Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel GCE

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 on 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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Q:1/1/1/

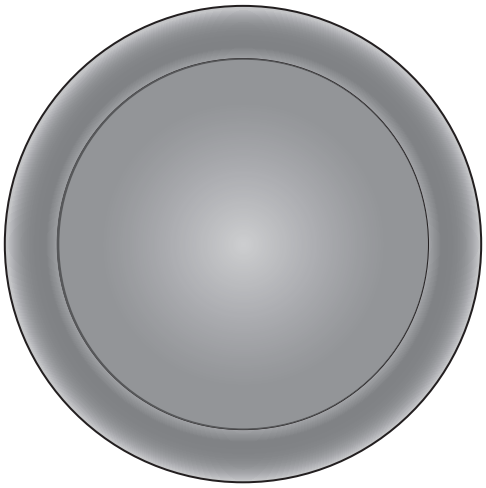
P 6 9 4 9 7 A 0 1 3 2

Pearson

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 The diagram shows a magnified human red blood cell.



(a) The actual diameter of this cell is 7.20 μm.

Calculate the magnification of this diagram.

(2)

Answer .....

(b) A regular sphere with a diameter of 7.20 μm has a surface area of 162.86 μm^2.

(i) Calculate the volume of a sphere with a diameter of 7.20 μm.

Use the formula $V = \frac{4}{3} \pi r^3$

(2)

Answer ..... μm^3

(ii) Explain how a red blood cell with the same diameter as this sphere enables it to carry out its functions in transporting gases in the blood.

(3)

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(Total for Question 1 = 7 marks)

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2 The biodiversity of habitats can be measured by recording the species present.

(a) Describe **two** reasons why biodiversity of habitats should be maintained.

(2)

1 .....

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2 .....

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(b) A student investigated the plant species growing in a sand dune habitat.

Plants were identified and counted in two regions, A and B, of the sand dune.

The results for region A are shown in Table 1.

Species	Number of individual plants
sea holly	8
sand couch	10
sea bindweed	2
sand dropwort	3
prickly parsnip	7

Table 1

The index of diversity (D) was calculated from the data.

This gave a value of 4.44.

The results for region B are shown in Table 2.

Species	Number of individual plants
sea holly	6
sand couch	7
sea bindweed	5
sand dropwort	8
prickly parsnip	4

Table 2

(i) Calculate the index of diversity (D) for region B using the formula

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

(3)

Answer .....

(ii) Comment on the diversity of each region.

(3)

(Total for Question 2 = 8 marks)

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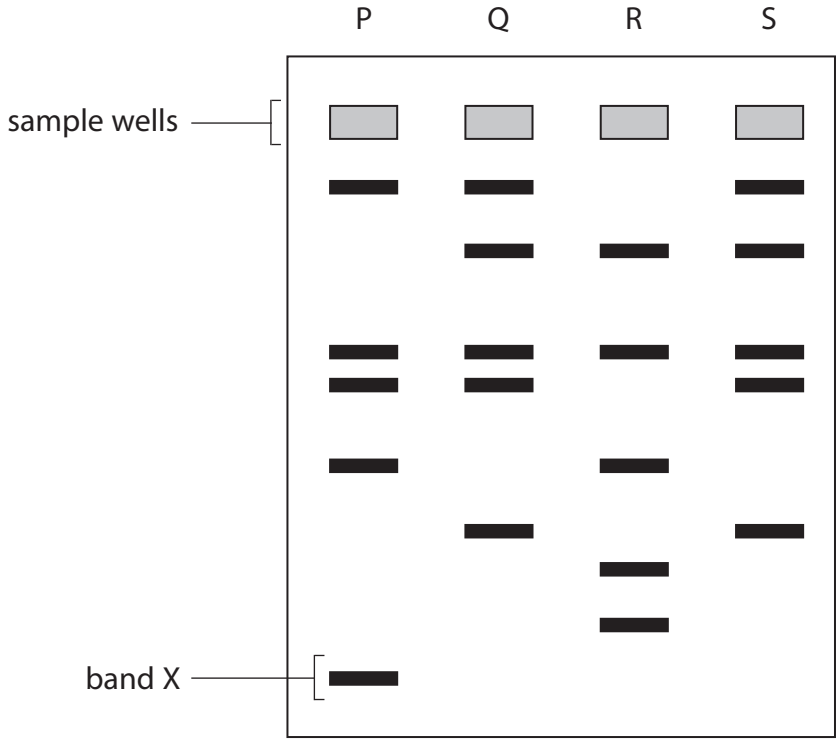
3 Gel electrophoresis is a method used to analyse DNA fragments from different organisms.

(a) The diagram shows the results of gel electrophoresis of DNA samples from four organisms: P, Q, R and S.



What is shown by the band labelled X?

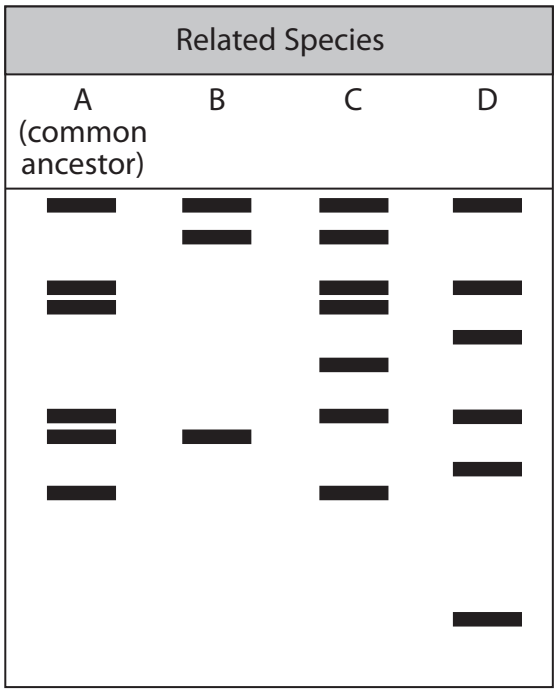
(1)

- ☒ **A** largest fragment of DNA that travelled the fastest
- ☒ **B** largest fragment of DNA that travelled the slowest
- ☒ **C** smallest fragment of DNA that travelled the fastest
- ☒ **D** smallest fragment of DNA that travelled the slowest

(b) Gel electrophoresis of DNA can be used to study the evolutionary relationships between species.

Scientists used gel electrophoresis to examine the relationship between four species: A, B, C and D.

The diagram shows the results.



Explain which species is most closely related to the common ancestor using these results.

(3)

(c) Describe evidence, other than the gel electrophoresis of DNA, that a scientist could use to establish the evolutionary relationships between species.

(4)

(Total for Question 3 = 8 marks)

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4 Passive smoking is the inhalation of tobacco smoke from another person's cigarettes.

A study was conducted into the effect of passive smoking on the development of babies, during pregnancy, in women who do not smoke.

The study compared the condition of new-born babies from women who had been exposed to passive smoking with babies from women who had not been exposed to passive smoking. All babies were assessed on:

- birth weight
- length
- head circumference
- apgar score after 1 minute
- apgar score after 5 minutes.

Apgar scores are a measure of the baby's condition at 1 minute and 5 minutes after birth. The measure covers appearance, pulse, grimace (reflex), activity and respiration.

Scores of 7 or higher are considered normal.

The results of the study are shown in the table.

	Group			
	Exposed to passive smoking number of mothers = 1085		**Not exposed to passive smoking** number of mothers = 2341	
Measure	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Birth weight / kg	3.15	0.46	3.21	0.46
Baby's length / cm	49.62	3.09	49.87	2.48
Head circumference / cm	34.05	1.59	34.14	1.73
Apgar score at 1 min	7.73	0.86	7.75	0.82
Apgar score at 5 min	8.92	0.64	8.91	0.66

(a) Explain why all the women chosen for the study were non-smokers.

(2)

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*(b) Cigarette smoke contains the gas carbon monoxide.

The affinity of haemoglobin for carbon monoxide is 200 times greater than its affinity for oxygen.

When carbon monoxide binds to a haemoglobin molecule, this increases its affinity for oxygen.

This causes the dissociation curve to shift to the left.

Analyse the data to evaluate the effect of passive smoking on the development of babies.

(6)

(Total for Question 4 = 8 marks)

5 Substances can move into or out of cells by a variety of methods.

(a) (i) A small ion is in high concentration outside a cell.

By which method is the ion most likely to enter the cell?

(1)

☒ **A** active transport

☒ **B** diffusion

☒ **C** facilitated diffusion

☒ **D** osmosis

(ii) Which of the following are required for active transport?

(1)

1 ATP

2 carrier proteins

3 cell membrane

☒ **A** 1 only

☒ **B** 1 and 2 only

☒ **C** 1 and 3 only

☒ **D** 1, 2 and 3

(iii) Which is a description of exocytosis?

(1)

☒ **A** a form of active transport in which large particles move into cells

☒ **B** a form of active transport in which large particles move out of cells

☒ **C** a form of passive transport in which large particles move into cells

☒ **D** a form of passive transport in which large particles move out of cells

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

The following procedure was used:

- equal sized discs of beetroot were cut, washed and placed in boiling tubes containing 5 cm^3 of distilled water
- one of these boiling tubes was placed in a water bath at 20 °C for 30 minutes
- the discs of beetroot were then removed from the boiling tube
- a colorimeter was then used to measure the absorbance of the liquid in the boiling tube
- this was repeated using water baths at 30 °C, 40 °C, 50 °C, 60 °C and using an ice bath at 5 °C
- each temperature was tested 8 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 results of this investigation are shown in the table.

Temperature / °C	Absorbance / a.u.									
	1	2	3	4	5	6	7	8	Mean	Standard deviation
5	0.02	0.03	0.04	0.02	0.04	0.03	0.02	0.01	0.03	0.01
20	0.10	0.08	0.05	0.10	0.07	0.09	0.06	0.07	0.08	
30	0.12	0.09	0.07	0.10	0.08	0.07	0.09	0.10	0.09	0.02
40	0.09	0.10	0.12	0.09	0.12	0.13	0.11	0.09	0.11	0.02
50	0.12	0.17	0.14	0.15	0.20	0.23	0.18	0.19	0.17	0.04
60	0.85	0.97	1.03	0.89	1.10	0.89	0.92	0.87	0.94	0.09

(i) Explain which temperature above 30 °C shows the most variation in absorbance.

(2)

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(ii) Calculate the standard deviation for the results at 20 °C.

Use the formula

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

(3)

Answer .....

(iii) Explain the effect of increasing temperature on membrane permeability.

(3)

(Total for Question 5 =11 marks)

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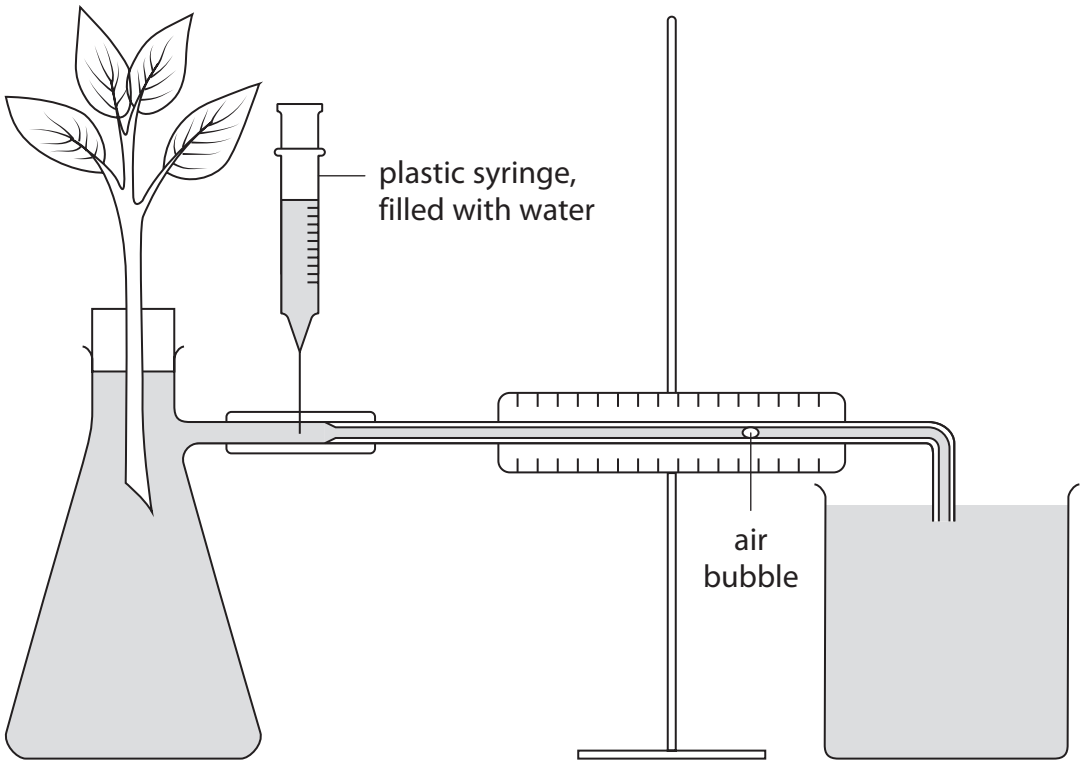
6 The diagram shows apparatus used by a student to investigate water uptake by a leafy shoot.



This apparatus was used in a variety of environmental conditions and the following results were obtained.

Environmental condition	**Rate of water uptake / mm min^{-1}**				
	minute 1	minute 2	minute 3	minute 4	Mean
control	20	19	17	21	19
increased humidity	14	14	15	16	15
increased wind speed	26	24	25	25	25
increased air temperature	26	28	26	25	
lower light intensity	17	16	15	17	16
removal of 50% of leaves	10	12	11	11	

(a) (i) Give the name of the apparatus.

(1)

(ii) Explain **one** precaution that needs to be taken when setting up this apparatus before it can be used to measure the water uptake of the leafy shoot.

(2)

(iii) Explain why the water uptake of the leafy shoot may not be the same as the water transpired.

(2)

(b) Determine which condition produced the greatest change in the mean rate of water uptake.

(2)

(c) (i) State how the student could vary the humidity around the shoot.

(1)

(ii) Give **one** way in which the temperature could be increased without affecting the validity of this investigation.

(1)

(iii) Describe how the student would use the syringe to convert the results into a measure of the volume of water uptake in mm^3 min^{-1}.

(2)

(d) Explain the effect of increasing humidity on the rate of water uptake by the leafy shoot.

(2)

(Total for Question 6 =13 marks)

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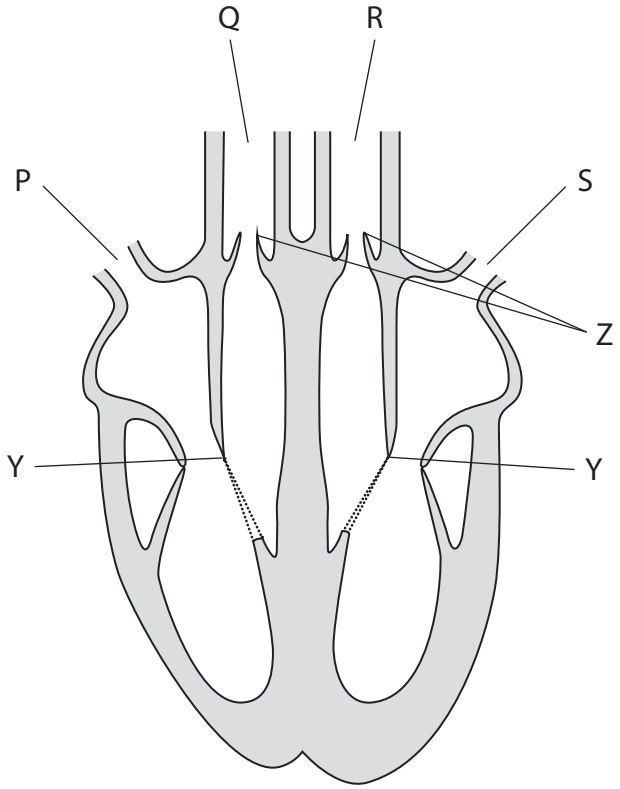
7 The diagram shows a human heart and blood vessels.



(a) (i) Give **one** reason why the heart is divided into left and right sides.

(1)

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(ii) State why there is a difference in the thickness of the muscle of the atria and the muscle of the ventricles.

(1)

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(b) (i) Which blood vessel carries deoxygenated blood towards the heart?

(1)

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

(ii) Which describes the state of the valves at Y and Z when the ventricles are in systole?

(1)

- ☒ **A** Y closed and Z closed
- ☒ **B** Y closed and Z open
- ☒ **C** Y open and Z closed
- ☒ **D** Y open and Z open

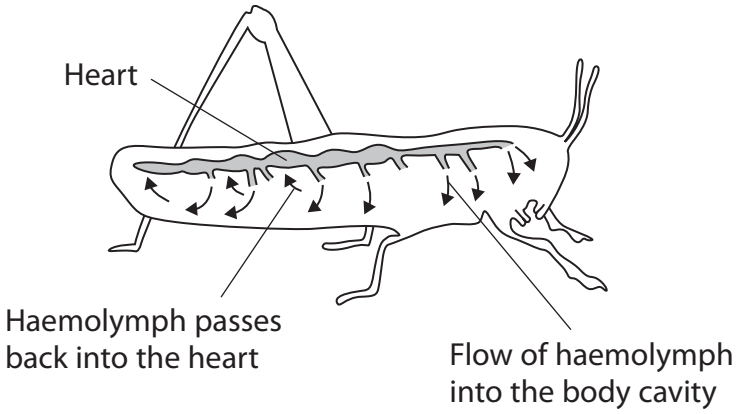
(c) Describe how the structure of blood vessel R differs from the structure of blood vessel S.

(3)

(d) The heart of an insect is a long tube with valves. It pumps fluid, called haemolymph, into the body cavity so that fluid bathes the body cells.

The haemolymph then passes back into the heart from the body cavity.

The diagram illustrates the circulatory system of an insect.



(i) Compare and contrast the structure of the circulatory system of an insect with the structure of the circulatory system of a mammal.

(4)

(ii) Give **two** substances that are carried in the haemolymph for the growth of an insect.

(2)

1 .....

2 .....

(Total for Question 7 =13 marks)

8 The photograph shows a satin bowerbird, *Ptilonorhynchus violaceus*, in its bower.

(Source: ©Imogen Warren / Shutterstock)

(a) The classification hierarchy for the satin bowerbird is:

Eukarya

Animalia

Chordata

Aves

Passeriformes

Ptilonorhynchidae

Ptilonorhynchus

violaceus

(i) Which of these is the phylum for the satin bowerbird?

(1)

☒ **A** Animalia

☒ **B** Chordata

☒ **C** Eukarya

☒ **D** Vertebrata

(ii) Which of these is the genus for the satin bowerbird?

(1)

- ☒ **A** Aves
- ☒ **B** Bower
- ☒ **C** *Ptilonorhynchus*
- ☒ **D** *violaceus*

(b) The males are known for building and decorating a bower to attract females.

This is made of two parallel walls of sticks and is used as a courtship arena during the breeding season.

The male decorates the bower with bright blue coloured objects that it collects. Blue clothes pegs, drinking straws and bottle tops are among the favourite items.

Away from human habitation, bright blue parrot feathers, flowers and snail shells make up the majority of the decorations.

(i) Describe how courtship ensures that bowerbirds mate successfully.

(2)

(ii) Explain how this bower building behaviour has evolved by natural selection.

(4)

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(iii) Devise an investigation to determine the effect of changing the colour of the objects used to decorate the bower on its attractiveness to female bowerbirds.

(4)

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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