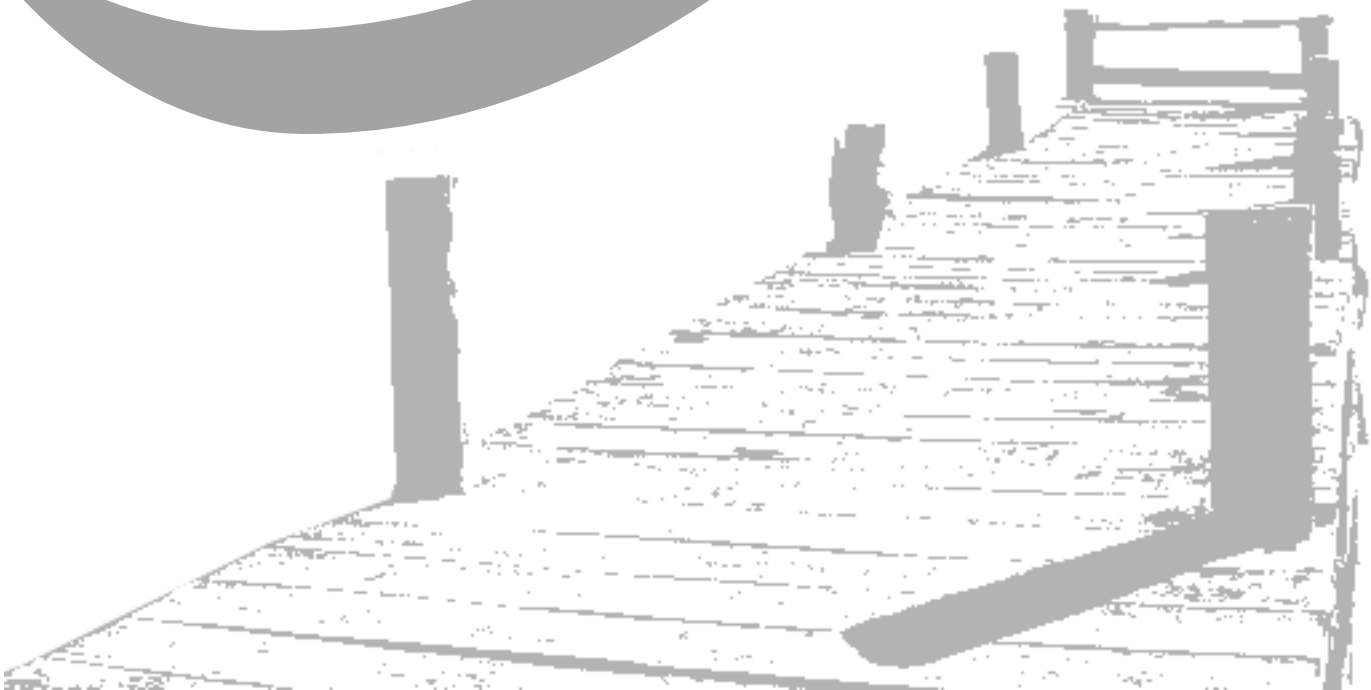
GCE
AS and A Level

Biology

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 2:
Specimen question paper

Version 0.2



Version 0.2

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Education
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY **BIOL2**
The variety of living organisms

Specimen Paper

In addition to this paper you will require
- a ruler with millimetre measurements

You may use a calculator.

Time allowed: 1 hour 45 minutes

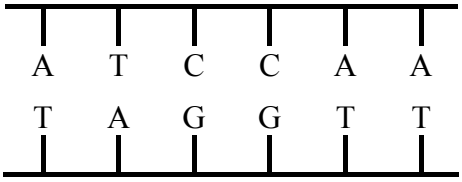
Instructions
- Use black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked

Information
- The maximum mark for this paper is 85.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.
- Quality of Written Communication will be assessed in all answers.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
10			
Total (Column 1)			
Total Column 2)			
TOTAL			
Examiner's Initials			

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

1 (a) The diagram shows part of a DNA molecule. In the space below, draw a similar diagram to show this part of the molecule after it has replicated.
Label the original strands and the new strands.



(2 marks)

(b) Biologists found the mean mass of DNA in three different types of cells from different animals. Their results are shown in the table.

Animal	**Mass of DNA in nucleus/picograms**		
	Liver cell	Blood cell	Sperm cell
Chicken	2.53	2.51	1.26
Goldfish	3.29	3.28	1.64
Trout	5.79	5.78	2.89
Toad	7.33	7.31	3.68

(i) What would you expect to be the mean mass of DNA in a skin cell from a toad?
Explain your answer.

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(2 marks)

(ii) A zygote is formed when a sperm cell fertilises an egg cell. How much DNA would you expect to find in a trout zygote that had just been formed? Explain your answer.

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(2 marks)

6

Turn over for the next question

2 (a) The pulmonary artery and aorta are described as organs. Explain why.

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(1 mark)

(b) Give **one** way in which blood in the pulmonary artery is different from blood in the aorta.

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(1 mark)

(c) Give **two** ways in which the structure of a artery is different from the structure of a vein.

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(2 marks)

(d) The maximum blood pressure in the aorta changes as the distance from the heart increases.

(i) Describe how the blood pressure changes.

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(1 mark)

(ii) What causes this change in maximum blood pressure?

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(1 mark)

6

3 (a) *Class, family, genus* and *kingdom* are terms used in classifying organisms.
Write the terms in the correct sequence.

Largest number of species			Smallest number of species
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(1 mark)

(b) Cytochrome c is a protein. The table shows the sequence of the last six amino acids in cytochrome c in humans and three other animals.

Animal	**Sequence of amino acids in cytochrome c**
Human	lys–ile–phe–ile–met–lys
	lys–th–rphe–va–lglu–lys
	lys–ile–phe–ile–met–lys
	lys–ile–phe–val–glu–lys

- The three other animals are a monkey, a fish and a horse.
- One of the three is in the same order as humans.
- Two are in the same class.

(i) Complete the table to show the animal from which each sample of cytochrome c was taken.

(1 mark)

(ii) Explain your answer.

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(1 mark)

(c) DNA hybridisation shows similarities between DNA samples. Explain why

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(3 marks)

6

Turn over ►

4 (a) Meiosis results in variation between individuals within a population. Describe and explain **one** way the production of gametes by meiosis contributes to this variation.

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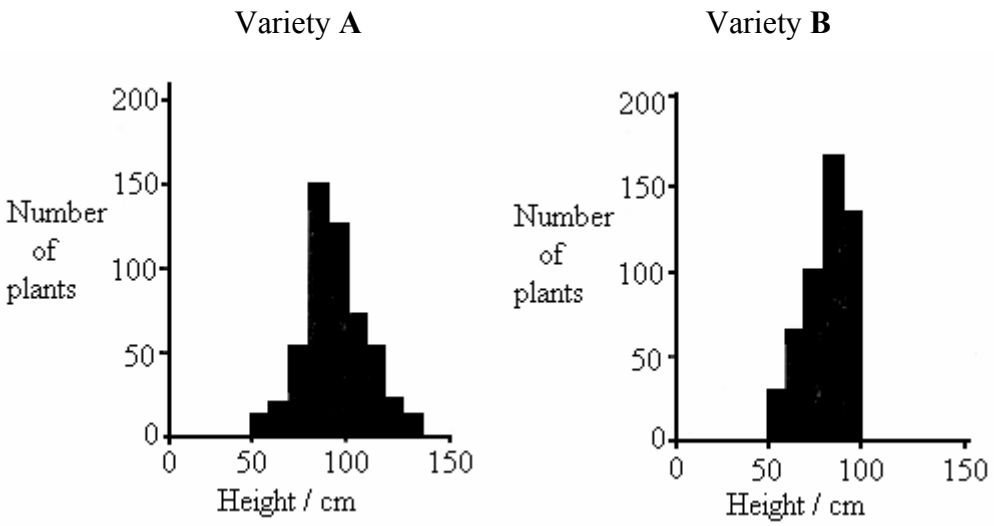
(2 marks)

(b) **A** and **B** are varieties of wheat. Scientists grew both varieties in identical conditions and measured the heights of the fully grown plants. The results are shown in the diagram.



(i) Describe **two** ways in which the results for variety **A** differ from the results for variety **B**.

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2 .....

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(2 marks)

(ii) Suggest the advantage to a farmer of growing variety **B** rather than variety **A**.

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(2 marks)

(c) The effect of global warming on the environment is uncertain. It is important to keep seeds of the old varieties. Suggest why.

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(2 marks)

8

5 (a) Boxes **A** to **E** show some of the events of the cell cycle.

A	Chromatids separate.
B	Nuclear envelope disappears
C	Cytoplasm divides
D	Chromosomes condensed and become visible
E	Chromosomes on the equator of the spindle

(i) List these events in the correct order starting with **D.**

……. **D**……. ……. ……. ……. …….

(1 mark)

(ii) Name the stage described in box **E.**

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(1 mark)

(b) Name the stage of the cell cycle during which DNA replication occurs.

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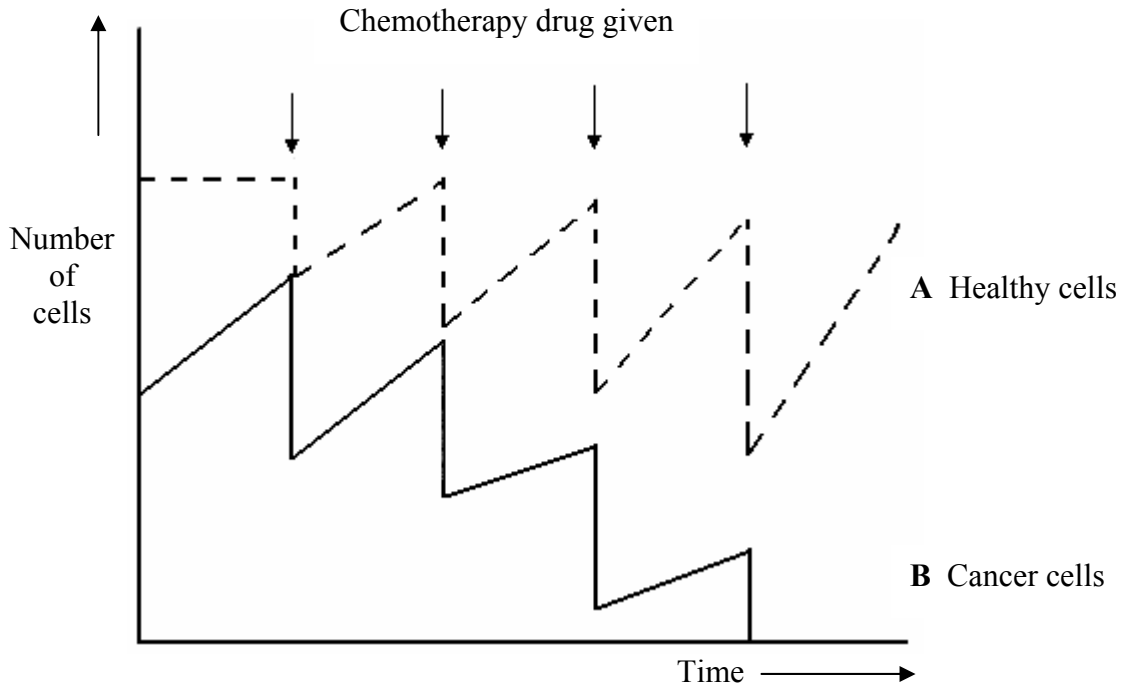
(1 mark)

(c) Scientists produced a model to show how chemotherapy works in the treatment of cancer. The model is shown in the diagram.



(i) Explain the difference in curves **A** and **B** before chemotherapy starts.

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(2 marks)

(ii) Chemotherapy drugs must be given a number of times if the treatment is to be successful. Use the diagram to explain why.

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(2 marks)

7

6 Students investigated the effect of modern farming on the diversity of birds. The table shows some results from one farm.

Species	Number of birds
Greenfinch	12
Goldfinch	7
Partridge	3
Lapwing	2

(a) (i) The index of diversity can be calculated from the formula

$$d = \frac{N\,(N\text{-}1)}{\Sigma\, n\,(n\text{-}1)}$$

where

d = Index of diversity
N = total number of organisms of all species
n = total number of organisms of a particular species

Use this formula to calculate the index of diversity for the results shown in the table. Show your working.

Answer.....

(2 marks)

(ii) It is useful in an investigation like this to calculate the index of diversity. Explain why it is more useful to calculate the index of diversity than to record just the number of species present.

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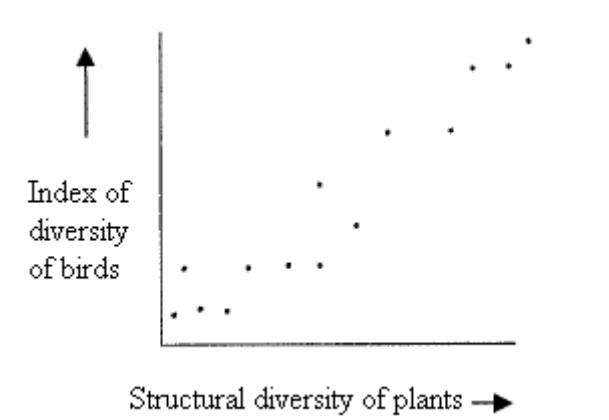
(2 marks)

Structural diversity refers to the different forms of plants such as herbs, shrubs and trees present in a particular area. The graph shows the relationship between the index diversity of birds and structural diversity of the plants on farmland.



(b) (i) Describe the relationship between the index of diversity for birds and structural diversity for plants.

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(1 marks)

(ii) Suggest an explanation for this relationship.

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(2 marks)

(c) The European Union gives grants to farmers to re-plant hedges previously removed. Explain how re-planting hedges might affect the index diversity for birds found on farms.

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(1 mark)

8

7 (a) Haemoglobin is a protein. Its molecules have a quaternary structure. Explain what is meant by a quaternary structure.

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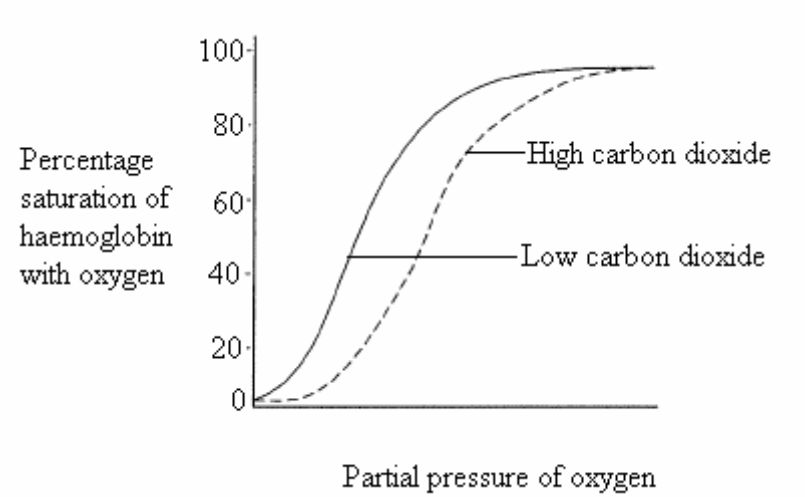
(1 mark)

The diagram shows oxygen dissociation curves for human haemoglobin.



(b) Haemoglobin is 96 % saturated with oxygen when it leaves the lungs. Use the graph to explain why.

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(2 marks)

(c) (i) There is a high concentration of carbon dioxide in rapidly respiring tissue. Explain why.

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(1 mark)

(ii) Carbon dioxide helps haemoglobin to release oxygen to rapidly respiring tissues. Use the graph to explain how.

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(2 marks)

(d) Ground squirrels are mammals that spend much of their lives in burrows underground. The table shows the partial pressure of oxygen in a ground-squirrel burrow and in the air above ground.

Source of air sample	**Partial pressure of oxygen / kPa**
Ground-squirrel burrow	15.8
Above ground	21.1

Suggest the advantage to a ground squirrel of having haemoglobin that has an oxygen dissociation curve to the left of the curve for human haemoglobin.

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(2 marks)

8

8 (a) What is a species?

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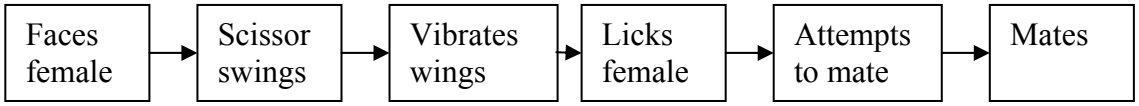
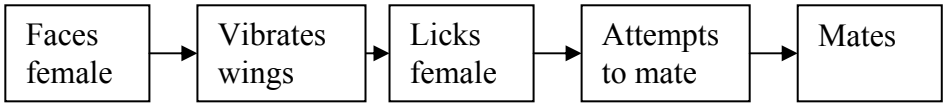
(2 marks)

The courtship behaviour of male fruitflies has several components. The diagram shows the courtship sequences of males from two closely related species of fruitfly.

Species **A**



Species **B**



(b) Suggest how the courtship sequences provide evidence that

(i) the fruitflies are separate species

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(1 mark)

(ii) the species are closely related.

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(1 mark)

(c) During courtship males of both species vibrate their wings. This produces a sound. Explain how this sound helps to ensure that the female mates only with a male of the same species.

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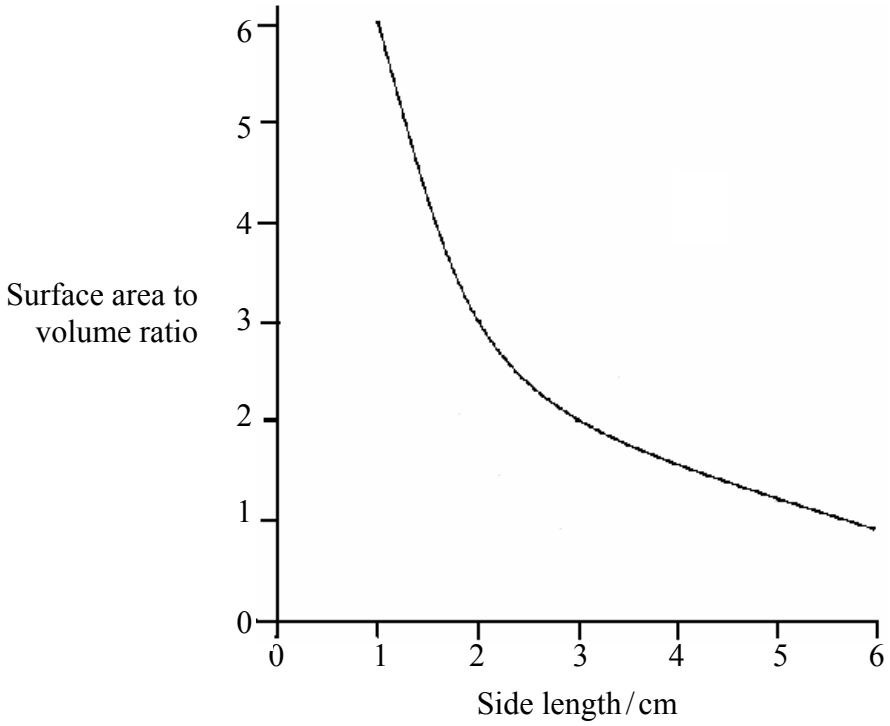
(2 marks)

6

Turn over for the next question

9 The graph shows the surface area to volume ratio of cubes of different size.



(a) Elephant seals are mammals that live in water that has a temperature of between 0°C and 4°C. Elephant seals are very large. Use the graph to explain the advantage of a large size to elephant seals.

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(2 marks)

(b) (i) Describe how single-celled organisms exchange respiratory gases.

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(1 mark)

(ii) This method of gas exchange is only possible in very small organisms. Explain why.

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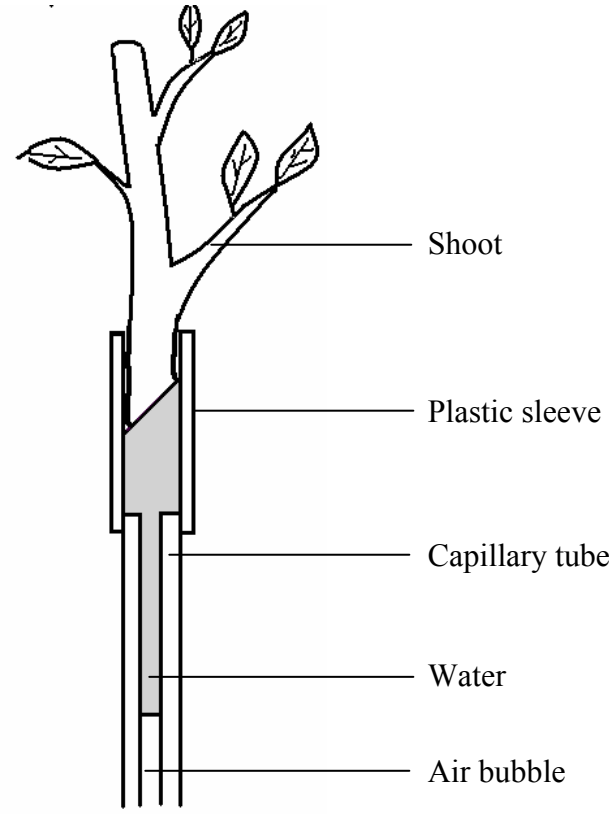
(2 marks)

Question 9 continues on the next page

Students used the apparatus shown in the diagram to measure the rate at which a leafy shoot took up water.



(c) The students measure the distance moved by the air bubble every 30 seconds. What other measurement should they take if they wanted to compare water loss from different shoots? Explain your answer.

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(2 marks)

(d) The students plotted the distance moved by the air bubble against time on a graph. Describe how they could use the graph to calculate the mean rate of water uptake.

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(2 marks)

(e) An insect lives in air. Describe how the insect is able to obtain oxygen and limit water loss.

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(6 marks)

15

10 Humans introduced rats to New Zealand. These introduced rats affected the numbers of native birds.

(a) Rats eat a wide variety of animal and plant food. Suggest **two** ways in which rats may have affected the numbers of native birds.

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(2 marks)

In the Nelson Lakes National Park, scientists set up a project to reduce the number of rats. They hoped that this would lead to an increase in the number of native birds in the park.

(b) Before they started work, the scientists read many scientific papers. One of these was a paper on "Using tracking tunnels to monitor populations of rats and mice".
What was the advantage of reading this paper before they started work?

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(1 mark)

(c) The scientists set traps in one area of the park to catch rats. The table shows the numbers of all introduced mammals caught in these traps in 2001 and 2002.

Year	**Species**			
	Rat	Mouse	Stoat	Weasel
2001	2174	4093	18	14
2002	708	341	4	5
Ratio 2001 : 2002	3.1 : 1	12 : 1	4.5 : 1	2.8 : 1

(i) The data for each species are summarised as a ratio. Explain the advantage in summarising the data as a ratio.

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(2 marks)

(ii) One of the scientists concluded that there was a larger relative fall in the number of stoats than in the number of weasels. Do you support this statement? Explain your answer.

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(2 marks)

Other scientists suggested that the numbers of rats present in any one year were related to the number of seeds that fell from the beech trees in the park. They tested this hypothesis.

(d) The scientists collected the seeds in sample areas that they chose at random. Why was it important that they chose the sample areas at random?

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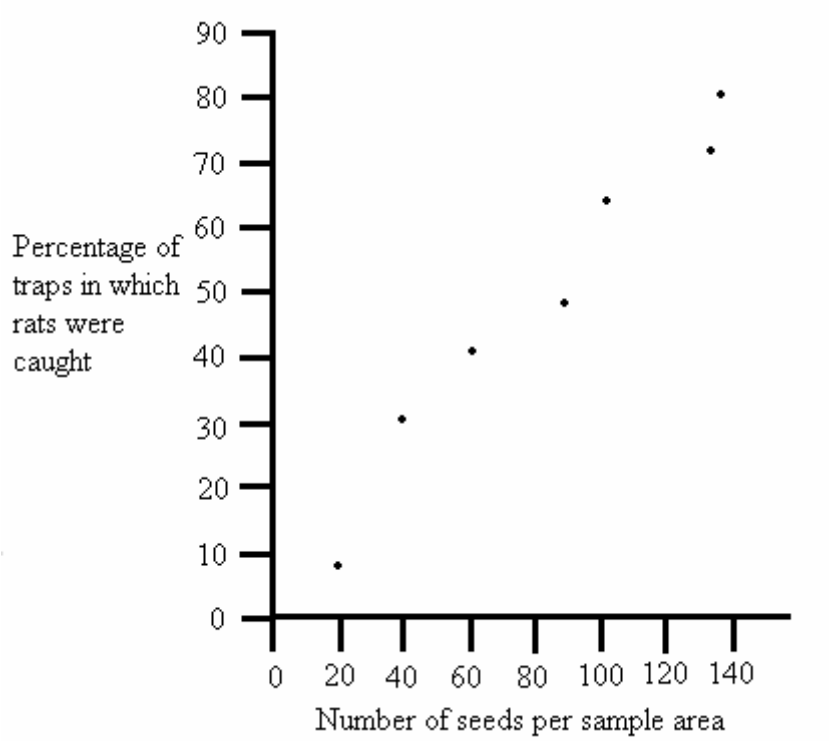
(1 mark)

Question 10 continues on the next page

The data collected by the scientists are shown in **Figure 1**.

Figure 1



(e) (i) The scientists used the data in **Figure 1** to predict the number of rats from the number of seeds that fell from the beech trees. Describe how.

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(2 marks)

(ii) A relationship between two variables does not necessarily mean that one causes the other. Use **Figure 1** to explain what is meant by this statement.

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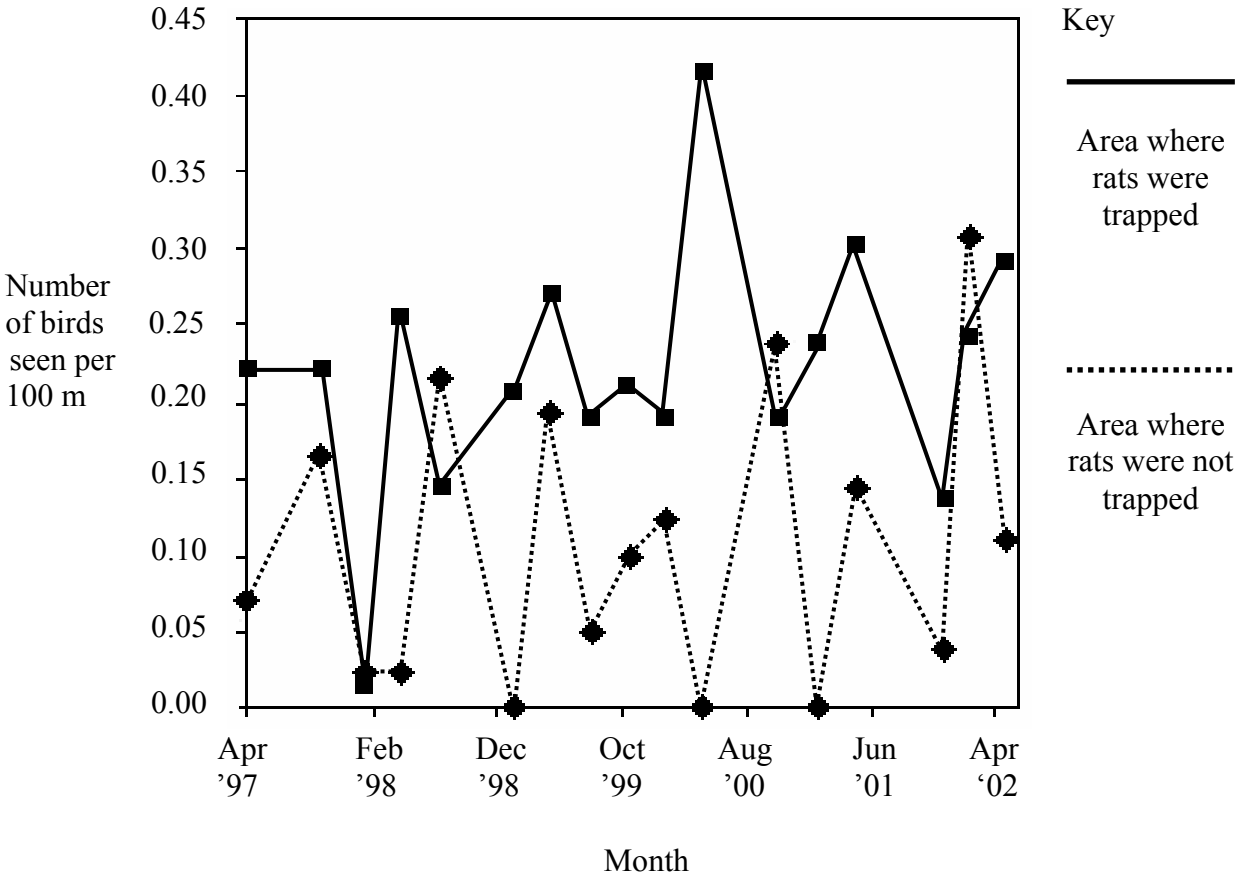
(2 marks)

The scientists wanted to know if the project was successful. **Figure 2** is a graph showing the effect of trapping rats on the numbers of one native bird, the tui.

Figure 2



(f) Use the data in **Figure 2** to evaluate the project and suggest whether or not it had been successful.

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(3 marks)

15

END OF QUESTIONS