Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel GCE

Thursday 23 May 2024

Morning (Time: 1 hour 30 minutes)

Paper reference **8BI0/02**

Biology B

Advanced Subsidiary

PAPER 2: Core Physiology and Ecology

You must have:
Scientific 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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

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.*
- 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 from each other where appropriate.

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.

Turn over ▶

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P 7 4 4 7 5 A 0 1 2 8

Pearson

Answer ALL questions.

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 problem that has developed in recent years is the emergence of bacteria that are resistant to some antibiotics.

(a) (i) Which of the following will lead to fewer resistant bacteria?

(1)

☒ **A** antibiotics being given to farm animals to prevent disease

☒ **B** doctors only prescribing antibiotics that are effective against the pathogen

☒ **C** doctors only prescribing antibiotics for viral infections

☒ **D** patients stopping taking the antibiotics when they feel better

(ii) Which of the following would cause an increase in resistant bacteria?

(1)

☒ **A** antibiotic use leads to increased competition between bacteria

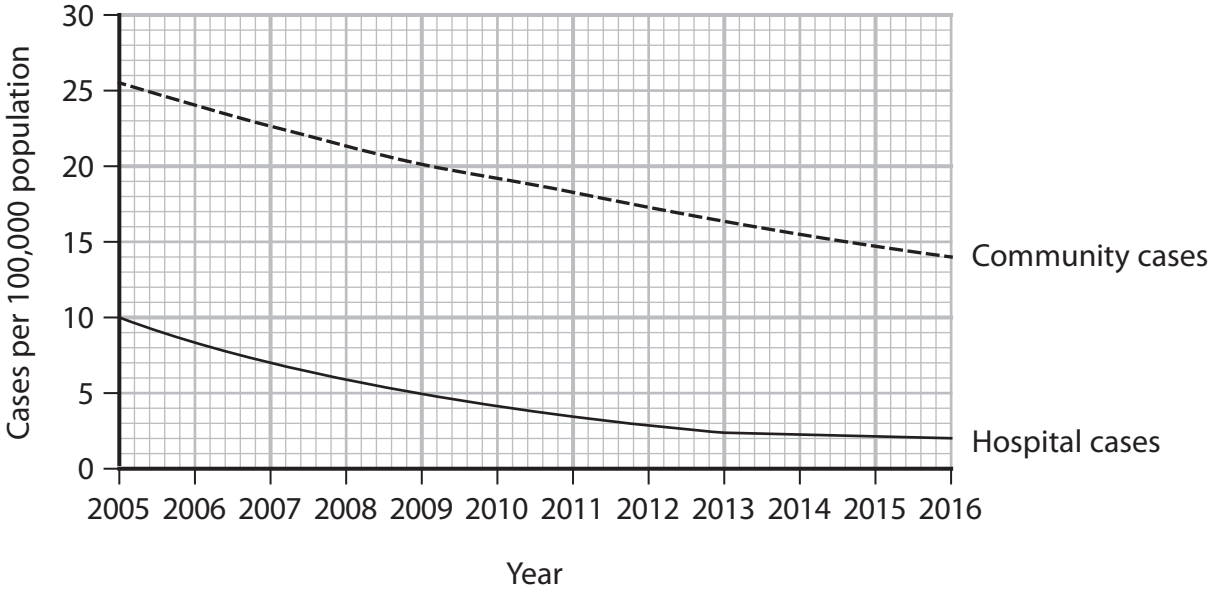
☒ **B** the antibiotic reducing the frequency of mutations in the bacteria

☒ **C** the resistant bacteria being killed by the antibiotic

☒ **D** the resistant bacteria surviving the antibiotic

(b) The bacteria referred to as MRSA are resistant to many antibiotics.

The graph shows the number of cases of MRSA in several US states from 2005 to 2016.



(i) Explain why the number of hospital cases of MRSA is lower than the number of community cases of MRSA.

(2)

(ii) Explain the changes in hospital cases and community cases from 2012 to 2016.

(2)

(c) Describe how DNA sequencing of pathogens may help doctors to prescribe antibiotics more effectively.

(2)

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(Total for Question 1 = 8 marks)

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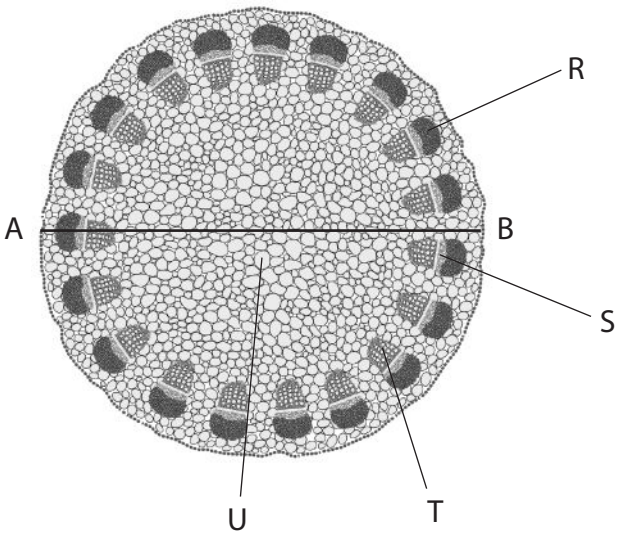
2 (a) The photograph shows a section through a plant stem as seen using a light microscope.



(Source: © Aldona Griskeviciene/Shutterstock)

(i) Which structure is the xylem?

(1)

- ☒ **A** R
- ☒ **B** S
- ☒ **C** T
- ☒ **D** U

(ii) The actual diameter of the stem section A to B is 12 mm.

Calculate the magnification of the photograph.

(2)

Answer .....

(b) (i) Which **one** of the following is a function of the xylem vessels in a plant?

(1)

- ☒ **A** transport of amino acids from leaves to growing regions
- ☒ **B** transport of mineral ions from roots to growing regions
- ☒ **C** transport of sucrose from leaves to growing regions
- ☒ **D** transport of water from leaves to stem

(ii) Which **one** of the following describes transport in the phloem?

(1)

- ☒ **A** the movement of substances is downwards only
- ☒ **B** the movement of substances is a passive process
- ☒ **C** the movement of substances is upwards only
- ☒ **D** the movement of substances is upwards and downwards

(c) Xylem and phloem are involved in the transport of substances in plants.

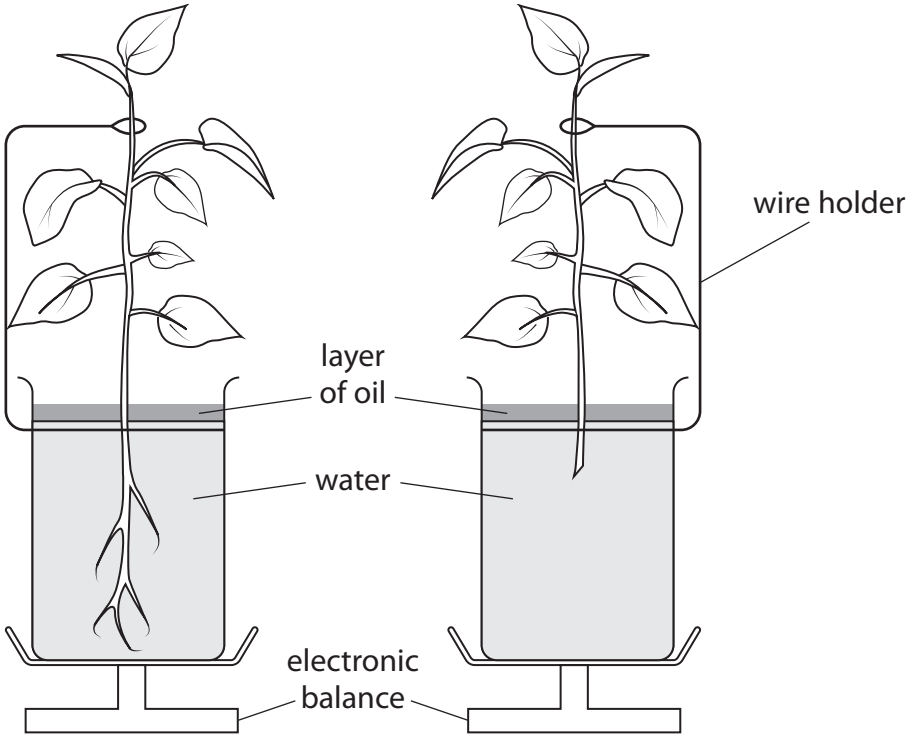
Compare and contrast the structure of xylem and phloem tissues.

(4)

(Total for Question 2 = 9 marks)

3 A student investigated the rate of water loss by a seedling.

The diagram shows the apparatus used in this investigation.



The student recorded the mass of each apparatus every 10 minutes for three hours.

(a) (i) State the hypothesis being tested by the investigation.

(1)

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(ii) Explain **one** feature of the plants that should be controlled in this investigation.

(2)

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(iii) State the function of the layer of oil in this apparatus.

(1)

(b) The student assumed that the rate of water loss is equal to the rate of water uptake.

Explain why these two rates could be different.

(2)

(c) Describe how this investigation could be modified to determine the effect of humidity on the rate of water uptake by seedlings.

(4)

(Total for Question 3 = 10 marks)

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4 Biodiversity can be measured within a habitat and within a species.

Students measured out a small area within woodland A. They then identified and counted the number of species present and the numbers of individuals of the different species in that area.

The table shows the results for woodland A.

Species	Number of individuals of each species
Woodrush	4
Holly	8
Bramble	1
Sedge	3
Ivy	4

(a) Calculate the index of diversity (D) for woodland A.

Use the formula:

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

where N = total number of organisms of all species
and n = total number of organisms of a particular species.

(3)

Answer .....

(b) The students then collected data from the same sized area in woodland B.

The table shows the results for woodland B.

Species	Number of each species
Woodrush	0
Holly	10
Bramble	4
Sedge	0
Ivy	4

The index of diversity (D) for woodland B was found to be lower than for woodland A.

Comment on the biodiversity of each woodland.

(3)

(c) Describe how the students could modify their procedure to obtain a valid comparison of the diversity of each woodland.

(2)

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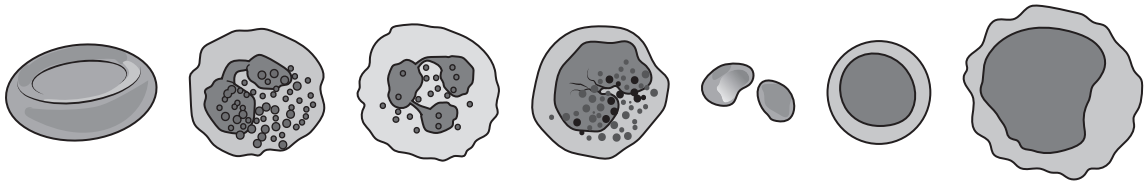
(Total for Question 4 = 8 marks)

5 Blood cells carry out a wide variety of roles in the body.

The diagram shows some of the components present in a sample of blood.



P Q R S T U V

(a) (i) Which of these components is involved in blood clotting?

(1)

☒ **A** Q

☒ **B** R

☒ **C** S

☒ **D** T

(ii) Which of these pairs of components is involved in the immune response?

(1)

☒ **A** P and Q

☒ **B** S and T

☒ **C** T and U

☒ **D** U and V

(iii) Which of these components is a lymphocyte?

(1)

☒ **A** P

☒ **B** R

☒ **C** T

☒ **D** U

*(b) The relative number of each type of blood cell can be used to diagnose blood conditions.

Tables 1 and 2 show data for the blood conditions, A, B, C and D.

The tables also show the normal number of blood cells.

Table 1

Condition	Number of lymphocytes per dm^3
A	below 1.5×10^9
Normal range	1.5×10^9 to 4.5×10^9
B	above 4.8×10^9

Table 2

Condition	Number of neutrophils per dm^3
C	below 1.0×10^9
Normal range	2.0×10^9 to 7.5×10^9
D	above 8.0×10^9

Table 3 gives some of the possible symptoms and medical advice for patients with each condition.

Table 3

Condition	Possible symptoms	Medical advice
A	infections that do not get better	have a seasonal flu vaccine avoid uncooked foods
B	swelling of lymph nodes	if condition persists check for no underlying condition such as leukaemia
C	increased susceptibility to infection in severe cases, bacteria that are normally present in the mouth can cause serious infections	cancer treatments such as chemotherapy often cause this condition
D	can occur as a normal response to infection	if condition persists check for no underlying condition such as leukaemia

Analyse the data in Tables 1, 2 and 3 to explain the consequences for patients with these conditions.

(6)

(Total for Question 5 = 9 marks)

6 (a) A species may be defined as a group of organisms with similar characteristics that interbreed to produce fertile offspring.

Explain the limitations of this definition.

(3)

(b) The evolutionary relationship between species can be determined using gel electrophoresis.

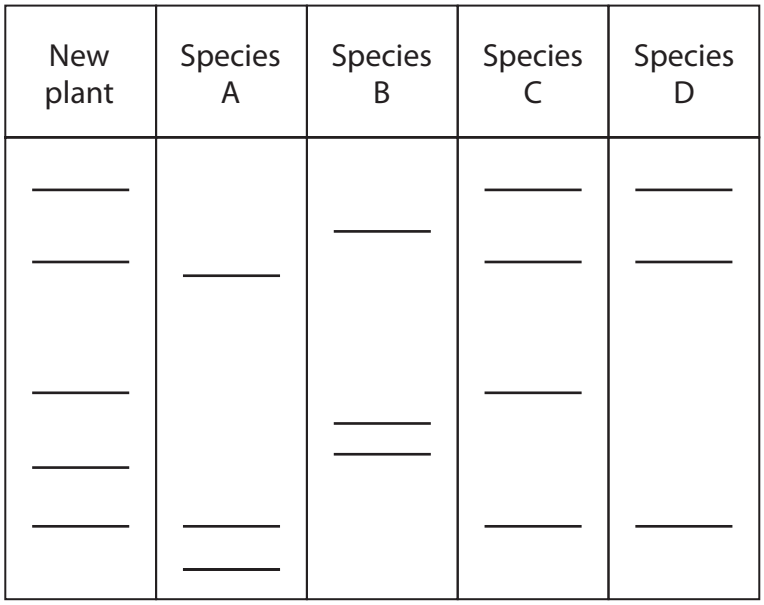
Which of the following describes the movement of DNA fragments in gel electrophoresis?

(1)

- ☒ **A** all fragments travel the same distance
- ☒ **B** larger fragments travel faster than smaller fragments
- ☒ **C** larger fragments travel further than smaller fragments
- ☒ **D** smaller fragments travel further than larger fragments

(c) Scientists discovered a new plant. They wanted to determine if this plant was a new species related to one or more of four known plant species.

The diagram shows the results of gel electrophoresis of DNA samples from the new plant and the four known plant species, A, B, C and D.



(i) Analyse the data to assess whether the new plant is a new species.

(4)

(ii) Describe **two** other pieces of information the scientists could use to confirm if the new plant is a new species.

(2)

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(Total for Question 6 = 10 marks)

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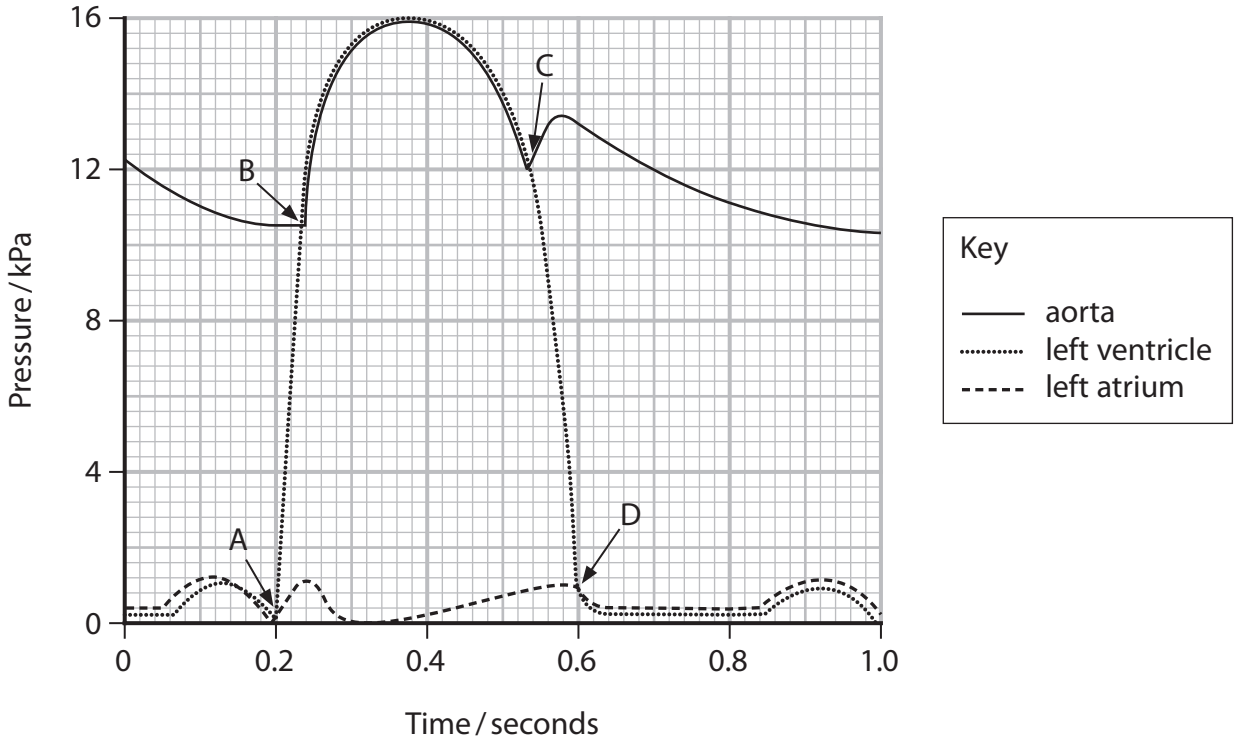
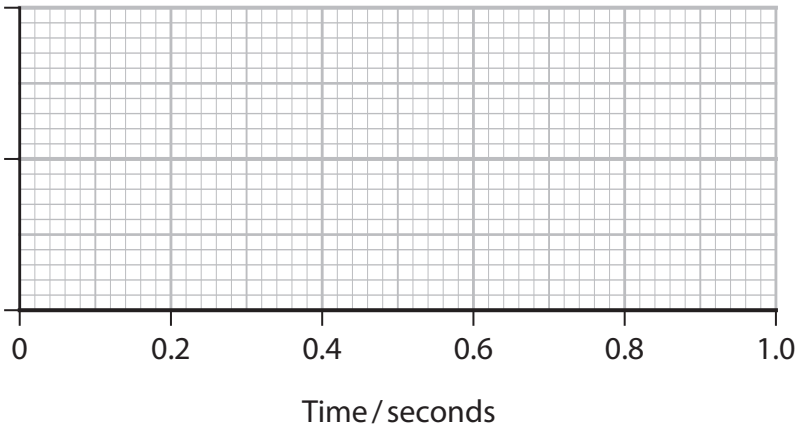
7 The graph shows the pressure changes in the left side of the heart and in the aorta during the cardiac cycle.





(a) (i) Draw, on the blank grid, an ECG recording for this cardiac cycle and label the parts P, Q, R, S and T.

(2)

(ii) Determine how many cardiac cycles there are in one minute, using the graph.

(1)

Answer .....

(b) Explain what is happening at each point, labelled A, B, C and D, on the graph.

(4)

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(c) Describe the myogenic stimulation of the heart.

(4)

(Total for Question 7 = 11 marks)

8 (a) Describe **three** named methods of passive transport by which substances can enter or leave a cell.

(3)

(b) The properties of cell membranes were investigated using samples of tissue from a beetroot.

The following method was used.

Step 1 Equal sized discs of beetroot were cut, washed, and placed in a boiling tube containing 10 cm^3 of ethanol with a concentration of 20%.

Step 2 The boiling tube was placed in a water bath at 20 °C for 30 minutes.

Step 3 The discs of beetroot were then removed from the boiling tube.

Step 4 A colorimeter was then used to measure the absorbance of the liquid in the boiling tube.

Steps 1 to **4** were repeated using ethanol concentrations of 10%, 30%, 40%, 50%, 60% and 0% using distilled water.

Each ethanol concentration was tested 6 times.

The boiling tubes contained a red pigment that had leaked out of the beetroot discs.

The darker the red colour of the liquid in the boiling tube, the higher the absorbance.

The table shows the results of this investigation.

Concentration of ethanol (%)	Absorbance / a.u.							
	1	2	3	4	5	6	Mean	Standard deviation
0 (distilled water)	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.01
10	0.04	0.02	0.02	0.02	0.03	0.03	0.03	0.01
20	0.06	0.07	0.08	0.11	0.10	0.09	0.09	0.02
30	0.10	0.12	0.12	0.11	0.12	0.13	0.12	0.01
40	0.15	0.14	0.16	0.12	0.15	0.16	0.15	0.02
50	0.19	0.21	0.22	0.18	0.22	0.21	0.21	0.02
60	0.70	0.53	0.64	0.58	0.65	0.78	0.65	

(i) State why the discs were washed in **Step 1**.

(1)

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(ii) Explain the purpose of **Step 2**.

(2)

(iii) Calculate the standard deviation (s) for the results at 60% ethanol.

Give your answer to **two** decimal places.

(3)

Use the formula:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Answer .....

(iv) State which ethanol concentration shows the lowest range of absorbance.

(1)

(v) Explain why standard deviation is a better measure of variation than range.

(2)

(vi) Explain the effect of increasing ethanol concentration on membrane permeability.

(3)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS