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Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Biology B

Advanced Subsidiary

Paper 2: Core Physiology and Ecology

Monday 4 June 2018 – 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.

Turn over ▶

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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 The photograph shows an insect.



Explain how the gas exchange system of an insect is adapted for the efficient uptake of oxygen.

(4)

(Total for Question 1 = 4 marks)

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2 Water potential in plant cells can be represented by the equation

Water potential = turgor pressure + osmotic potential

$$\psi = P + \pi$$

(a) Plant tissue is placed in distilled water.

(i) Which of the following will occur?

(1)

☒ **A** more water will leave the tissue than enter

☒ **B** the cells will become turgid

☒ **C** the tissue will become flaccid

☒ **D** the cells will burst

(ii) When the plant tissue is placed in distilled water the value of

(1)

☒ **A** P will decrease

☒ **B** π will decrease

☒ **C** P will increase

☒ **D** ψ will not change

(iii) Which row of the table correctly identifies the values of P and π if the value of ψ is 0 kPa?

(1)

	P / kPa	π / kPa
☒ **A**	0	0
☒ **B**	–4.6	4.6
☒ **C**	4.6	–4.6
☒ **D**	4.6	0

(iv) Which liquid has the lowest water potential (ψ)?

(1)

☒ **A** distilled water

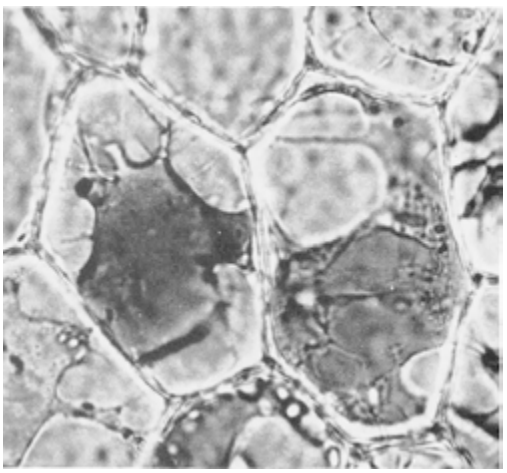
☒ **B** 1.0 mol dm^{-3} sodium chloride solution

☒ **C** 0.1 mol dm^{-3} sodium chloride solution

☒ **D** 0.1 mol dm^{-3} potassium chloride solution

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(b) If plant cells are placed in a solution with a lower water potential, the cell membranes will shrink away from the cell wall. The cells are described as plasmolysed.



The point at which 50% of the cells are plasmolysed can be used to estimate the osmotic potential of the cells.

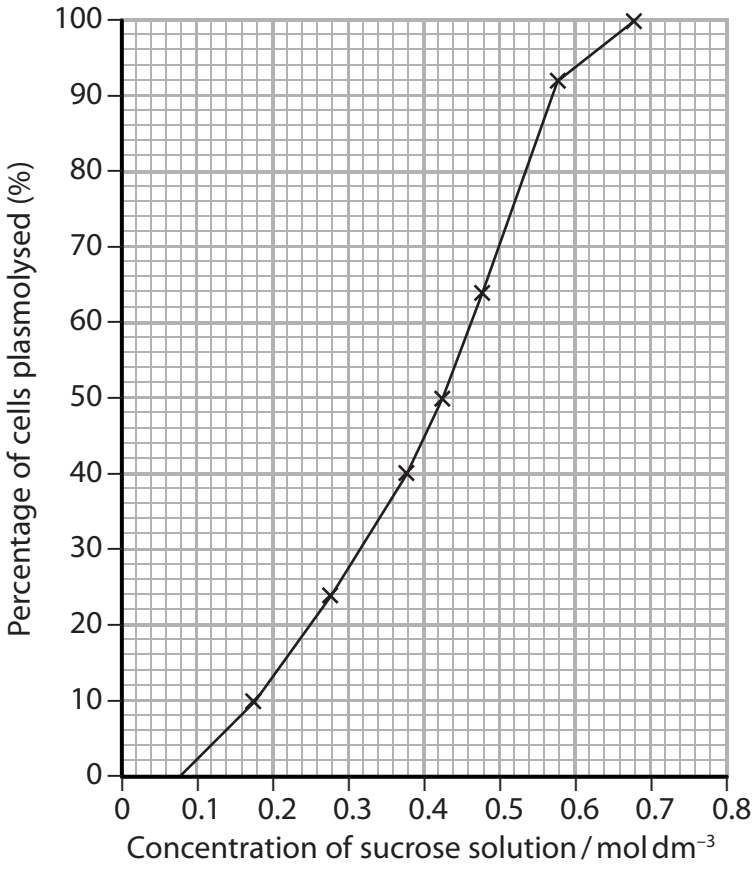
An experiment was carried out to determine the osmotic potential of onion cells.

Onion cells were placed in a range of sucrose concentrations and left for 10 minutes at 25 °C.

A sample of 50 cells was observed for each solution.

The percentage of plasmolysed cells was recorded.

The results are shown in the graph.



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The table shows the osmotic potential of a range of sucrose solutions.

Concentration of sucrose solution / mol dm^{-3}	Osmotic potential / kPa
0.30	–860
0.35	–970
0.40	–1120
0.45	–1280
0.50	–1450
0.60	–1800

(i) Analyse the data in the graph and in the table to explain how the osmotic potential of these onion cells could be determined.

(3)

(ii) Explain why the plant tissue was left in sucrose solution for 10 minutes before the cells were observed.

(2)

(Total for Question 2 = 9 marks)

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3 Stroke volume is the volume of blood that leaves the left ventricle of the heart in each beat.

Cardiac output is the volume of blood that leaves the left ventricle each minute.

The table shows the relationship between heart rate, stroke volume and cardiac output in a person.

Heart rate / beats min^{-1}	Stroke volume / cm^3	Cardiac output / $dm^3\ min^{-1}$
60	110	6.6
100	120	12.0
120	120	14.4
160	120	
175	120	21.0

(a) Calculate the cardiac output for the heart with a stroke volume of 120 cm^3 and a heart rate of 160 beats min^{-1}.

(1)

Answer ..... $dm^3\ min^{-1}$

(b) Analyse the data to explain the relationship between heart rate and cardiac output.

(2)

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(c) (i) Explain how electrical events during the cardiac cycle can lead to an increase in stroke volume.

(3)

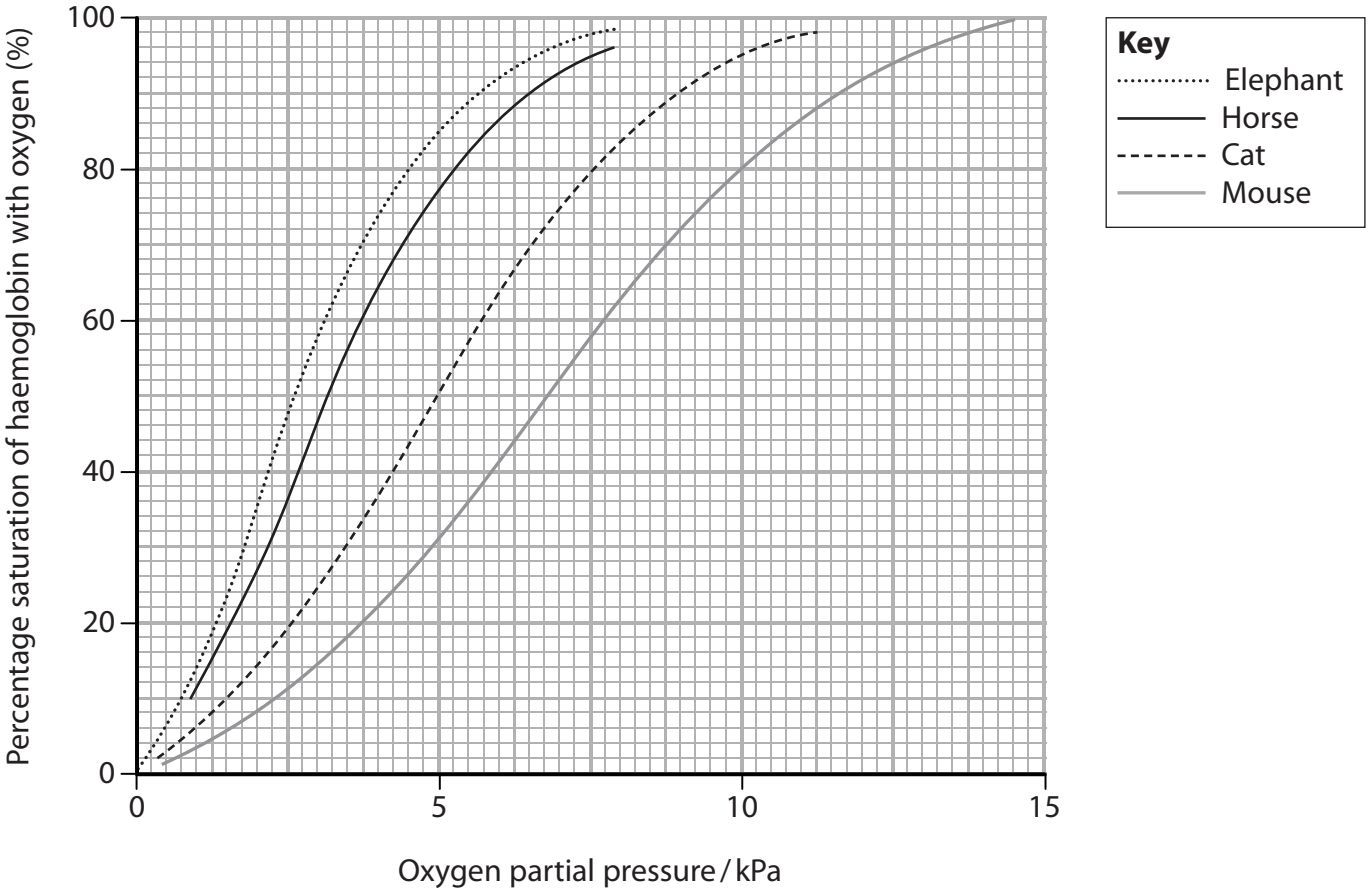
(ii) Explain why Olympic athletes who train for long distance events often have low resting heart rates.

(4)

(Total for Question 3 = 10 marks)

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4 The graph shows the oxygen dissociation curves of haemoglobin from four species of mammal.



(a) Explain the shape of the haemoglobin dissociation curve.

(3)

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(b) Calculate how much more oxygen is released as the partial pressure falls from 10 kPa to 5 kPa in the mouse than in the cat.

(3)

Answer .....

(c) Explain why the dissociation curve for mouse haemoglobin is to the right-hand side of the dissociation curve for elephant haemoglobin.

(3)

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(d) Some species of horse live at high altitudes where the partial pressure of oxygen is very low.

Draw a curve on the graph to show the oxygen dissociation curve of these horses.

(1)

(Total for Question 4 = 10 marks)

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5 Gel electrophoresis is used to separate biological molecules such as proteins.

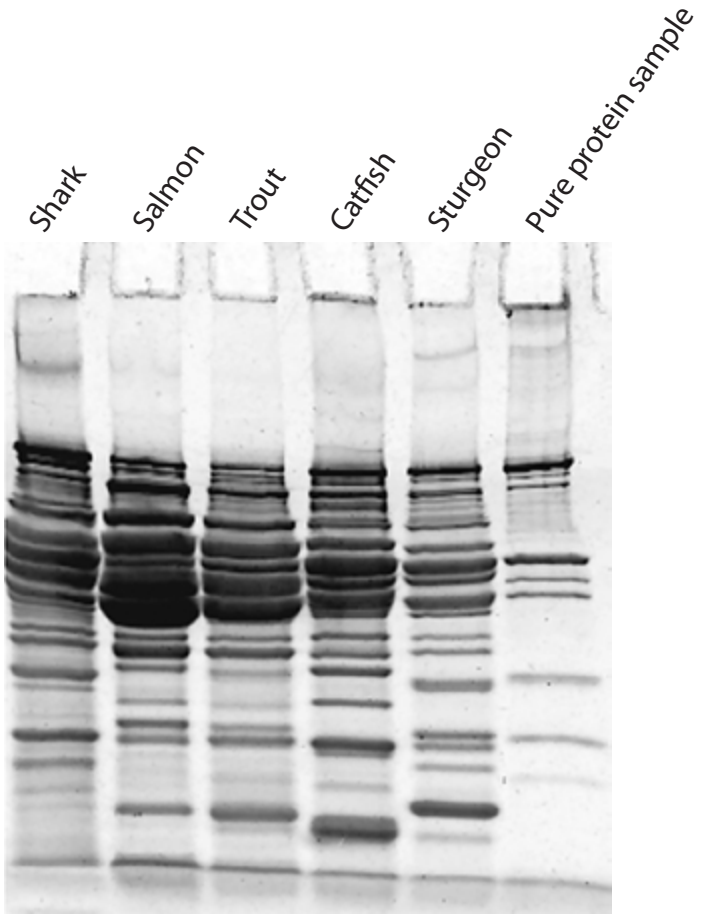
(a) Explain how gel electrophoresis separates molecules.

(2)

(b) Proteomics is the study of proteins that are produced in different species.

Scientists used gel electrophoresis to separate muscle proteins from five species of fish and from a pure protein sample.

The photograph shows the results of a gel separation of proteins from these fish and from the pure protein sample.



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(i) Protein molecules in solution do not separate as easily as DNA fragments.

Explain how protein molecules in solution must be treated so that they can be separated by gel electrophoresis.

(2)

(ii) Analyse the information shown in the photograph to explain how this banding pattern can be used to confirm that these are separate species of fish.

(4)

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(iii) Give a reason why pure protein samples were included in the gel.

(1)

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(iv) The bands in the photograph vary in thickness.

State what the thickness of the bands indicates.

(1)

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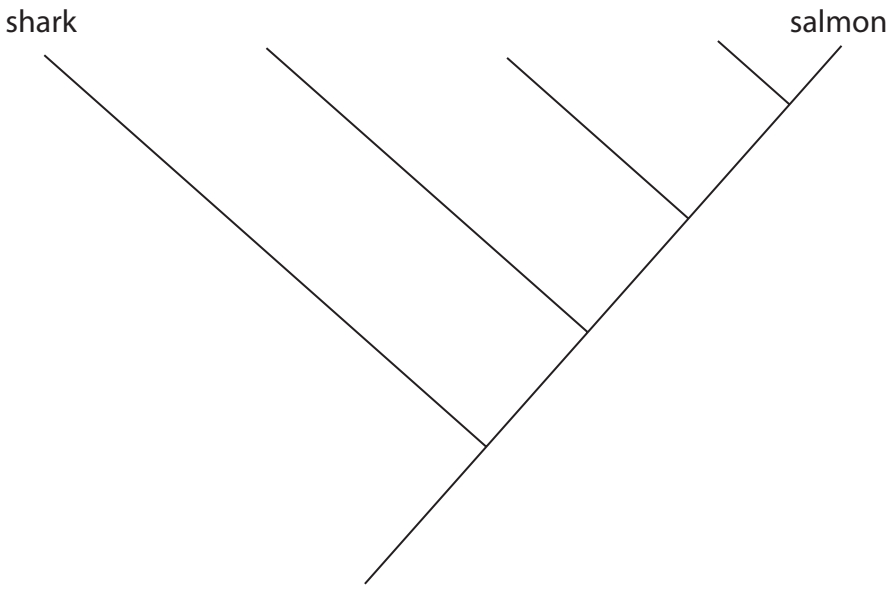
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(c) The table shows the number of bands each fish has in common with the other species.

Species	Shark	Salmon	Trout	Catfish	Sturgeon
Shark	8	2	2	2	2
Salmon		10	10	5	3
Trout			13	5	4
Catfish				10	2
Sturgeon					12

Analyse the data to complete the diagram showing the evolutionary relationships between these species of fish.

(2)



(Total for Question 5 = 12 marks)

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6 Natural selection can lead to adaptations in organisms.

(a) Explain how evolution can occur through natural selection.

(3)

(b) (i) Which of the following is an example of a behavioural adaptation?

(1)

- ☒ **A** courtship display in sticklebacks
- ☒ **B** litter size in pigs
- ☒ **C** number of *Drosophila* eggs that hatch
- ☒ **D** pollen production in sycamore trees

(ii) Which of the following is an example of anatomical adaptation?

(1)

- ☒ **A** an alarm call by a song thrush
- ☒ **B** dominance behaviour in dairy cattle
- ☒ **C** limb structure in primates
- ☒ **D** water potential in root hair cells

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(iii) Which of the following is an example of physiological adaptation?

(1)

- ☒ **A** increased number of stomata on leaf upper surface in a water lily
- ☒ **B** production of venom by a snake
- ☒ **C** reduction of leaves to spines in a cactus
- ☒ **D** salmon swimming upstream to mate

(c) Natural selection can lead to speciation.

(i) Which information about a new organism would to lead to it being classified as a new species?

(1)

- ☒ **A** anatomical differences
- ☒ **B** behavioural differences
- ☒ **C** genetic differences
- ☒ **D** inability to produce fertile offspring with similar species

(ii) Give one method that a scientist might use to inform the scientific community about the discovery of a new species.

(1)

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(d) Compare and contrast allopatric and sympatric speciation.

(4)

(Total for Question 6 = 12 marks)

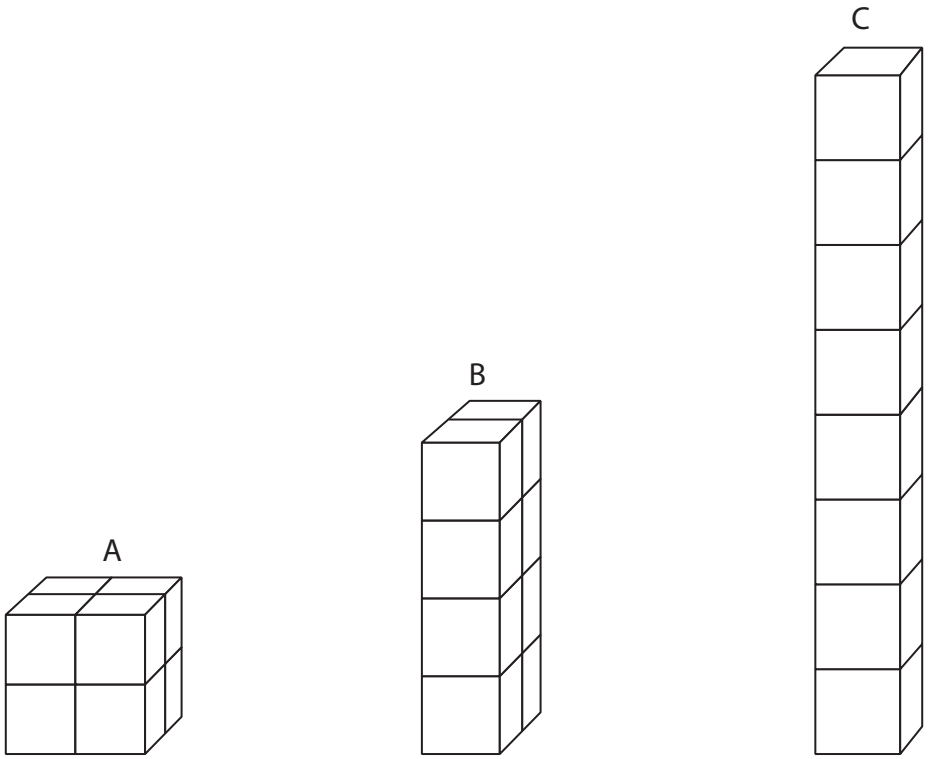
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7 A student investigated the effect of the shape of a potato chip on the rate of absorption of water.

Different shaped chips, A, B and C, were used.



(a) Calculate the surface area to volume ratio of potato chip B.

(3)

Answer.....

(b) These three chips will absorb water at different rates.

Predict the order in which the chips will absorb water, from the lowest rate to the highest rate.

(1)

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*(c) Devise an investigation to determine the effect of shape on the rate of absorption of water by potato chips.

(6)

(Total for Question 7 = 10 marks)

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8 Water enters a plant through root hair cells and then travels by the apoplastic and by the symplastic pathways.

(a) Describe the differences between the apoplastic and the symplastic pathways.

(3)

(b) Herbicides are chemicals used to control the growth of weeds.

Herbicides that are absorbed from the soil also travel through the apoplastic and symplastic pathways.

The rate of absorption of herbicides is affected by their chemical properties.

(i) Explain how the properties of herbicide molecules affect their ability to pass through plant cell membranes.

(3)

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(ii) Some herbicides are applied to the soil.

Explain how these herbicides will be transported to the leaves.

(2)

(c) To grow plants successfully in a glasshouse, the humidity needs to be controlled because the humidity would be higher in the summer than in the spring.

Explain why the humidity in a glasshouse would be higher in the summer than in the spring.

(5)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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