Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel GCE

Thursday 25 May 2023

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 questions 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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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) As organisms change size their relative dimensions also change.

Which of the following statements are true?

(1)

As organisms become larger

1. the surface area increases
2. the volume increases
3. the surface area to volume ratio decreases
4. the volume to surface area ratio increases

☒ **A** 1 and 2 only

☒ **B** 1, 2 and 3 only

☒ **C** 1, 2 and 4 only

☒ **D** 1, 2, 3 and 4

(b) Explain why larger organisms need a mass transport system but smaller organisms do not.

(3)

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(c) Compare and contrast the gas exchange adaptations in an insect and in a fish.

(4)

(Total for Question 1 = 8 marks)

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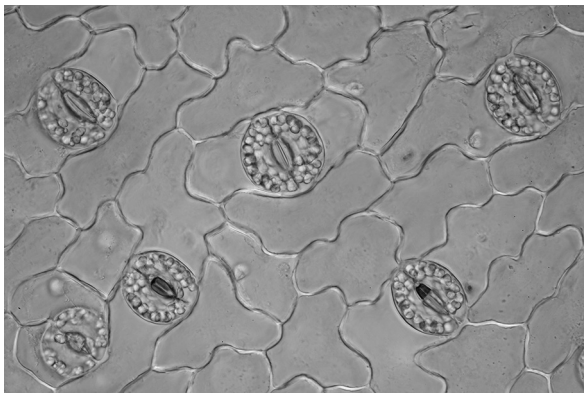
2 Plants and animals have specialised tissues that are adapted for gas exchange.

(a) Which of the following allow gases to enter woody plant stems?

(1)

- ☒ **A** lenticels
- ☒ **B** stomata
- ☒ **C** waxy cuticle
- ☒ **D** xylem

(b) The photograph shows stomata from part of the lower leaf surface of the plantain lily.



(Source: © MAREK MIS/SCIENCE PHOTO LIBRARY)

Magnification $\times 370$

(i) Calculate the number of stomata per cm^2 on this part of the leaf surface.

Give your answer to the nearest whole number.

(3)

Answer .....

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(ii) Calculate the estimated number of stomata found on the lower surface of a leaf that has a total area of 130 cm^2.

Use your answer from b(i) in your calculation.

(1)

Answer .....

(iii) Give a reason why the estimated number of stomata on the lower surface of the leaf may not be accurate.

(1)

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(iv) Explain why it is important for plants to be able to open and close their stomata.

(3)

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(Total for Question 2 = 9 marks)

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3 When a blood vessel is damaged a clot is formed.

(a) Give **one** function of blood clotting when a blood vessel is damaged.

(1)

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(b) (i) Which of the following factors are likely to lead to increased plaque formation and atherosclerosis?

(1)

1. increased levels of high-density lipoproteins
2. smoking tobacco
3. too little exercise
4. type 2 diabetes

☒ **A** 1 only

☒ **B** 1, 2 and 3 only

☒ **C** 1, 2, 3 and 4

☒ **D** 2, 3 and 4 only

(ii) Which of the following describes atherosclerosis?

(1)

☒ **A** develops in arteries because blood flow is slower

☒ **B** develops in arteries because blood pressure is higher

☒ **C** develops in veins because blood flow is slower

☒ **D** develops in veins because blood pressure is lower

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(c) A deep vein thrombosis (DVT) is a blood clot in the legs.

The blood clot may travel into the lungs and block the flow of blood.

Airline passengers on long-distance flights are advised to carry out exercises such as stretching and flexing their leg muscles to reduce the risk of DVT.

Aspirin is a drug that can be used to prevent platelets binding to the inside of blood vessels.

The use of aspirin for the prevention of DVT in air travel is not based on evidence.

Passengers who are at low risk of DVT are not advised to take aspirin because of the small risk of serious side effects such as bleeding.

Analyse this information to explain the advice airline passengers are given.

(4)

(Total for Question 3 = 7 marks)

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4 Biologists use systems of classification to group organisms together.

(a) (i) Which of the following is a domain?

(1)

- ☒ **A** Archaea
- ☒ **B** Fungi
- ☒ **C** Insecta
- ☒ **D** Plantae

(ii) Which of the following groups is **not** in the domain Eukaryota?

(1)

- ☒ **A** Animalia
- ☒ **B** Bacteria
- ☒ **C** Insecta
- ☒ **D** Mammalia

(iii) Which of the following represents the correct hierarchy for classification?

(1)

- ☒ **A** domain, kingdom, phylum, class, order, family, genus, species
- ☒ **B** domain, kingdom, phylum, order, class, family, genus, species
- ☒ **C** kingdom, domain, phylum, class, order, family, genus, species
- ☒ **D** kingdom, domain, order, phylum, class, family, genus, species

(b) Describe the peer review process used by scientists to validate evidence for a new species.

(2)

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(c) Explain the advantages and disadvantages of using zoos in the conservation of endangered animals.

(3)

(Total for Question 4 = 8 marks)

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5 Haemoglobin and myoglobin are both pigments involved in the transport and storage of oxygen.

(a) Compare and contrast the structures and roles of haemoglobin and myoglobin.

(4)

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*(b) Some species of mammal are able to dive underwater for long periods of time.

Table 1 shows information about the concentration of myoglobin in the muscle, the maximum duration of an underwater dive and the mean body mass of different mammal species.

Table 1

Mammal species	Mean myoglobin concentration / mg g^{-1}	Mean body mass / kg	Maximum dive time / seconds
American water shrew	11.0	0.016	24
Grey seal	54.0	240	1920
Harbour seal	61.0	112	1935
Human	6.45	62	150
Rat	1.43	0.40	20

Table 2 describes the habitats for each of these species.

Table 2

Species	Habitat
American water shrew	Semi-aquatic
Grey seal	Aquatic
Harbour seal	Aquatic
Human	Terrestrial
Rat	Terrestrial or semi-aquatic

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Analyse the data to comment on the factors affecting dive time in these mammals.

(6)

(Total for Question 5 = 10 marks)

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6 The equation $\psi = P + \pi$ is used to determine the water potential of plant cells.

(a) State what the terms P and π represent.

(2)

P .....

π .....

(b) Students carried out an investigation to determine the osmotic potential and therefore water potential of plant epidermal cells.

Plant cells were placed in salt solutions of different concentrations.

The concentration that has the same osmotic potential as the cell sap causes visible plasmolysis in 50% of the cells. In a plasmolysed cell, the cell contents can be seen to have shrunk away from the cell wall.

When 50% of the cells are plasmolysed, this is referred to as the point of incipient plasmolysis.

The students counted the number of plasmolysed cells in different concentrations of salt solution.

The results are shown in Table 1.

Table 1

Salt concentration / mol dm^{-3}	Number of plasmolysed cells in a sample of 25				Mean percentage plasmolysis (%)
	count 1	count 2	count 3	count 4	
0.0	0	0	0	1	1
0.1	2	3	4	3	
0.2	6	4	7	4	21
0.3	8	10	9	7	34
0.4	11	9	12	8	40
0.5	12	13	15	16	56
0.6	18	17	16	17	68
0.7	22	19	20	21	82
0.9	23	25	22	24	94

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(b) (i) Calculate the mean percentage plasmolysis in the salt concentration of 0.1 mol dm^{-3}.

(1)

Answer .....

(ii) Plot a suitable graph to show the relationship between salt concentration and mean percentage plasmolysis.

(3)



(iii) Determine the concentration of salt solution in which incipient plasmolysis would occur, using your graph.

(1)

Answer ..... mol dm^{-3}

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(iv) Table 2 shows the relationship between molarity and osmotic potential of salt solutions.

Table 2

Salt concentration / mol dm^{-3}	Osmotic potential / kPa
0.1	–270
0.2	–550
0.3	–830
0.4	–1130
0.5	–1460
0.6	–1820
0.7	–2200
0.8	–2610
0.9	–3050
1.0	–3560

Determine the water potential of the epidermal cells using table 2 and your answer to (b)(iii).

(2)

Answer .....

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(c) Explain how finding the point of incipient plasmolysis allows the students to determine the water potential of the epidermal cells.

(2)

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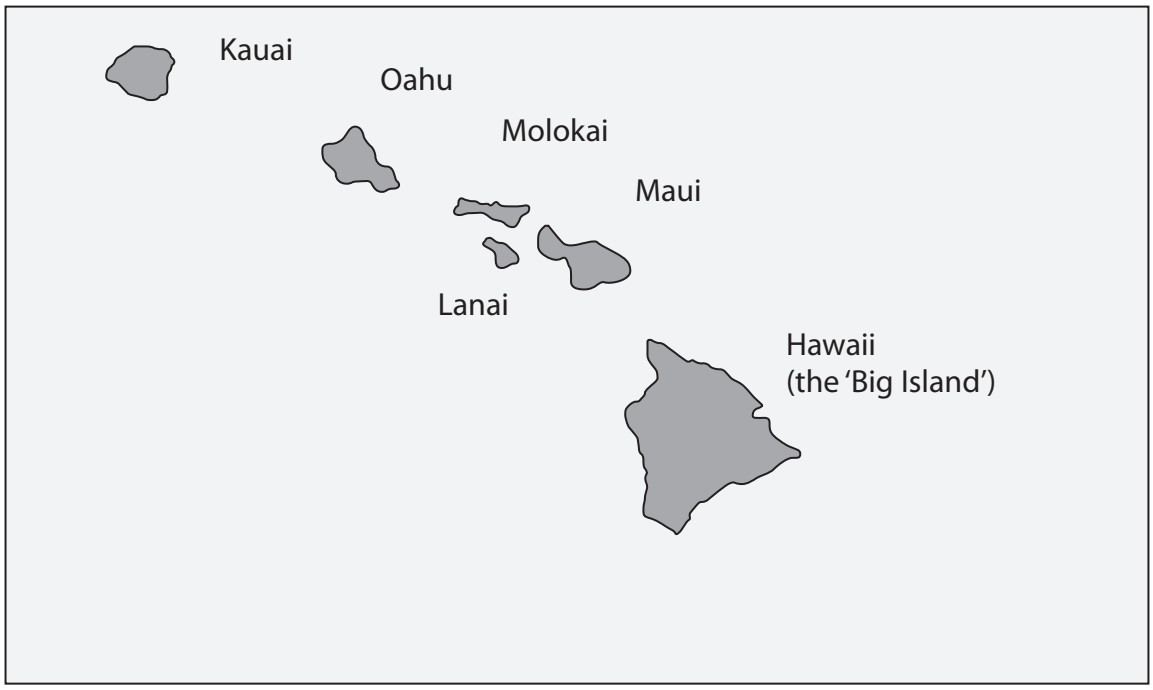
(Total for Question 6 = 11 marks)

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7 The map shows a group of islands found in the Pacific Ocean.



Drosophila silvestris and *Drosophila planitibia* are two related species of fly.

Drosophila silvestris is found only on Hawaii island and *Drosophila planitibia* is found only on Maui island.

These species occupy similar niches.

(a) Describe what is meant by the term niche.

(2)

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(b) Which groups do *Drosophila silvestris* and *Drosophila planitibia* belong in?

1. the same family
2. the same genus
3. the same order
4. the same phylum

(1)

☒ **A** 1 only

☒ **B** 1 and 2 only

☒ **C** 1, 2 and 3 only

☒ **D** 1, 2, 3 and 4

(c) When these two species of fly are crossed together, some of the offspring are sterile and some are fertile.

Explain how the production of some sterile and some fertile offspring may cause a problem in classifying these flies.

(2)

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(d) Explain how these two species evolved from a common ancestor.

(4)

(e) Describe what additional information can be used to help clarify the evolutionary relationship between these two species of fly.

(3)

(Total for Question 7 = 12 marks)

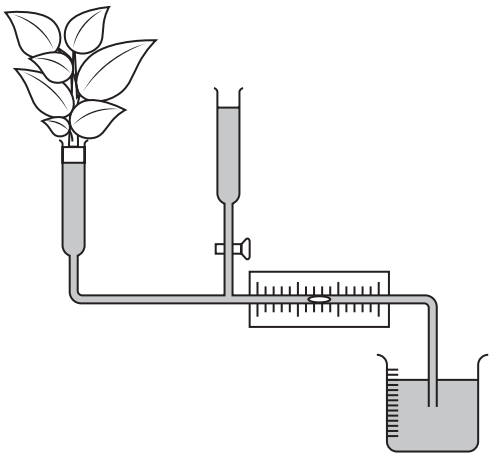
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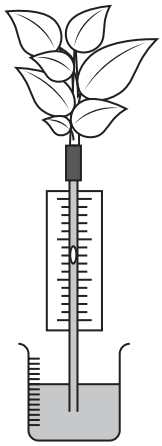
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8 A bubble potometer can be used to investigate the water uptake by a plant shoot under different environmental conditions.

The diagram shows two types of bubble potometer, A and B.



Potometer A



Potometer B

(a) State **one** advantage of using potometer A compared with using potometer B.

(1)

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(b) A student used potometer B and an electric fan to investigate the effect of air movement on the rate of water uptake by a leafy shoot.

The table shows the results obtained.

Fan speed setting	Rate of bubble movement / mm min^{-1}			
	1	2	3	Mean
off	42	38	43	41
low	63	58	60	60
medium	82	78	83	81
high	82	80	78	80

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Explain the effect of changing fan speed on the rate of the air bubble movement.

(2)

(c) Some variables in this investigation are difficult to control.

These variables and other factors associated with the apparatus reduce the accuracy and validity of the results.

(i) Explain **one** variable that is difficult to control in this investigation.

(2)

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(ii) Explain **one** factor that may reduce the accuracy of potometer B.

(2)

(d) The distance moved by the bubble in one minute can be converted to rate of water uptake in $mm^3\ min^{-1}$.

The volume of water taken up by the shoot can be calculated using the formula

$$v = \pi r^2 h$$

where v is the volume of water

r is the radius of the capillary tube and

h is the length in mm that the bubble has moved.

The capillary tube has a diameter of 1.0 mm.

(i) Calculate the mean rate of water uptake by the shoot when the fan speed setting was high.

Give your answer to two significant figures.

(3)

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

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(ii) Describe how the student could determine the rate of water uptake per cm^2 of leaf surface.

(2)

(e) Describe how the student could use potometer B to measure the effect of temperature on the rate of water uptake.

(3)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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