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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Tuesday 14 January 2020

Afternoon (Time: 1 hour 15 minutes) | Paper Reference **4BI1/2B**

Biology

Unit: 4BI1

Paper: 2B

You must have:
Calculator, 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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- 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 ☒.

Information

- The total mark for this paper is 70.
- 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.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Badgers and bovine tuberculosis

The bacterium *Mycobacterium bovis* causes the lung disease bovine tuberculosis (TB) in cattle. Infected cattle have damaged lungs, which causes gas exchange problems and makes them cough into the air. The pathogen spreads to humans if they inhale air containing the bacterium. Humans also become infected if they drink unpasteurised milk from infected cattle. Milk is usually pasteurised by heating it for a period of time at a high temperature.

Bovine TB can kill humans. In one year, 13 400 people died from a total of 149 000 reported cases of TB. Some of these cases were from Europe, where 103 people died from 1290 reported cases. The rest of the cases were from outside Europe.

Some farmers in the United Kingdom are concerned that badgers spread the TB pathogen to cattle.

The photograph shows a badger.



Badgers act as a reservoir for the TB pathogen and can live for several years without showing any signs of TB. Some farmers want badgers to be culled (killed) to stop the spread of bovine TB to cattle.

However, some scientists claim that only a fraction of cattle catch TB from badgers, and that culling badgers could spread the disease to new areas. This is because badger culling changes the behaviour of the badgers that survive. Normally, badgers live in social groups and will defend their territory from other badgers by being aggressive. This territorial behaviour reduces the spread of disease between groups. If badgers are culled, then their territories cannot be defended. Surviving badgers could move in to occupy the undefended territory, bringing TB with them. This could spread TB to new animals and new areas.

Some people believe that badgers should be vaccinated to stop the spread of TB. However, there is some concern that vaccination may increase the spread of TB because it might also change badger behaviour.

An investigation is needed to find out if badger vaccination can reduce TB both in badgers and in cattle.

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(a) Explain why cattle with damaged lungs have gas exchange problems (lines 2 to 3).

(2)

(b) Explain the advantage of drinking pasteurised milk rather than unpasteurised milk (lines 4 to 5).

(2)

(c) Suggest two reasons why there were fewer cases of bovine TB in Europe compared with outside Europe (lines 7 to 9).

(2)

1

2

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(d) The case to death ratio in Europe is 12.5 : 1 (lines 7 to 9).

Calculate the case to death ratio from outside Europe.

(2)

case to death ratio = ...

(e) Territorial behaviour reduces the spread of disease between badger groups (lines 19 to 20).

Suggest two other ways that badgers benefit from territorial behaviour.

(2)

1 .....

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2 .....

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(f) Explain how vaccination reduces the risk of infection in badgers (line 24).

(3)

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(g) Describe how scientists could find out if badger vaccination reduces TB in cattle (lines 27 to 28).

(3)

(Total for Question 1 = 16 marks)

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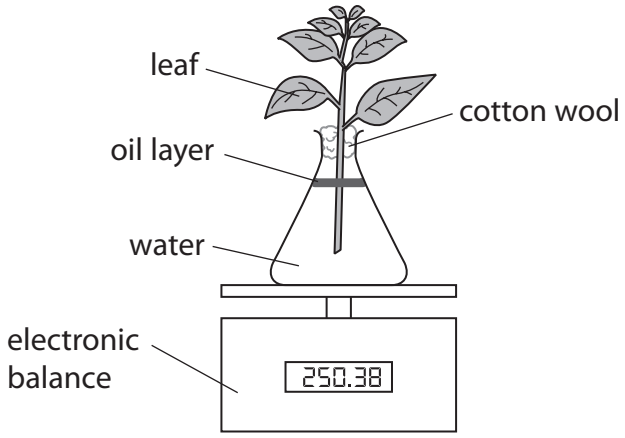
2 Transpiration is the evaporation of water from the surface of a plant.

(a) Explain why transpiration is useful for plants.

(2)

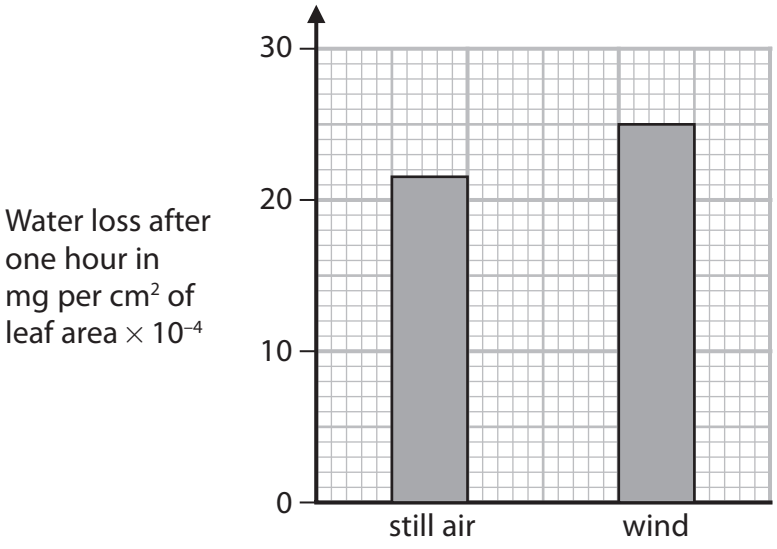
(b) A student uses this apparatus to measure the rate of transpiration in still air and the rate of transpiration in windy conditions.



The student calculates the total loss of water after one hour in mg per cm^2 of leaf area $\times 10^{-4}$ for the plant in still air.

He then repeats this calculation for the plant in windy conditions.

The graph shows the student's results.



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(i) The total leaf surface area from which transpiration occurs is 250 cm^2.

Calculate the loss of water from this plant in still air in mg per hour.

(2)

loss of water = ... mg per hour

(ii) Explain the results shown by the graph.

(3)

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(c) Justify two factors that the student needs to control to make a valid comparison of transpiration in still air and in windy conditions.

(4)

1 .....

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2 .....

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(Total for Question 2 = 11 marks)

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3 The human heart pumps blood when its muscle tissue contracts.

Diagram 1 shows a human heart and a cross-section through its ventricles.

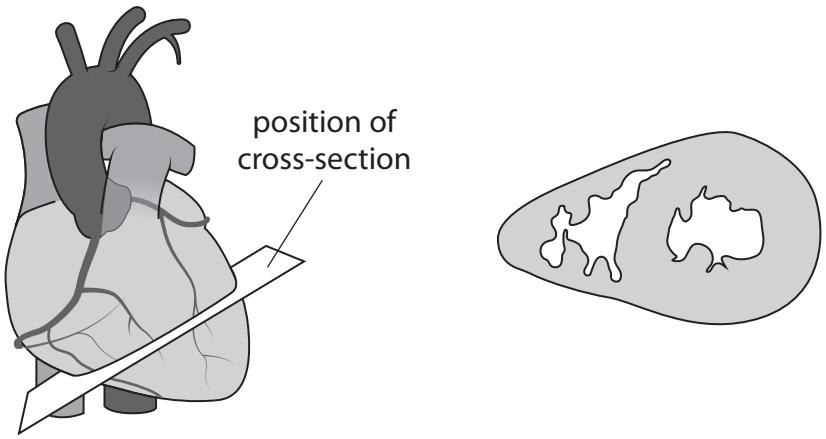

Diagram 1

(a) Which of these statements about the ventricles is correct?

(1)

☒ **A** the left ventricle wall is thick because it has to pump blood to the body

☒ **B** the left ventricle wall is thin because it has to pump blood to the lungs

☒ **C** the right ventricle wall is thin because it has to pump blood to the body

☒ **D** the right ventricle wall is thick because it has to pump blood to the lungs

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(b) Ventricle muscle tissue is damaged if the blood supply is reduced.

Diagram 2 shows the damaged part of a human heart and a cross-section through its ventricles.

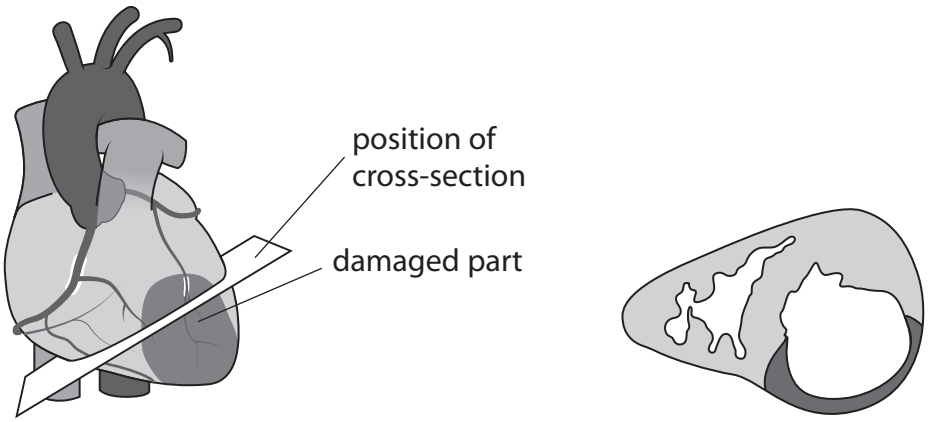

Diagram 2

Explain the cause of the change in the appearance of the muscle tissue in diagram 2.

(3)

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(c) Scientists are investigating the use of stem cells to repair damaged hearts.

The stem cells are injected into the ventricle muscle tissue.

(i) Explain why stem cells could repair a damaged heart.

(2)

(ii) The stem cells are obtained from the person who has the damaged heart.

Explain why using stem cells from the same person is better than using stem cells from a different person.

(2)

(Total for Question 3 = 8 marks)

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4 DNA and RNA are involved in the processes of transcription and translation.

(a) State three ways in which the structure of a DNA molecule differs from the structure of an RNA molecule.

(3)

1 .....

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2 .....

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3 .....

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(b) Describe the differences between the processes of transcription and translation.

(5)

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(c) The DNA molecule codes for the amino acids used to make proteins.

There are four different bases in DNA and 20 amino acids used to make proteins.

Use this information to show that a minimum of three bases on the DNA molecule is needed to code for each amino acid.

(3)

(Total for Question 4 = 11 marks)

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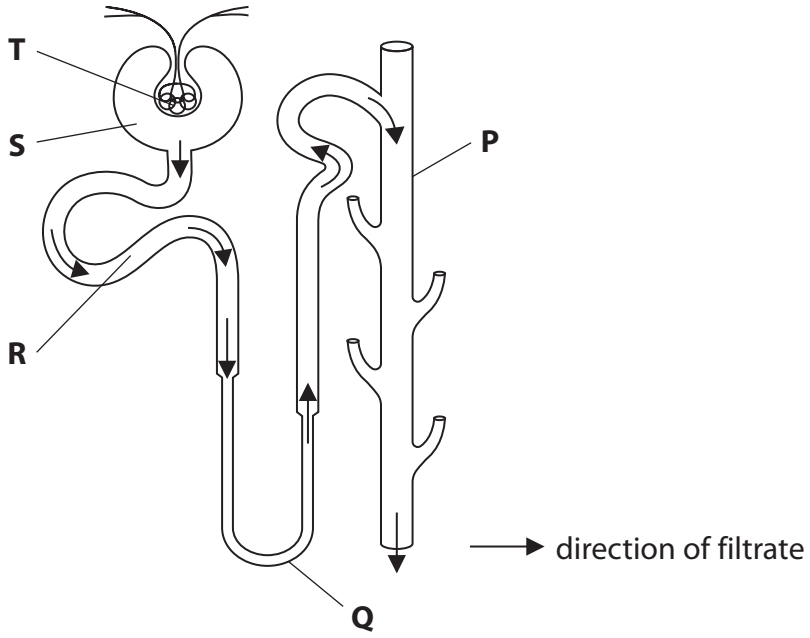
5 The diagram shows part of a human nephron, with parts labelled P, Q, R, S and T.



(a) (i) What is the name of part P?

(1)

- ☒ **A** collecting duct
- ☒ **B** glomerulus
- ☒ **C** proximal convoluted tubule
- ☒ **D** renal artery

(ii) Where does ultrafiltration occur?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** T

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(iii) Where is permeability affected by ADH?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(iv) Where is glucose selectively reabsorbed into the blood?

(1)

☒ **A** Q

☒ **B** R

☒ **C** S

☒ **D** T

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(b) Scientists investigate the relationship between birth mass and the number of nephrons in the kidney.

The scatter diagram shows their results.



(i) Describe the relationship shown by the scatter diagram.

(2)

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(ii) Babies born with low birth mass are more likely to develop high blood pressure when they become adults.

Explain why protein in the urine of these adults may be an indication of kidney damage caused by high blood pressure.

(4)

(iii) Describe a simple test to show that a urine sample contains protein.

(2)

(Total for Question 5 = 12 marks)

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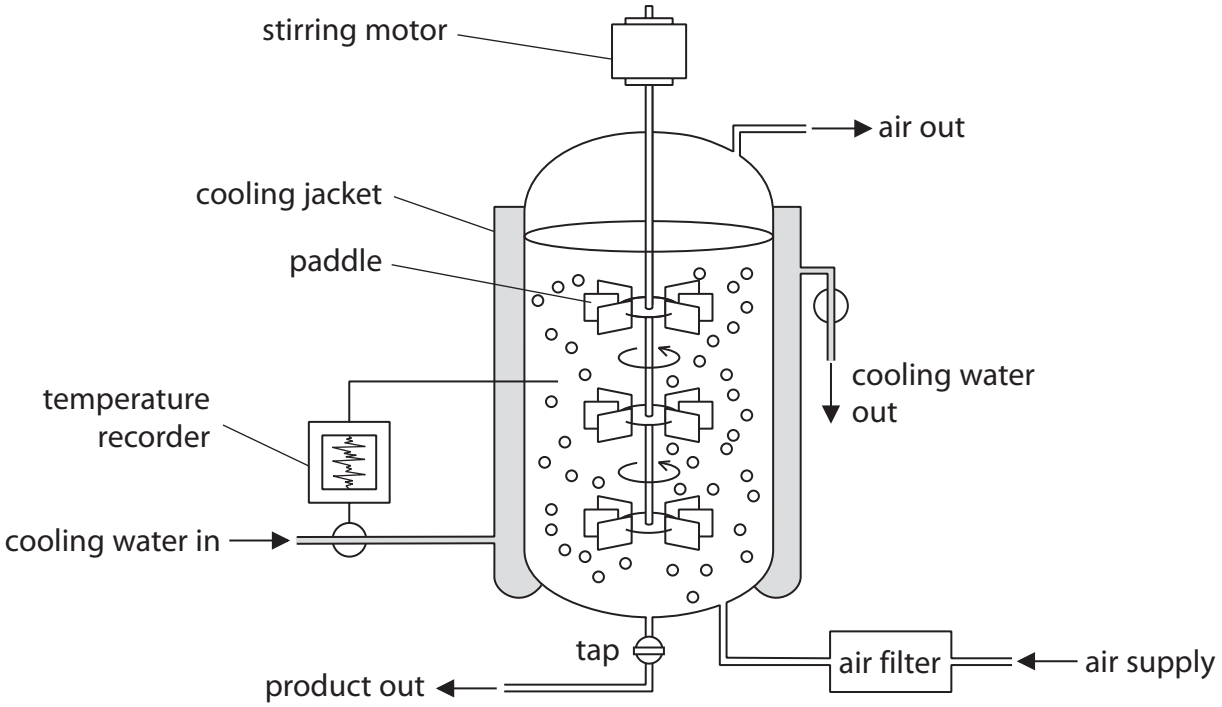
6 The diagram shows a fermenter used to grow microorganisms.



(a) Describe the functions of the paddles in the fermenter.

(2)

(b) Explain why the fermenter has a filtered air supply.

(2)

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(c) Explain why the temperature recorder is connected to the liquid in the fermenter and the water input of the cooling jacket.

(2)

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(Total for Question 6 = 6 marks)

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7 Some mice have yellow hair and some mice have brown hair.

The gene for hair colour in mice has two alleles. The dominant allele is H and the recessive allele is h.

A scientist crosses a yellow-haired male mouse with a yellow-haired female mouse.

He predicts a 3 : 1 ratio of yellow to brown mice in the offspring.

(a) Give the genotype of the yellow parent mice that would produce this 3 : 1 ratio.

(1)

.....

(b) The scientist then crosses three other pairs of male and female yellow mice.

The table shows his results.

	Number of offspring	
	yellow	**brown**
Cross one	7	3
Cross two	8	4
Cross three	6	3

Calculate the ratio of the total number of yellow to brown mice for these crosses.

(1)

ratio = ...

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(c) Suggest reasons why the predicted ratio of 3 : 1 is not obtained.

(4)

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 70 MARKS

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