Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Biology B

Advanced Subsidiary

Paper 2: Core Physiology and Ecology

Tuesday 6 June 2017 – Afternoon **Time: 1 hour 30 minutes**	Paper Reference **8BI0/02**

You must have: Calculator, HB pencil, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- In question(s) marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Answer ALL questions.

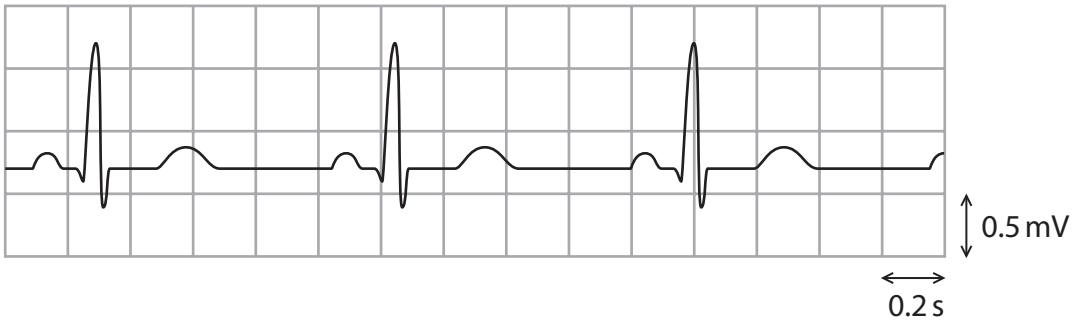
Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 A person visited his doctor for a health check.

The doctor obtained an ECG trace to show the electrical activity of the person's heart.

The diagram shows part of this trace.



(a) The trace shows the P waves, T waves and QRS complexes.

Which of the following shows the electrical activity during ventricular systole?

(1)

☒ **A** P wave only

☒ **B** P and T wave

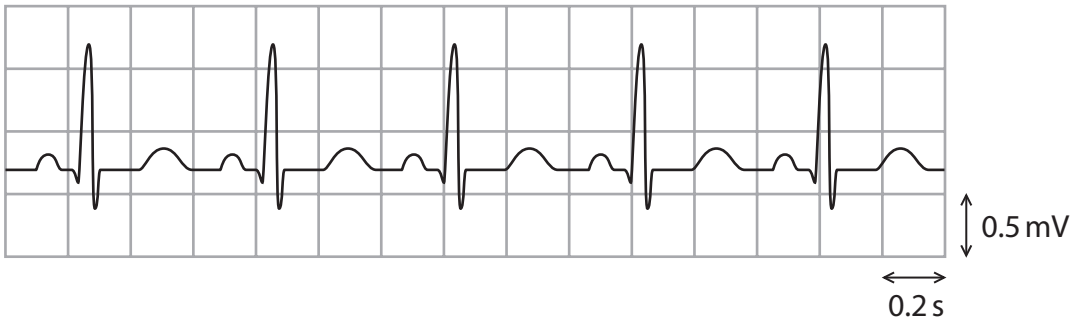
☒ **C** T wave only

☒ **D** QRS complex

(b) Twelve months later, the same person visited his doctor with symptoms of stress.

The doctor obtained another ECG trace.

The diagram shows part of this trace.



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The doctor diagnosed that the person was suffering from stress.

Analyse the data in both ECG traces to comment on this diagnosis.

(3)

(c) Stress increases blood pressure, which can damage blood vessels.

Explain why stress is a health risk.

(4)

(Total for Question 1 = 8 marks)

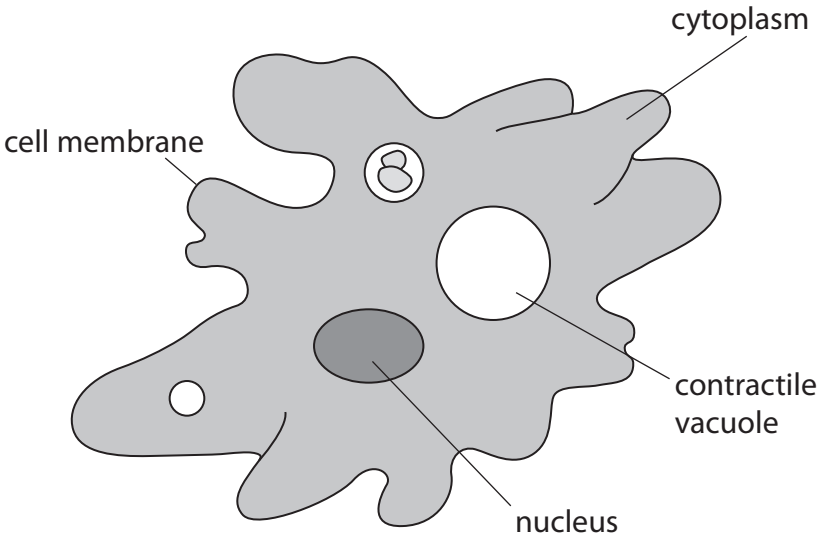
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2 *Amoeba proteus* is a single-celled organism that lives in pond water.

Amoeba has a structure called a contractile vacuole that removes excess water from the cell.

Water that moves into the cytoplasm is transported into the contractile vacuole. When full, the contractile vacuole moves to the surface of the cell and fuses with the cell membrane. This allows the water it contains to be removed from the cell.

The diagram shows *Amoeba* with a contractile vacuole.



(a) *Amoeba* belongs to the domain

(1)

☒ **A** Eukaryota

☒ **B** Bacteria

☒ **C** Archaea

☒ **D** Animalia

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(b) The actual diameter of the contractile vacuole shown in this diagram is 20 μm.

Calculate the magnification of this *Amoeba*.

(2)

Answer .....

(c) (i) The water leaves the contractile vacuole by

(1)

- ☒ **A** endocytosis
- ☒ **B** exocytosis
- ☒ **C** osmosis
- ☒ **D** facilitated diffusion

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(ii) A student investigated the effect of mineral ions in pond water on the rate at which the contractile vacuole emptied.

The student placed different specimens of *Amoeba* in different concentrations of mineral ion solution on microscope slides.

The student recorded the rate at which the contractile vacuole emptied.

The results are shown in the table.

Concentration of mineral ions / arbitrary units	Number of times contractile vacuole emptied per minute
5	14
10	6
15	5
20	3
25	2

Analyse the data to explain the change in the rate at which the contractile vacuole emptied.

(2)

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(Total for Question 2 = 6 marks)

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3 Mineral ions are transported from the soil into the cytoplasm of plant root cells.

The table shows the concentration of sodium ions and chloride ions in soil and in the cytoplasm of plant root cells.

Location	Ion concentration / mg dm^{-3}	
	Sodium	**Chloride**
soil	28	25
cytoplasm	1988	3750

(a) (i) Give the ratio of sodium ions in the soil to those in the cytoplasm.

(1)

.....

(ii) Which of the following describes how these mineral ions are transported into the cytoplasm of plant root cells?

(1)

☒ **A** active transport through carrier proteins

☒ **B** diffusion through the phospholipid bilayer

☒ **C** facilitated diffusion through the phospholipid bilayer

☒ **D** mass transport through carrier proteins

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(b) Water is also taken up by plant root cells.

(i) Which of the following describes the pathway taken by this water before entering the xylem?

(1)

☒ **A** apoplast only

☒ **B** apoplast and symplast

☒ **C** neither apoplast nor symplast

☒ **D** symplast only

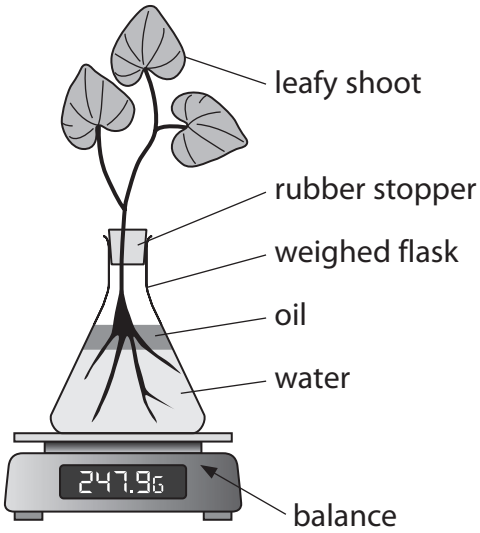
(ii) Explain how this water is transported in the xylem to the leaves.

(3)

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(c) Transpiration involves the loss of water vapour from leaves.

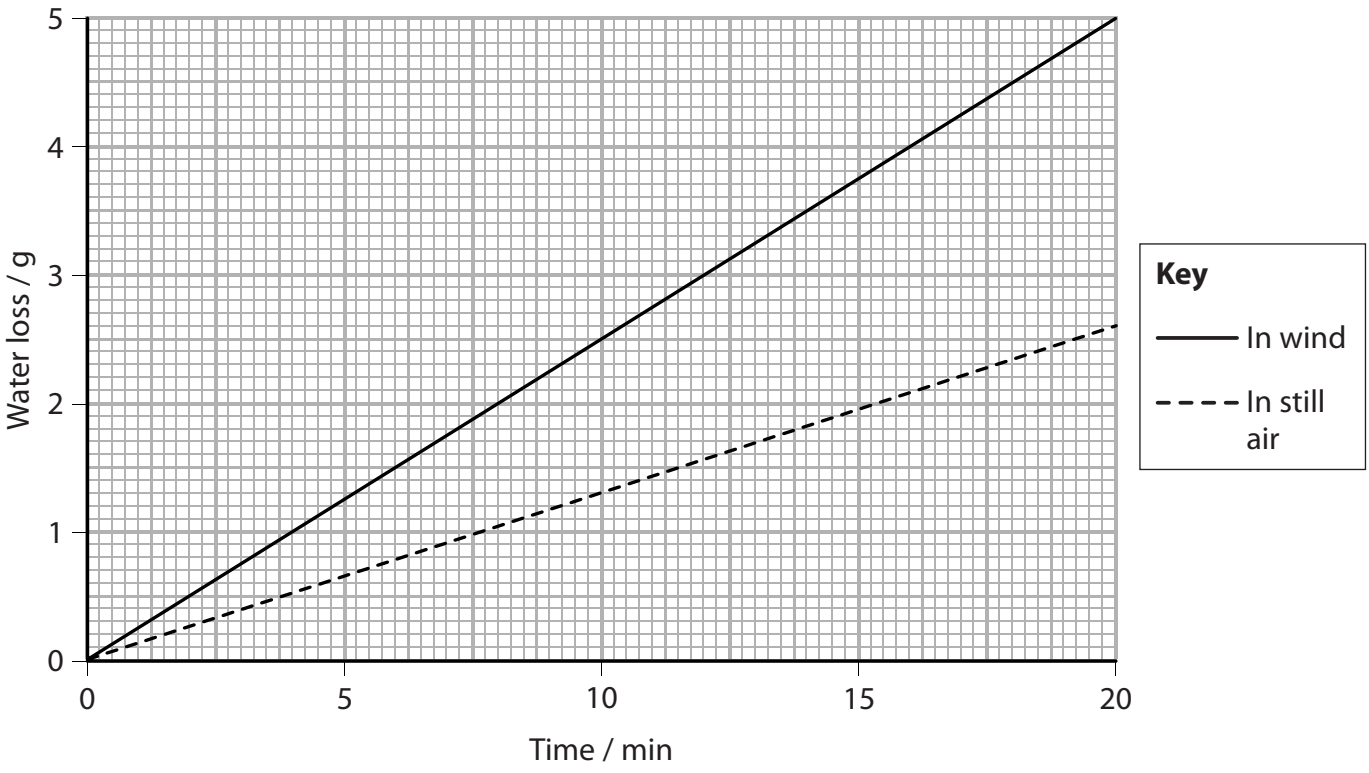
The rate of transpiration can be measured using the apparatus shown in the diagram.



A student used this apparatus to investigate how wind affected the rate of transpiration by a plant.

The mass of water lost by a plant was measured during a twenty-minute period in still air. This was repeated in wind.

The graph shows the results.



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(i) Calculate the increase in the rate of water loss caused by wind.

(2)

Answer ..... g min^{-1}

(ii) The student was told that this investigation was not valid because certain variables had not been controlled.

Explain how the student could modify this investigation to improve its validity.

(2)

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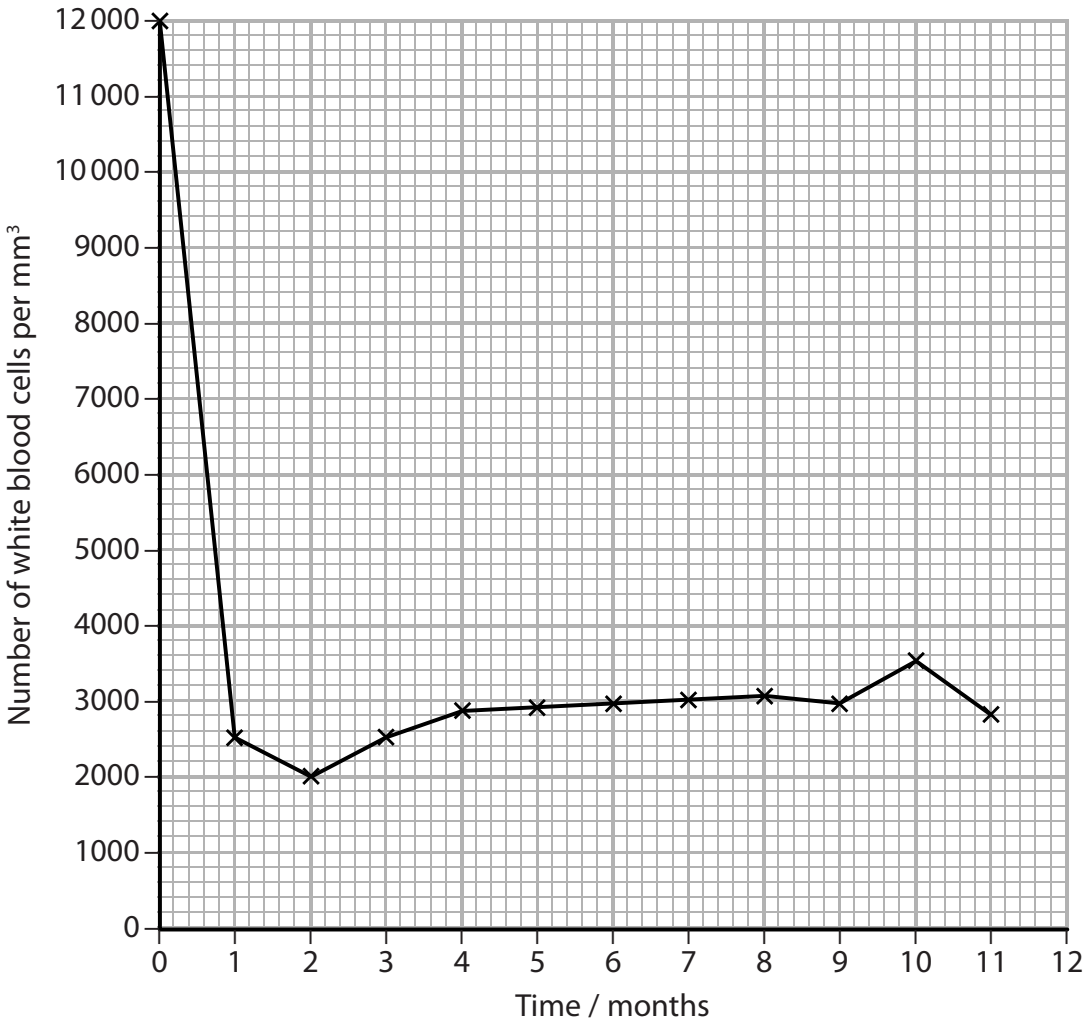
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(Total for Question 3 = 10 marks)

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4 Cancer treatment using chemotherapy can affect the number of white blood cells in the body.

The graph shows the number of white blood cells in a patient during chemotherapy.



(a) (i) Which of the following shows the white blood cell count in the blood of this patient at the start of treatment?

(1)

☒ **A** 12×10^3 per dm^3

☒ **B** 12×10^6 per dm^3

☒ **C** 12×10^9 per dm^3

☒ **D** 12×10^{12} per dm^3

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(ii) Calculate the percentage change in the white blood cell count by the end of the first month of chemotherapy.

(2)

Answer .....

(b) Cancer treatment can cause pancytopenia.

Pancytopenia is a condition in which the numbers of white blood cells, red blood cells and platelets in the body are reduced.

Explain how two of the symptoms of pancytopenia could be treated.

(4)

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(Total for Question 4 = 7 marks)

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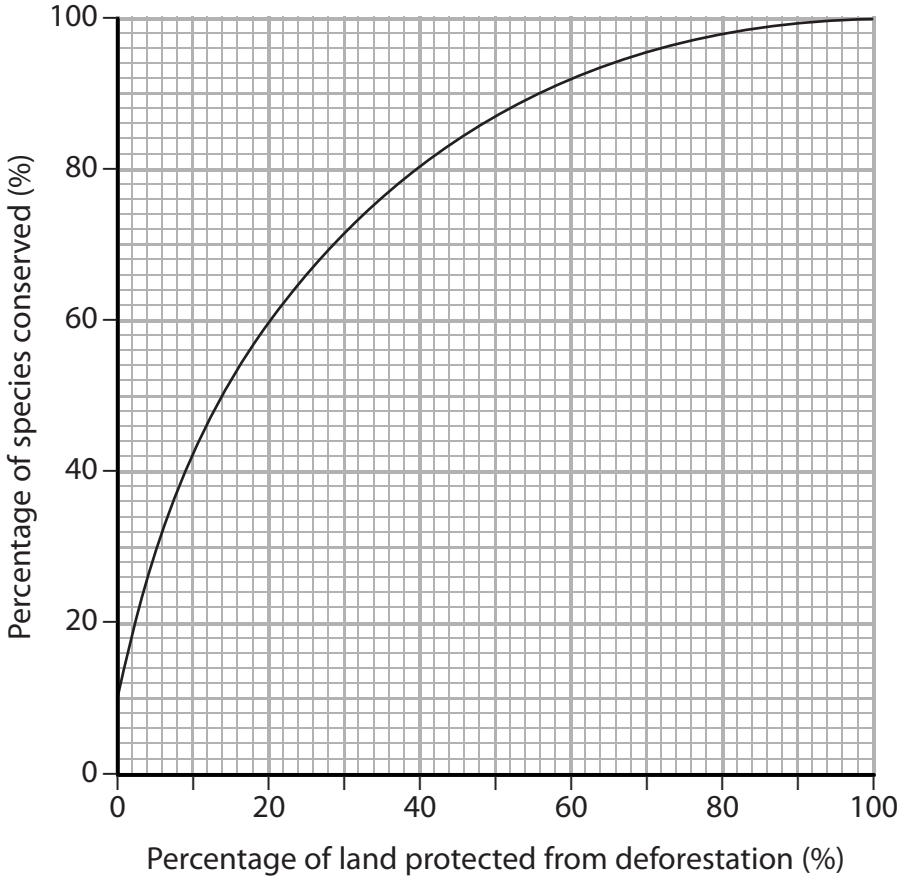
5 The World Wide Fund For Nature (WWF) is the largest conservation organisation in the world.

The WWF recently claimed that 'some 46 000 to 58 000 square miles of forest are lost each year. This is equivalent to 36 football fields every minute'.

This level of deforestation affects biodiversity.

Scientists studied the relationship between protecting land from deforestation and the percentage of species conserved.

The graph shows the results of the study.



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(a) Analyse the data in the graph to explain how protection of land affects the percentage of species conserved.

(4)

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(b) The number of species in a forest is one factor that affects biodiversity.

Some scientists use the following formula to calculate biodiversity.

$$D = \frac{N(N-1)}{\Sigma n(n-1)}$$

Describe how scientists could collect the data needed for this formula in order to calculate biodiversity.

(3)

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*(c) Some scientists state that 'all forests should be protected from deforestation'.

Evaluate this statement.

(6)

(Total for Question 5 = 13 marks)

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6 The photograph shows a species of insect, *Gryllus pennsylvannicus*.



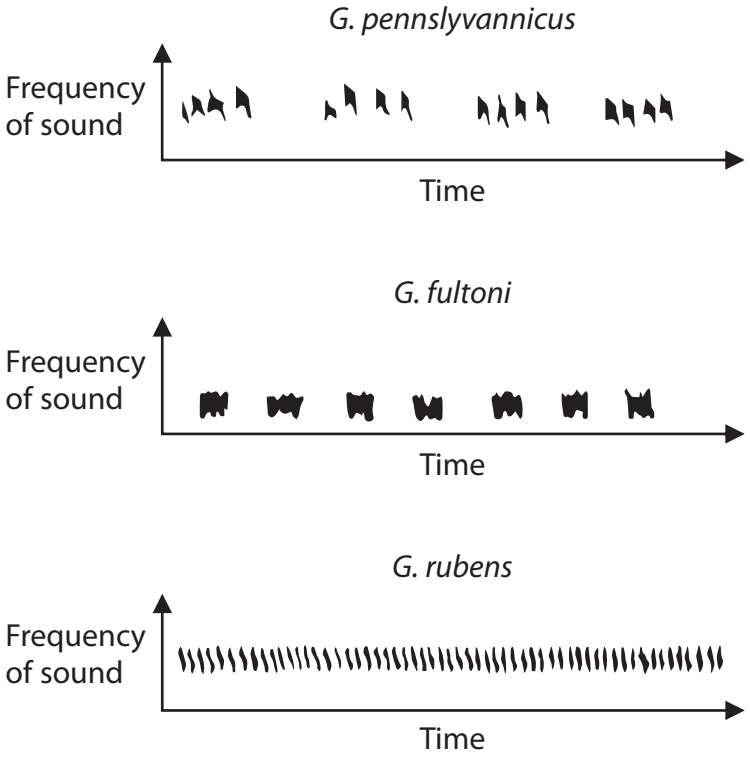
Scientists used to think that *G. pennslyvannicus* and two other species, *G. fultoni* and *G. rubens*, belonged to the same species.

The insects live in North Carolina in the USA.

Scientists have produced evidence that these insects have evolved into three distinct species from a common ancestor.

They recorded the male mating calls of each species and produced a graph representing the sound made. The graph is called a sonogram.

The diagram shows the sonogram for each species.



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(a) Explain how the insects evolved from a common ancestor into three distinct species.

(4)

(b) Explain how gel electrophoresis could be used to identify which species is most closely related to the common ancestor.

(4)

(Total for Question 6 = 8 marks)

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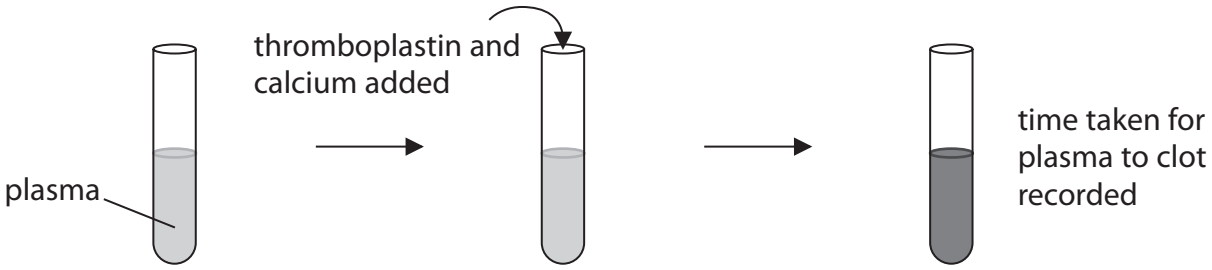
7 A farmer used anticoagulant bait to kill rats on his farm.

The anticoagulant prevents the activity of vitamin K that is needed for the synthesis of prothrombin.

The farmer's dog became ill with excessive bleeding in the gums.

A vet carried out a prothrombin test that measures the clotting time of blood plasma.

The diagram shows the test procedure with blood plasma from a healthy dog.



(a) (i) Give the reason why thromboplastin and calcium ions were added to the plasma samples.

(1)

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(ii) The clotting time for the plasma from the farmer's dog was 73 seconds. The clotting time for the plasma from the healthy dog was 12 seconds.

Explain the difference in these clotting times.

(3)

(b) Give one way in which the vet could treat the farmer's dog to reduce the symptom of excessive bleeding in the gums.

(1)

(c) The vet noticed that blood had collected in the lower part of the lungs of the farmer's dog.

Explain how this would affect the farmer's dog.

(2)

(Total for Question 7 = 7 marks)

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8 The production of tissue fluid is vital for cells in the human body.

(a) (i) Explain why the production of tissue fluid is vital for cells in the human body.

(2)

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(ii) Tissue fluid makes up 16% of the mass of a human body.

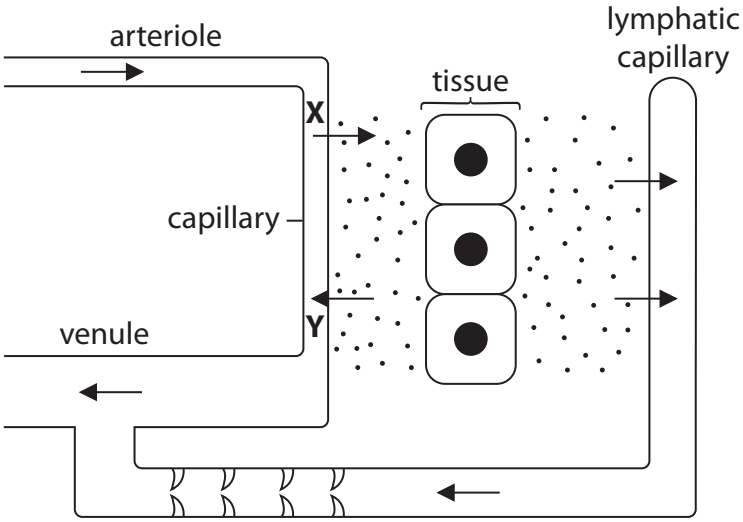
Calculate the mass of tissue fluid, in grams, that would be found in a person with a mass of 80 kg.

(2)

Answer ..... g

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(b) The diagram shows the production and circulation of tissue fluid.



(i) Which of the following describes the pressures at **X** and **Y** in the diagram?

(1)

	Blood hydrostatic pressure / kPa		Plasma oncotic pressure / kPa	
	At X	**At Y**	**At X**	**At Y**
☒ **A**	3.3	2.0	3.3	2.0
☒ **B**	3.3	3.3	4.7	2.0
☒ **C**	4.7	2.0	3.3	3.3
☒ **D**	4.7	3.3	2.0	3.3

(ii) Compare and contrast the transport of fluid in a vein with its transport in a lymph vessel.

(2)

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(c) In some parts of the world, mosquito bites can infect people with roundworms called *Wuchereria bancrofti*.

The roundworms block lymph vessels and prevent proteins in tissue fluid entering the lymph vessels.

This causes a disease called lymphatic filariasis (LF). One symptom of LF is swelling of the legs.

Which of the following explains why someone with LF has swollen legs?

(1)

☒ **A** turgor pressure in blood is higher than in tissues

☒ **B** turgor pressure in blood is lower than in tissues

☒ **C** oncotic pressure in blood is higher than in tissues

☒ **D** oncotic pressure in blood is lower than in tissues

(d) The World Health Organisation (WHO) considers LF to be a global health problem affecting over 120 million people in 73 countries.

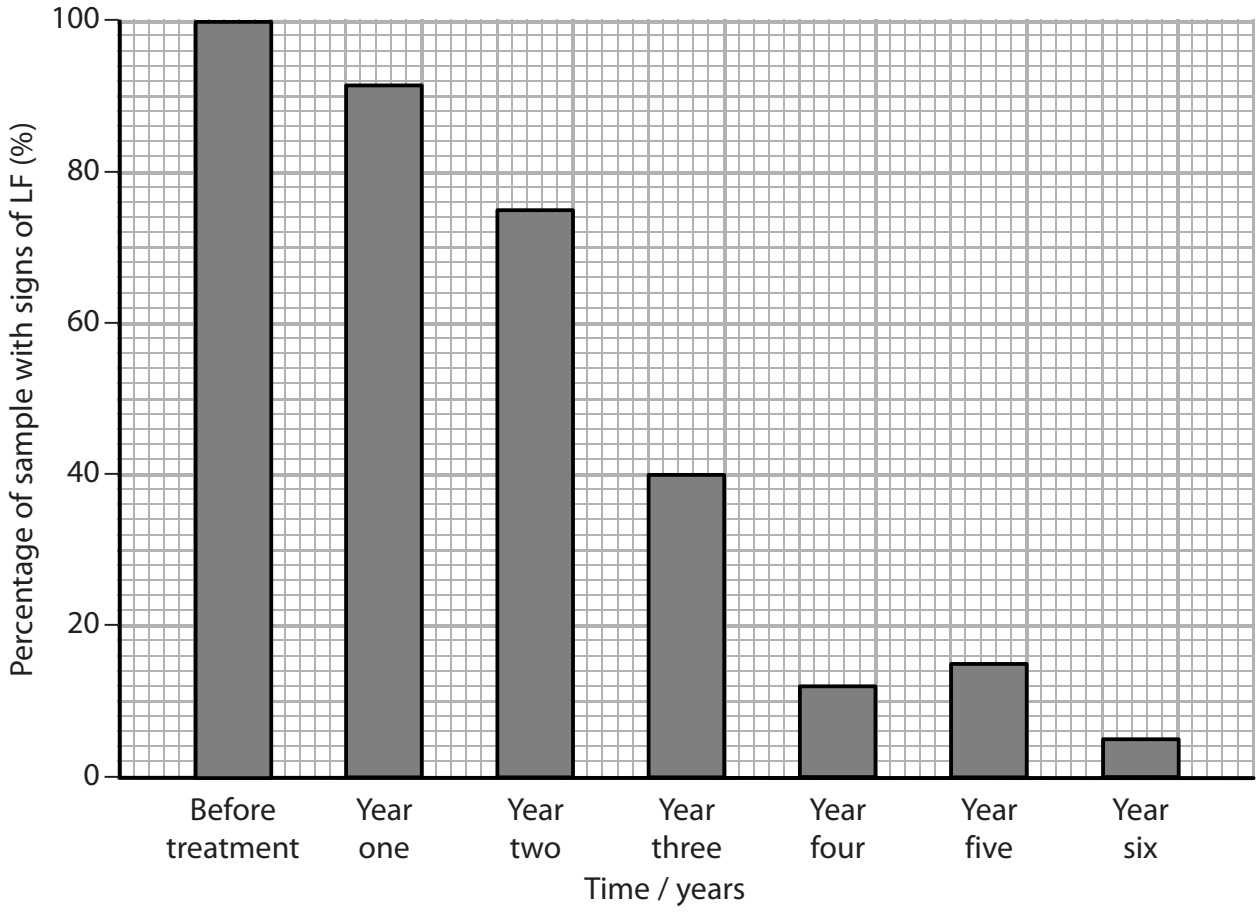
Scientists investigated whether drug treatment could protect people from LF.

All the people in one area were given drugs to kill the roundworms that cause LF.

This was done every year for six years.

Each year, a sample of five hundred people was randomly selected and tested for signs of LF.

The graph shows the results of this investigation.



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The scientists claimed that LF could be eradicated by using this drug treatment.

Analyse the data to criticise this claim.

(4)

(Total for Question 8 = 12 marks)

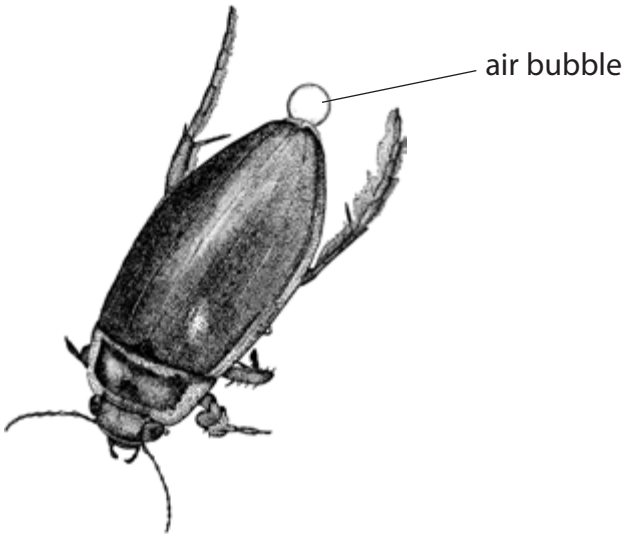
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9 The insect *Dytiscus marginalis* is a beetle that can dive underwater to feed.

Before diving underwater, the beetle traps an air bubble underneath its wings.

The air bubble is connected to its spiracles.

The diagram shows a beetle with an air bubble attached to its body.



(a) State how the oxygen in the air bubble reaches the cells in the beetle.

(1)

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(b) When the beetle is underwater, gases can enter or leave the air bubble.

These gas movements affect the size of the bubble.

When the beetle first dives, the concentration of oxygen is higher in the bubble than in the water.

Explain why these facts will affect the time the beetle can stay underwater.

(3)

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(c) Warm weather increases the temperature of the water.

This affects the time a beetle can stay underwater.

Devise an investigation to show the effect of water temperature on the time a beetle can stay underwater.

(5)

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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