Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

AQA Level 1/2 Certificate in Biology
Specimen Paper

Biology

Paper 2

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 90 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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

1 (a) Microorganisms can be grown on agar jelly in a Petri dish.

List A gives four actions that are sometimes used when growing microorganisms.

List B gives five possible effects of these actions.

Draw a line from each action in **List A** to its effect in **List B**.

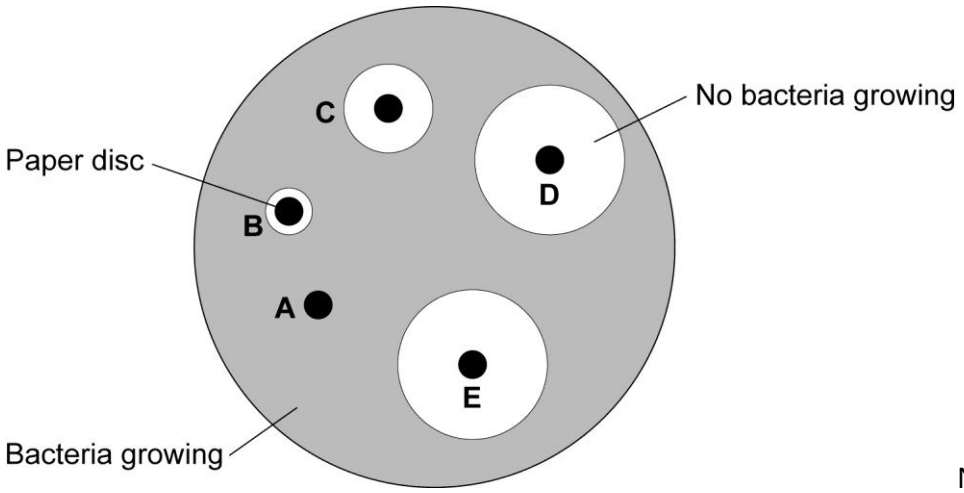
List A – Action	**List B – Effect**
	Increases the risk of contamination with bacteria
Heating loop in flame	
	Decreases the risk of bacteria entering
Placing loop on bench to cool	
	Kills bacteria
Only lifting lid of Petri dish a little	
	Prevents air entering
Placing Petri dish in incubator at 25 °C rather than 35 °C	
	Decreases the risk of growth of pathogens

(4 marks)

Question 1 continues on the next page

1 (b) An investigator placed paper discs containing different concentrations of an antibiotic onto a culture of bacteria in a Petri dish.

After an incubation period of two days, the dish looked like this.



NB: Not to scale

1 (b) (i) Explain why there are areas around some of the paper discs where no bacteria are growing.

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(2 marks)

1 (b) (ii) The results of the investigation are given in the table.

The table shows the concentration of the antibiotic on the paper discs and the diameter of the circles where no bacteria are growing.

Disc	Concentration of the antibiotic in units	Diameter of circle where no bacteria are growing in mm
A	0	0
B	2	8
C	4	14
D	6	26
E	10	26

Why did the investigator include Disc **A**?

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(1 mark)

1 (b) (iii) Use the table to describe the effect of an increase in the concentration of the antibiotic on the growth of the bacteria.

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(2 marks)

1 (b) (iv) The results of the investigation did **not** show the best concentration of antibiotic to kill the bacteria.

Describe how the experiment could be improved to find the best concentration.

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(2 marks)

Turn over ▶

1 (c) Scientists are concerned that many bacteria are developing resistance to antibiotics.

1 (c) (i) Name an antibiotic-resistant strain of bacterium that is causing problems in many hospitals.

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(1 mark)

1 (c) (ii) Name the process that produces an antibiotic-resistant strain of a bacterium.

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(1 mark)

1 (c) (iii) Give **one** reason why the rate of development of new antibiotic-resistant strains of bacteria has increased.

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(1 mark)

14

Turn over for the next question

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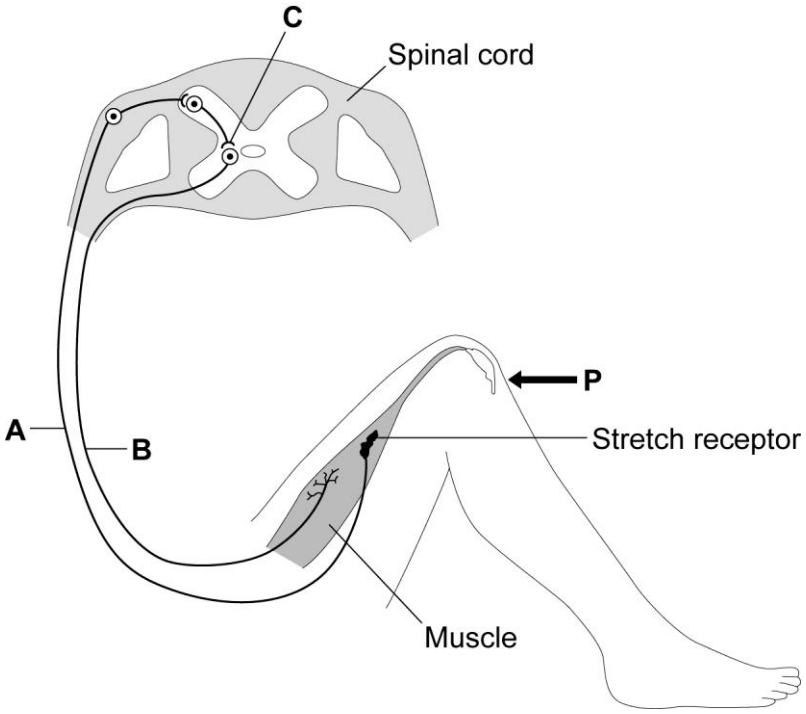
2 The diagram shows the nervous pathway that is used to coordinate the knee-jerk reflex. When the tendon below the knee is tapped with a hammer, the lower leg jerks upwards in a reflex action.



2 (a) On the diagram, draw arrows next to the neurones labelled **A** and **B** to show the direction in which an impulse moves in each neurone.

(1 mark)

2 (b) How is information passed across the synapse at **C**?

.....

(1 mark)

2 (c) On the diagram, label the effector with the letter **X**.

(1 mark)

2 (d) (i) The nerve pathway linking the stretch receptor with the muscle is about 1.5 metres in length.

A nerve impulse travels at 75 ms^{-1}.

Use this information to calculate the time interval between the stimulus and the response.

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Time interval ..... s

(2 marks)

2 (d) (ii) The actual time interval is longer than the interval you have calculated in part **(d)(i)**.

Suggest an explanation for the difference.

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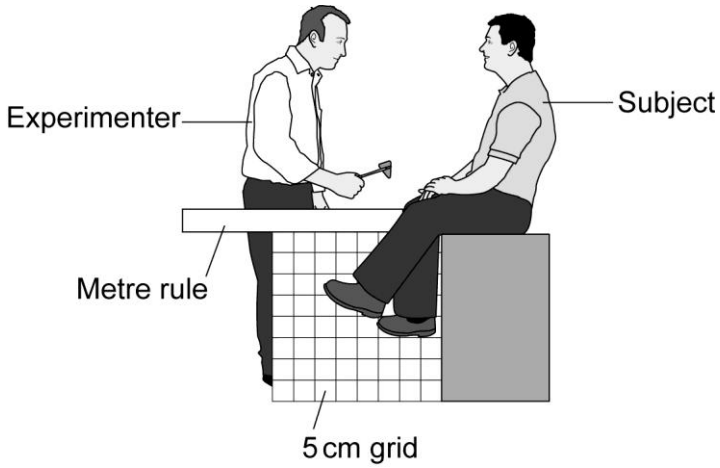
(2 marks)

Question 2 continues on the next page

2 (e) A group of students wanted to find out how the speed of the hammer affected the distance the lower leg moved.

The diagram shows how the experiment was set up.



Each trial was recorded on a video. A frame was taken every 33 milliseconds. The video was then played using single-frame advance. The number of frames for the hammer to move to the knee was found. The faster the speed, the smaller was the number of frames. The video was also used to find the distance moved by the toe.

In each trial, the experimenter held the hammer 20 cm from the subject's knee and then hit the subject's tendon. For each trial the experimenter used the hammer at a different speed.

The table shows some of the results.

Trial number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Distance hammer moved to knee in cm	20	20	20	20	20	20	20	20	20	20
Number of frames it took the hammer to move to the knee	15	14	12	10	9	8	7	6	2	2
Distance moved by toe in cm	0	0	5	5	4	10	10	10	10	10

2 (e) (i) What variable did the experimenter control in this experiment?

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(1 mark)

2 (e) (ii) Give **two** advantages of using a video to measure the time it took for the hammer to move to hit the tendon.

1 .....

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2 .....

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(2 marks)

2 (e) (iii) One of the results seems to be anomalous.

Draw a ring around the anomalous result in the table.

Suggest **one** reason why the anomalous result may have happened.

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(2 marks)

2 (e) (iv) Draw a conclusion from the results of the experiment.

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(2 marks)

2 (e) (v) Suggest **one** way in which the precision of the experiment could have been improved.

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(1 mark)

15

Turn over for the next question

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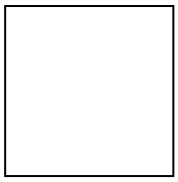
3 (a) The diagrams show apparatus you could use to mount a piece of leaf epidermis for examination under a microscope.

A

B



C

D

3 (a) (i) Name the pieces of apparatus labelled **A**, **B**, **C** and **D** on the diagram.

A .....

B .....

C .....

D .....

(4 marks)

3 (a) (ii) Describe how you would use **A**, **B**, **C** and **D** to mount a piece of leaf epidermis for examination under a microscope.

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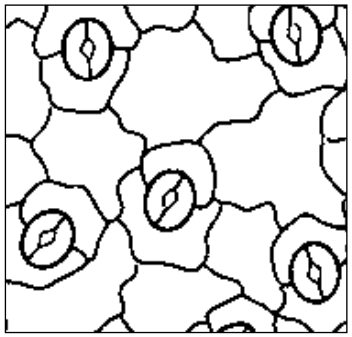
(3 marks)

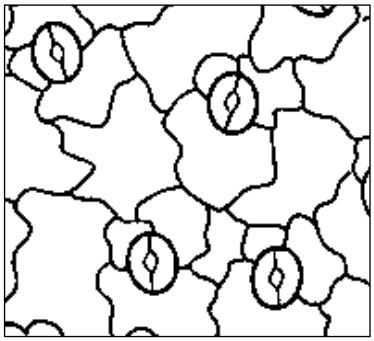
Turn over ▶

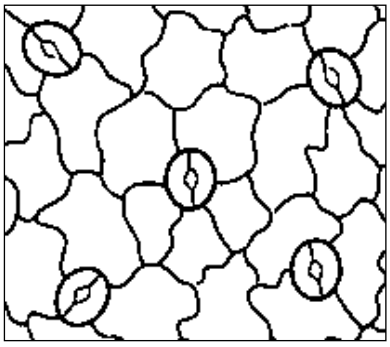
3 (b) A student used a grid on a microscope to estimate the number of stomata in some leaf epidermis.

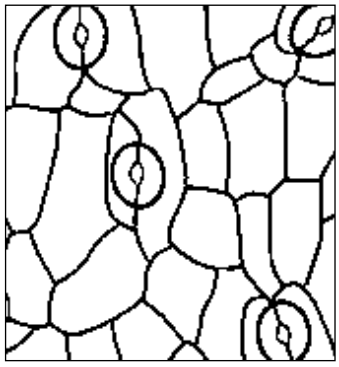
The drawings show four of the grid squares the student observed.

Each grid has an area of 0.0001 mm^2.









3 (b) (i) Calculate the mean number of stomata per grid square.

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Mean number of stomata per grid square .....

(2 marks)

3 (b) (ii) Calculate the mean number of stomata per 1 mm^2 of leaf epidermis.

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Mean number of stomata per 1 mm^2 .....

(2 marks)

3 (b) (iii) Each side of a grid square has a length of approximately 0.003 mm.

Use this information to estimate the length of a guard cell.

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Estimated length of guard cell ..... mm

(2 marks)

Question 3 continues on the next page

3 (c) A group of students looked at stomata on four different species of plant, **W**, **X**, **Y** and **Z**. The students estimated the number of stomata per cm^2 on the upper and lower surfaces of the leaves of the four species.

The results are shown in the table.

Plant species	Estimated number of stomata per cm^2 of leaf surface	
	Upper surface of leaf	Lower surface of leaf
W	4000	28 000
X	0	800
Y	8500	15 000
Z	8000	26 000

3 (c) (i) Which plant species, **W**, **X**, **Y** or **Z**, probably lives in a dry region?

Explain why you have chosen this species.

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(3 marks)

3 (c) (ii) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this feature could improve the chances of the survival for the plants.

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(2 marks)

18

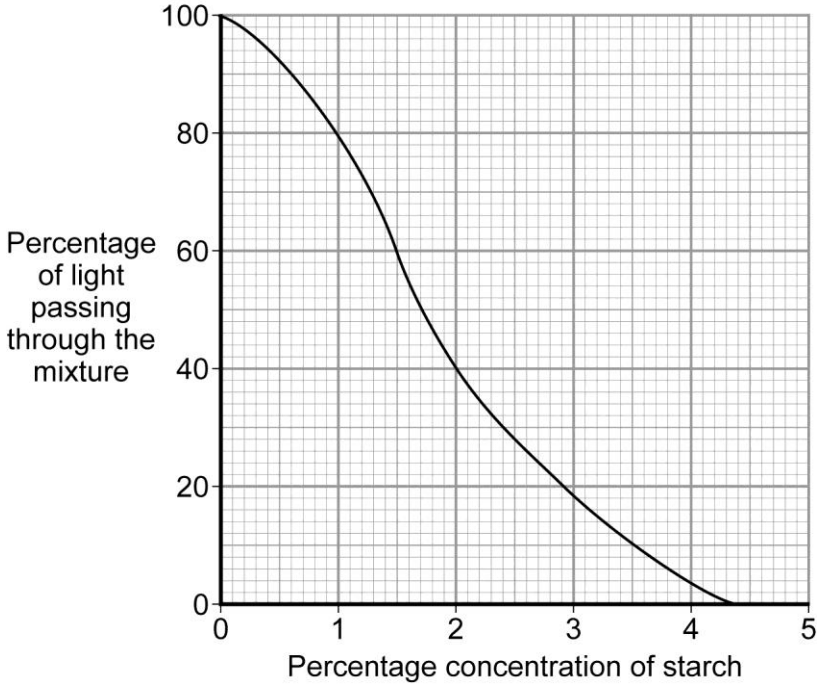
4 A manufacturer of slimming foods is investigating the effectiveness of carbohydrases from different microorganisms.

Iodine solution is a pale golden brown, transparent solution. Starch reacts with iodine to form a dark blue mixture.

Known concentrations of starch are added to iodine solution. The mixture is placed in a colorimeter, which measures the percentage of light passing through the mixture.

Graph 1 shows the results.

Graph 1



4 (a) (i) Explain why less light passes through the mixture when the starch is more concentrated.

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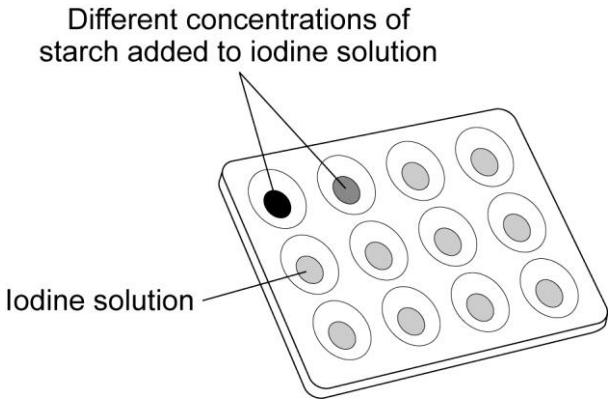
(1 mark)

Question 4 continues on the next page

Turn over ▶

4 (a) (ii) The manufacturer could have used a white spotting tile, as shown below, instead of a colorimeter. Suggest **two** advantages of using a colorimeter in this investigation rather than a spotting tile.



1 .....

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2 .....

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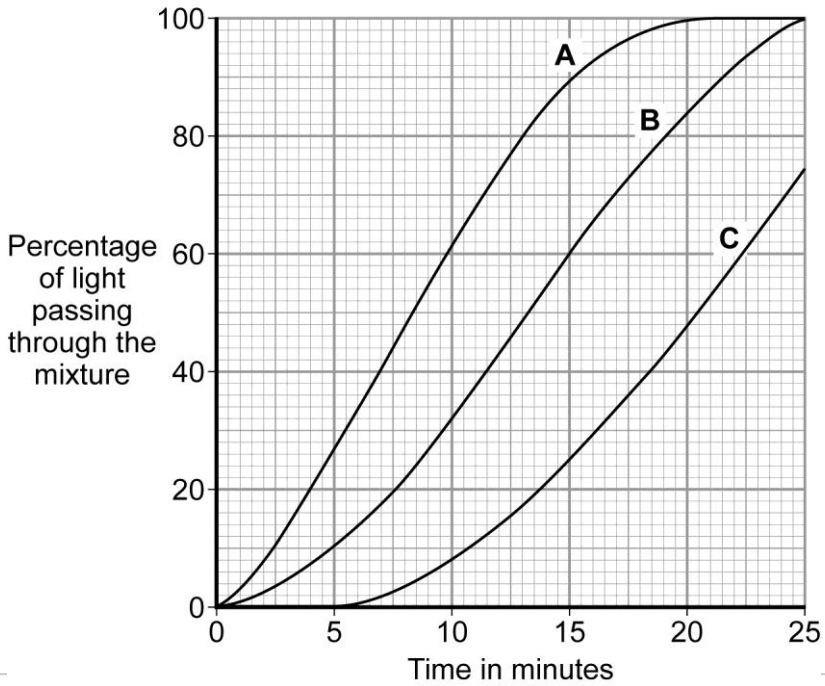
(2 marks)

4 (b) The manufacturer adds carbohydrase from each of three different microorganisms, **A**, **B** and **C**, to starch in flasks at 40 °C. Every minute a sample of the mixture is added to iodine solution and placed in the colorimeter.
Graph 2 shows these results.

Graph 2



4 (b) (i) When the concentration of starch reaches 2 %, digestion is considered to be sufficient for the next stage in the manufacture of the slimming food.

Use information from graphs **1** and **2** to find how long this takes for the most effective carbohydrase.

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..... minutes

(2 marks)

4 (b) (ii) Suggest why the amount of light passing through the mixture containing carbohydrase **A** did not change after 20 minutes.

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(1 mark)

4 (c) Explain why the manufacturer carried out the investigation at 40 °C.

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(2 marks)

4 (d) Carbohydrases convert starch into glucose. To complete the manufacture of the slimming food the glucose should be converted into fructose.

Explain why fructose, rather than glucose, is used in slimming foods.

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(2 marks)

10

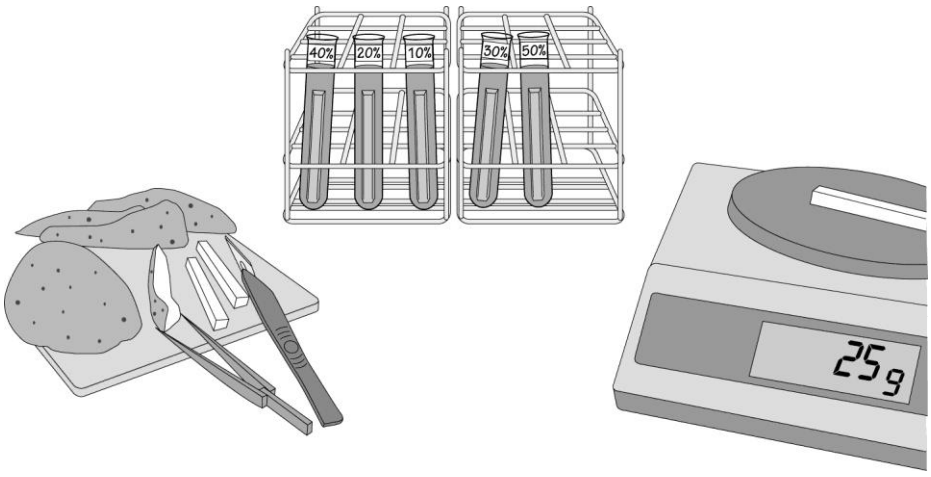
Turn over for the next question

5 In fish and chip shops, potatoes are cut into chips several hours before they are cooked.

The mass of water in the chips must be kept constant during this time.

To keep the water in the chips constant, the chips are kept in sodium chloride solution.

5 (a) The drawing shows some apparatus and materials.



In this question you will be assessed on using good English, organising information clearly and using scientific terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawing to find the concentration of sodium chloride in which to keep the chips so that the mass of water in the chips remains constant.

You should include:

- the measurements you would make
- how you would make the investigation a fair test.

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(6 marks)

Question 5 continues on the next page

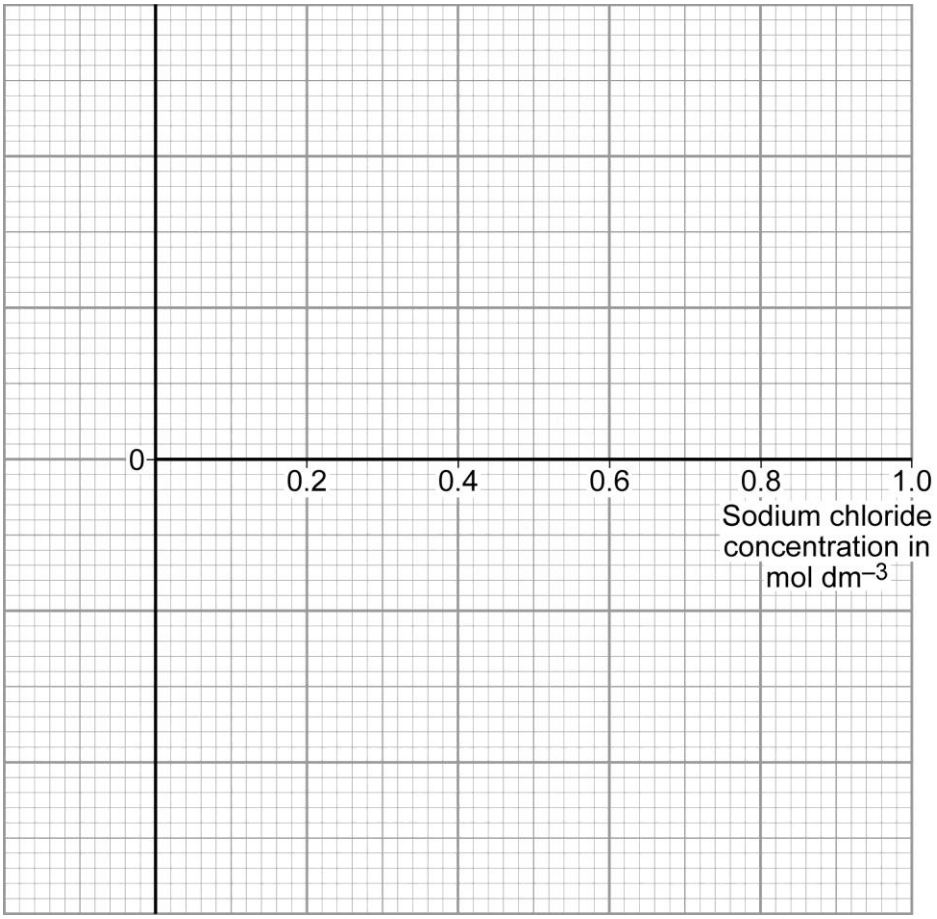
5 (b) In a similar investigation a student investigated the effect of the concentration of sodium chloride solution on standard-sized cylinders cut from a potato.

The table shows the student's results.

	Concentration of sodium chloride solution in mol dm^{-3}					
	0	0.2	0.4	0.6	0.8	1.0
Change in length of cylinders in mm	+4.1	+1.5	–1.4	–3.6	–4.6	–5.2

5 (b) (i) On the graph paper below draw a graph to display the student's results.

- Add a suitable scale and label to the *y* axis.
- Plot the student's results.
- Draw a line of best fit.



(4 marks)

5 (b) (ii) In which concentration of sodium chloride would the chips **not** change mass?

Concentration ..... mol dm^{-3}

(1 mark)

5 (b) (iii) Explain the change in length of potato cylinders that were placed in the 1 mol dm^{-3} sodium chloride solution.

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(3 marks)

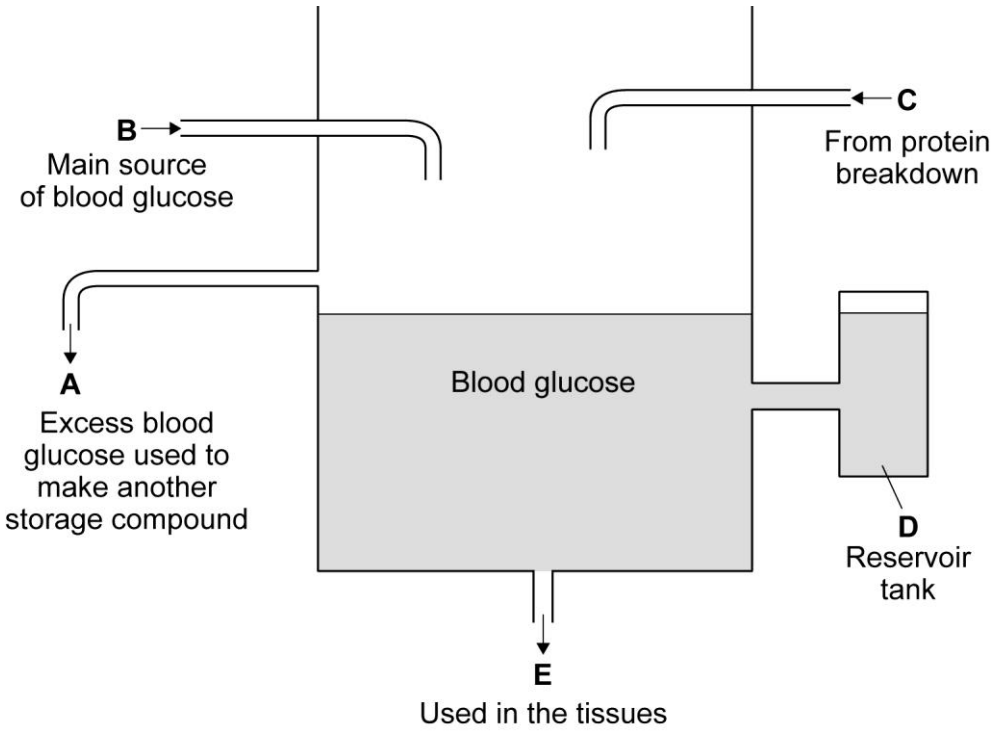
14

Turn over for the next question

6 The diagram shows a model for the control of blood glucose. The blood glucose is represented as a tank of fluid.

In this model:

- the pipes on the diagram represent 'routes' by which glucose may be added or removed
- the main source of glucose to the tank is through **B**
- a smaller amount of glucose enters through **C**, from protein breakdown
- there is an outflow from the tank to the tissues through **E**
- the reservoir tank, **D**, contains a carbohydrate that can be reconverted into blood glucose
- through **A**, any excess glucose can be used to produce another type of storage compound, which is different from the compound stored in **D**.



6 (a) What is the 'main source of blood glucose' entering through **B**?

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(1 mark)

6 (b) (i) Name the carbohydrate stored in reservoir **D**.

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(1 mark)

6 (b) (ii) Name the storage compound into which glucose is converted at **A**.

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(1 mark)

6 (c) The hormones insulin and glucagon are both involved in the regulation of blood sugar concentration.

Tick (✓) the appropriate boxes in the table that match descriptions of likely effects of the two hormones.

Effect of hormone	Insulin	Glucagon
Reduces the amount of storage carbohydrate in reservoir **D**		
Promotes the loss of blood glucose through **A**		
Increases the rate of outflow at **E**		

(3 marks)

Question 6 continues on the next page

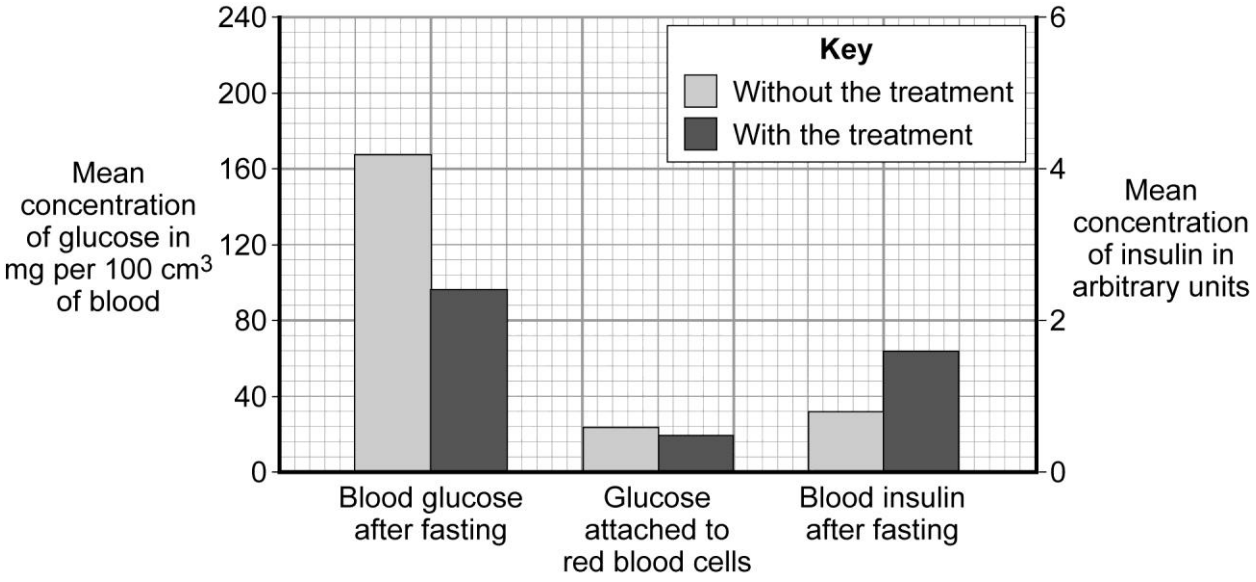
6 (d) A person with diabetes can be monitored in three ways:

- measuring the blood glucose concentration after fasting (going without food for 12 hours)
- measuring the amount of glucose attached to red blood cells: this is a measure of the average blood glucose concentration over the previous three months
- measuring the concentration of insulin in the blood after fasting.

The manufacturer of a new treatment for diabetes publishes the following claims.

98.6% of all people who used the new treatment reported an improvement in their condition.

An independent study of 30 diabetic patients showed a significant reduction in blood glucose concentrations and a significant increase in insulin production, as shown by the graph.



Evaluate the manufacturer's claims.

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(2 marks)

8

Turn over for the next question

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7 Environmental change can be measured by using invertebrate animals or by using non-living indicators.

Invertebrate animals are used to monitor pollution in streams.

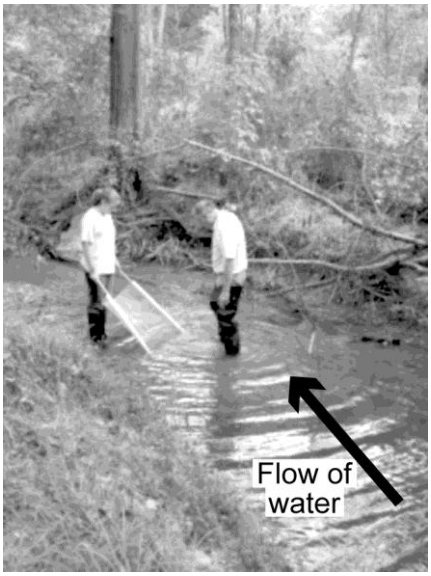
7 (a) Complete the sentence.

Invertebrate animals are used as indicators of the amount of

dissolved ..... in water.

(1 mark)

The photograph shows scientists collecting a sample of invertebrates from a stream.



This is the method that they use.

- A 1 m^2 area of the bed of the stream is marked out.
- A net 1 m wide is held by one person on the downstream side of the marked-out area.
- The other person uses their boots to gently move stones in this area of the stream bed. They do this for three minutes. This dislodges invertebrates, which are then caught in the net.
- The invertebrates are then identified and counted.

7 (b) Suggest **one** reason why the results from a sample might not be accurate.

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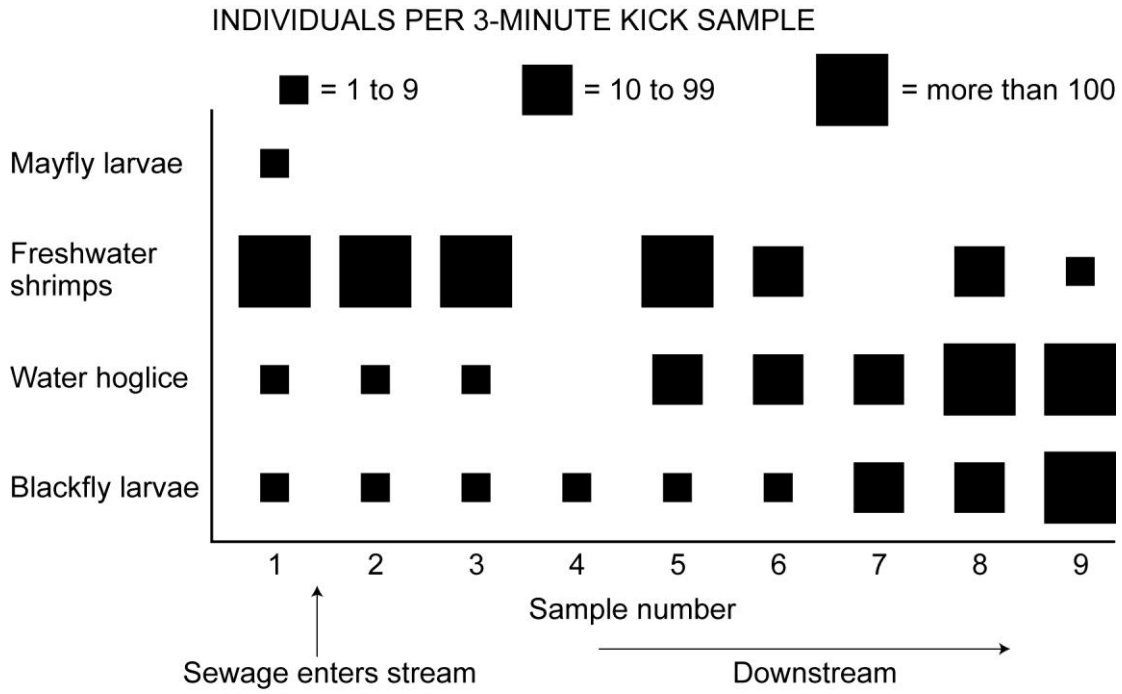
(1 mark)

7 (c) The technique described opposite was used to investigate the effect of sewage on stream invertebrates. Nine samples were taken.

- Sample 1 was taken upstream of the point where the sewage entered the stream.
- Samples 2–9 were taken at regular intervals downstream of the sewage inflow.

The chart shows the results.



Evaluate the use of the invertebrates shown in the chart as indicators of sewage pollution.

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(4 marks)

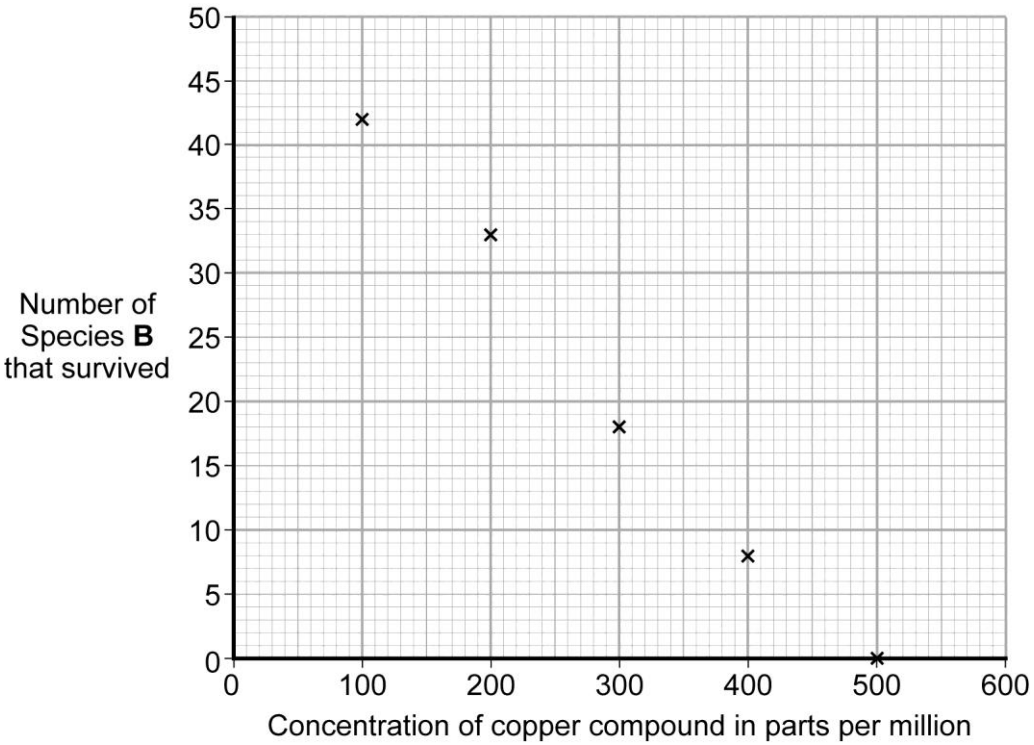
Turn over ▶

7 (d) Invertebrate animals are used to monitor the concentration of copper compounds in water. First, scientists must find out which invertebrate animals can survive in a range of concentrations of copper compounds.

This is how the procedure is carried out.

- Solutions of different concentrations of a copper compound are prepared.
- Batches of fifty of each of five different invertebrate species, **A**, **B**, **C**, **D** and **E**, are placed in separate containers of each solution.
- After a while, the number of each type of invertebrate that survive at each concentration is counted.

The graph below shows the results for species **B**.

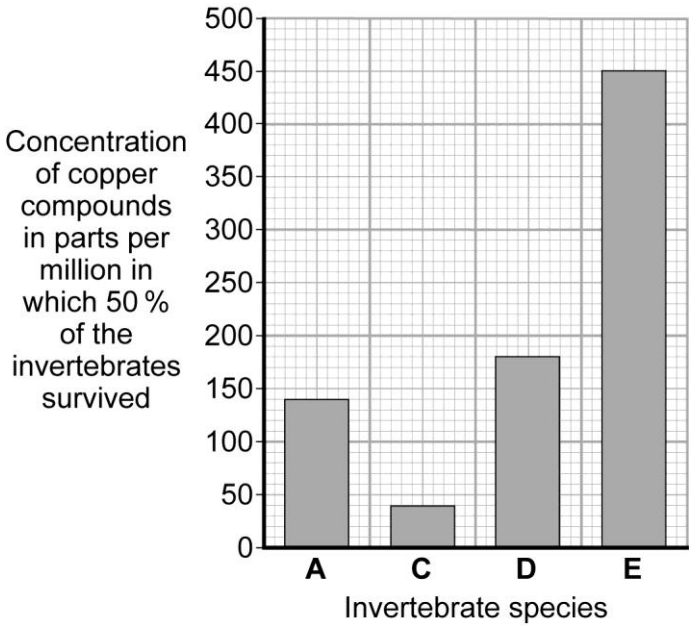


Use the graph to find the concentration of copper compounds in which 50 % of Species **B** survived.

Concentration ..... parts per million

(1 mark)

7 (e) The graph below shows the results of the tests on the other four invertebrate species.



7 (e) (i) Draw a conclusion from the results.

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(1 mark)

7 (e) (ii) Chemical tests can also be used to measure the effects of copper pollution.

Evaluate the use of invertebrates rather than chemical tests to measure copper pollution.

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(3 marks)

11

END OF QUESTIONS

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