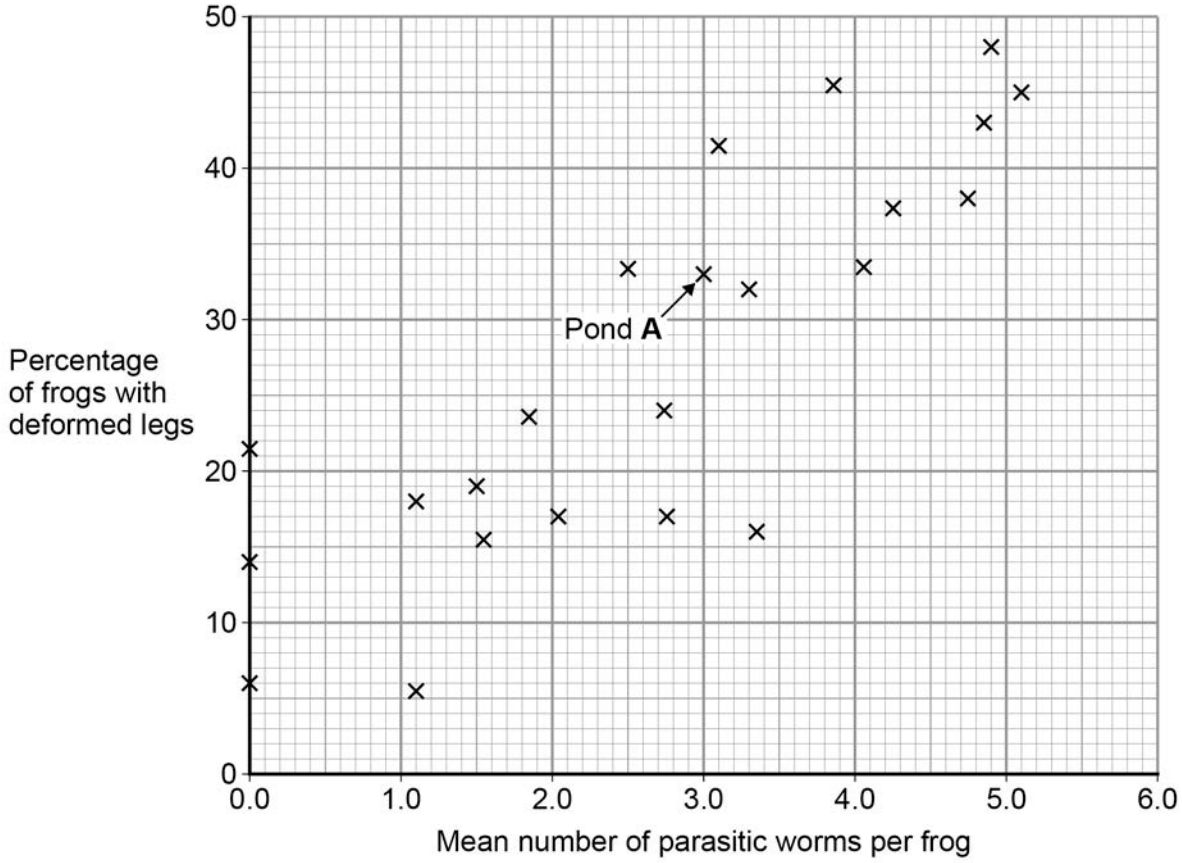
0 9 . 1 Give **one** feature of the sample, other than a large sample size, that would help to make sure that their data were reliable.

[1 mark]

The team of scientists then investigated frogs in ponds. The team measured many different factors and then analysed their results. **Figure 11** shows the relationship between the percentage of frogs with deformed legs and the mean number of parasitic worms found in the frogs.

[1 mark]

Figure 11



0 9 . 2 The scientists collected a sample of three frogs from pond **A**. What was the total number of parastic worms found in these three frogs?

[1 mark]

0 9 . 3 One scientist suggested that the parasites caused the deformed legs found in frogs.

Does **Figure 11** support this suggestion? Explain your answer.

[4 marks]

0 9 . 4 The scientists wrote a paper. In their discussion they wrote that they found very few ponds that were free from human influence. The few that they did find were only in mountainous areas.

The scientists could not draw any reliable conclusions about whether human influence contributed to the frogs' deformed legs. Explain why each of the following meant that they could not draw reliable conclusions.

There were very few ponds free from human influence.

[1 mark]

0 9 . 5 Explain why the following meant that they could not draw reliable conclusions.

The ponds free from human influence were found only in mountainous areas.

[2 marks]

In a second investigation, another research team investigated deformed legs in frogs in a different way.

- They chose six ponds, all of which contained parasitic worms. Three of the ponds were close to fields and received agricultural run-off from these fields. The other three ponds did not receive agricultural run-off.
- They built two cages in each of the six ponds. One cage in each pond allowed parasitic worms to enter and one cage did not.
- They put frogs that were not infected with parasitic worms into all twelve cages.

Table 2 shows the results of this second investigation.

Table 2

	Percentage of frogs with deformed limbs					
	Ponds with agricultural run-off			Ponds with no agricultural run-off		
Pond number	1	2	3	4	5	6
Cage with mean mesh diameter of 500 µm	22	27	24	3	4	7
Cage with mean mesh diameter of 75 µm	0	0	0	0	0	0

0 9 . 6 One of the boxes in **Table 2** has been shaded. Describe the information given in the shaded box.

[2 marks]

0 9 . 7 What conclusions can you draw from the data in **Table 2** about the factors causing deformed leg in frogs? Explain your answer.

[4 marks]

END OF QUESTIONS