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Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2013

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[AB121]

AB121

TUESDAY 15 JANUARY, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
There is an extra lined page at the end of the paper if required.
Answer **all nine** questions.
You are provided with **Photograph 2.5** for use with **Question 5** in this paper. Do not write your answers on this photograph.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Section A carries 60 marks. Section B carries 15 marks.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers.
Use accurate scientific terminology in all answers.
You should spend approximately **20 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B**, and awarded a maximum of 2 marks.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Section A

1 The following statements describe different components of blood. Using the information in each statement, identify the blood component described.

- Cell fragments with an important role in initiating the formation of blood clots.

_____

- A soluble plasma protein which is converted to an insoluble fibrous protein during clot formation.

_____

- A type of white blood cell involved in the immune response leading either to the production of antibodies or to the destruction of infected cells.

_____

- A type of white blood cell that, in the presence of infectious organisms, becomes transformed into a macrophage.

_____ [4]

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2 **(a)** Hay meadows are not intensively managed and produce a species-rich community. To increase agricultural productivity many such meadows have been drained, ploughed and reseeded with grass species suitable for cutting as silage. The result has been a reduction in the biodiversity of the grassland.

Explain how drainage, ploughing and reseeding reduce biodiversity.

- Drainage _____

_____

_____

- Ploughing _____

_____

_____

- Reseeding _____

_____

_____ [3]

(b) Describe **two** distinct ways in which the biodiversity of farmland may be improved. (Your answer should not refer to drainage, ploughing or reseeding.)

1. _____

_____

2. _____

_____ [2]

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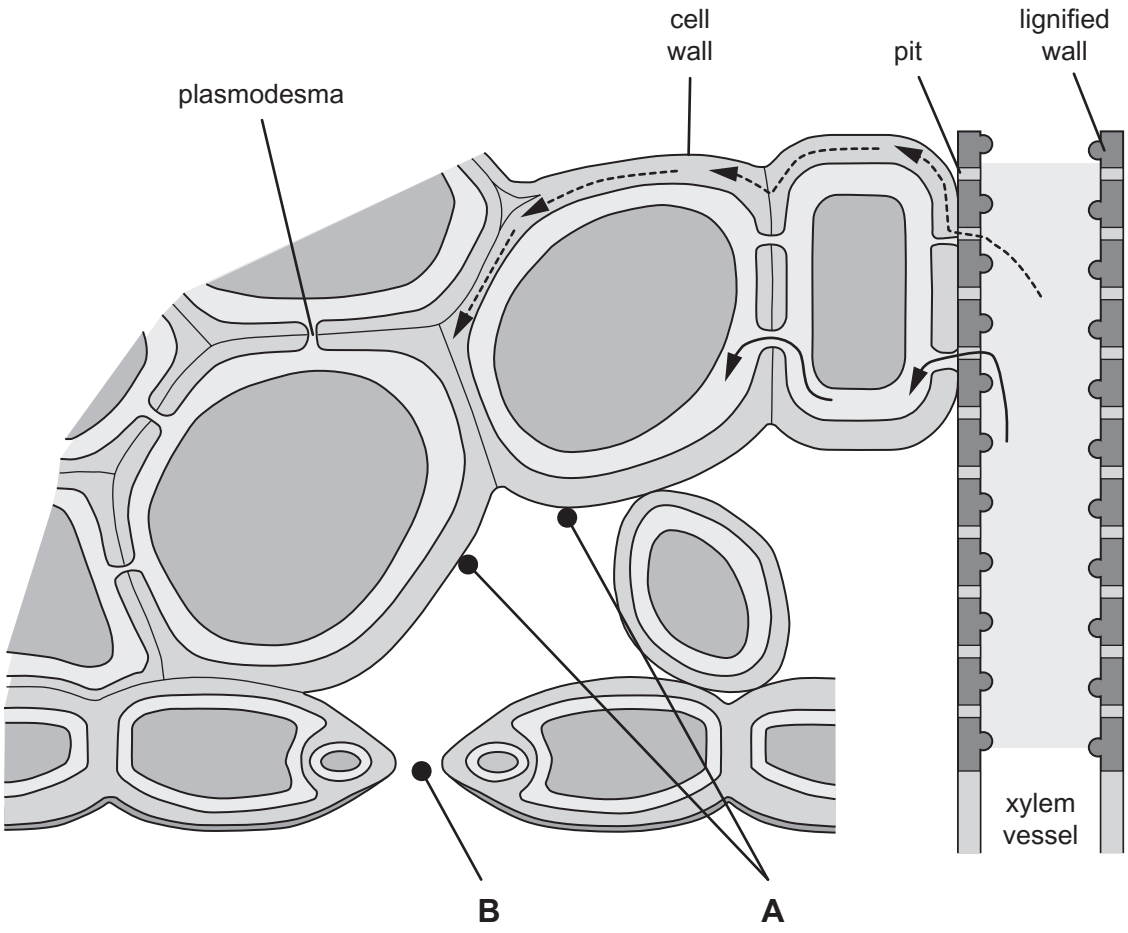
3 In a mesophytic leaf, water leaves the xylem and moves to other areas. The diagram below shows two possible pathways taken by water after leaving the xylem vessel.



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(a) Identify the **two** pathways for water movement shown in the diagram.

→ _____

⇢ _____ [2]

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(b) The following features have a role in the transport of water in the plant. Describe **one** role for each feature.

- Plasmodesma _____

  _____

- Pit _____

  _____

- Lignified wall _____

  _____ [3]

(c) The movement of water through the leaf depends on processes at **A** and **B**. Identify these processes.

A _____

B _____ [2]

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4 **(a)** Quadrats are a useful tool in ecology and are often used to sample plant populations.

(i) Describe how quadrats would be positioned in the following situations.

- A population which is scattered evenly throughout the area to be sampled.

_____

_____

- A population that varies in abundance as you move from one side of the area to be sampled to the other.

_____

_____ [2]

(ii) Within a quadrat individual plants are often difficult to distinguish. Describe how plant abundance may then be estimated.

_____

_____ [1]

(b) Students were asked to compare the length of a particular species of seaweed on two areas of a rocky shore. One student selected three specimens from each shore area, measured their lengths and from these calculated the mean length of seaweed for each area.

(i) This student's means are unlikely to be a reliable representation of the mean length of the entire population of the seaweed for each area. Explain why the student's means are unlikely to be reliable. Describe how reliability could have been improved.

_____

_____

_____

_____ [2]

(ii) Suggest **one** way in which the validity of this investigation might be improved.

_____

_____ [1]

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5 **Photograph 2.5** shows a section through a mammalian heart. The aorta, which has been cut open, and the semi-lunar valve are labelled.

(a) (i) Identify the structures labelled **A** to **C**.

A _____

B _____

C _____ [3]

(ii) The labelling lines all point to structures on the left side of the heart. Describe **two** features, visible in the photograph, which indicate that this is the left side of the heart.

1. _____

_____

2. _____

_____ [2]

(b) The semi-lunar valve is important in ensuring the one-way flow of blood through the heart.

(i) Describe the events in the cardiac cycle which lead to the semi-lunar valve opening.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(ii) During which phase in the cardiac cycle does the semi-lunar valve close?

_____ [1]

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6 **(a)** Define the term 'species'.

_____

_____

_____

_____

_____ [2]

(b) Duckweed is a tiny hydrophyte found floating or slightly submerged in ponds. The plant consists of a green frond, not differentiated into stem and leaves, and one or more roots. There are four native Irish duckweed species.

(i) Species are often identified with the use of a dichotomous key. A dichotomous key separates organisms into groups until individual species have been described. The table below shows features which may be used in the construction of a dichotomous key for the identification of the duckweed species.

Species	Single root	Round frond	Convex lower surface
Lemna minor	✓	✓	✗
Spirodela polyrhiza	✗	✓	✗
Lemna gibba	✓	✓	✓
Lemna triscula	✓	✗	✗

Using the information in the table, complete a dichotomous key for the duckweed species. A suitable key has been started for you.

1	Single root	→	2
	more than one root	→	*Spirodela polyrhiza*

2

[3]

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(ii) Another duckweed species, *Lemna minuta*, was first found in Ireland in 1993 at Blarney Castle. This species has a single root, round fronds and a flat lower surface. With which native species is this introduced species most likely to be confused?

_____ [1]

(iii) Suggest which of the four native species is least related to *Lemna minuta*. Explain your answer.

_____

_____

_____ [2]

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7 Small organisms obtain oxygen by diffusion through a permeable and moist body surface. However, their demand for oxygen is determined by their volume and how metabolically active their tissue is.

(a) A small single-celled organism, when at rest, is assumed to adopt a cube shape with a side of 12 µm long.

(i) Calculate the surface area and volume of this cube-shaped organism.

Surface area _____ μm^2

Volume _____ μm^3
[2]

When at rest, this organism absorbs oxygen at a rate of 0.02 μm^3 μm^{-2} min^{-1}, while it consumes oxygen at a rate of 0.01 μm^3 μm^{-3} min^{-1}.

(ii) Calculate the total volume of oxygen absorbed and consumed in one minute at rest.

Oxygen absorbed _____ μm^3

Oxygen consumed at rest _____ μm^3
[2]

(iii) Explain why this organism must change its shape if it is to become active.

_____

_____

_____

_____ [2]

(iv) Explain why smaller specimens of this species are more active than larger ones.

_____

_____

_____

_____ [2]

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Large organisms require specialised gas exchange surfaces.

(b) Describe how a large gas exchange surface is achieved in a mammal.

_____

_____

_____

_____

_____ [2]

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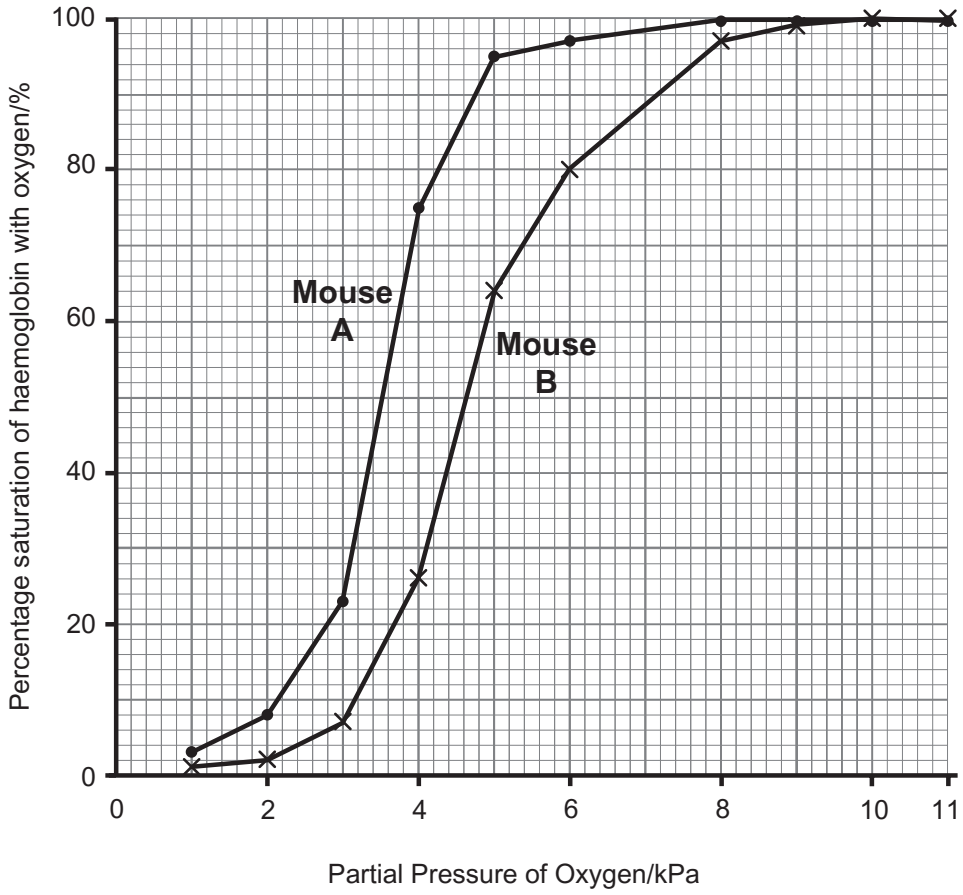
8 **(a)** Deer mice (*Peromyscus maniculatus)* populate much of the United States, inhabiting the widest range of altitudes of any North American mammal. Two types of deer mice are recognised, those adapted to life at high altitude and those at low altitude. Most importantly they possess different types of haemoglobin.

The graph below shows haemoglobin dissociation curves for a high altitude mouse and a low altitude mouse.



(i) State what is meant by the term 'percentage saturation'.

_____

_____ [1]

(ii) Using the haemoglobin dissociation curves, determine the difference in percentage saturation of the haemoglobin of mice **A** and **B** at a partial pressure of $O_2 = 5$kPa.

Difference in % saturation _____ [1]

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(iii) State which mouse, **A** or **B**, lives at high altitude. Explain your choice.

Mouse _____

Explanation _____

_____

_____

_____

_____ [3]

(b) People at high altitudes have developed various adaptations for living in places where the partial pressure of oxygen is less than that at sea level. Some of these adaptations are described below.

- *Natives of the Andes mountains in South America have higher concentrations of haemoglobin in their blood, although they breathe at a similar rate to people who live at sea level.*
- *Tibetans in the high Himalayas breathe faster and deeper than people who live at sea level. In addition, Tibetans' lungs synthesise larger amounts of a gas called nitric oxide from the air they breathe. One effect of nitric oxide is to dilate (widen) blood vessels.*

Explain how each of the following features allow people to live at high altitude.

(i) Increased haemoglobin levels

_____

_____

_____

_____ [2]

(ii) Increased number of breaths per minute

_____

_____

_____

_____ [2]

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(iii) Increased levels of nitric oxide

_____

_____

_____

_____ [2]

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Section B

Quality of written communication is awarded a maximum of 2 marks in this section.

9 Animals and plants are adapted to the environment in which they live and their populations are capable of remaining adapted even when the environment changes.

(a) Describe the environment to which xerophytic plants are adapted and explain the features which allow them to be adapted. [6]

(b) Explain how natural selection maintains the adaptiveness of a population in both stable and changing environments. [7]

Quality of written communication [2]

(a) Describe the environment to which xerophytic plants are adapted and explain the features which allow them to be adapted.

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(b) Explain how natural selection maintains the adaptiveness of a population in both stable and changing environments.

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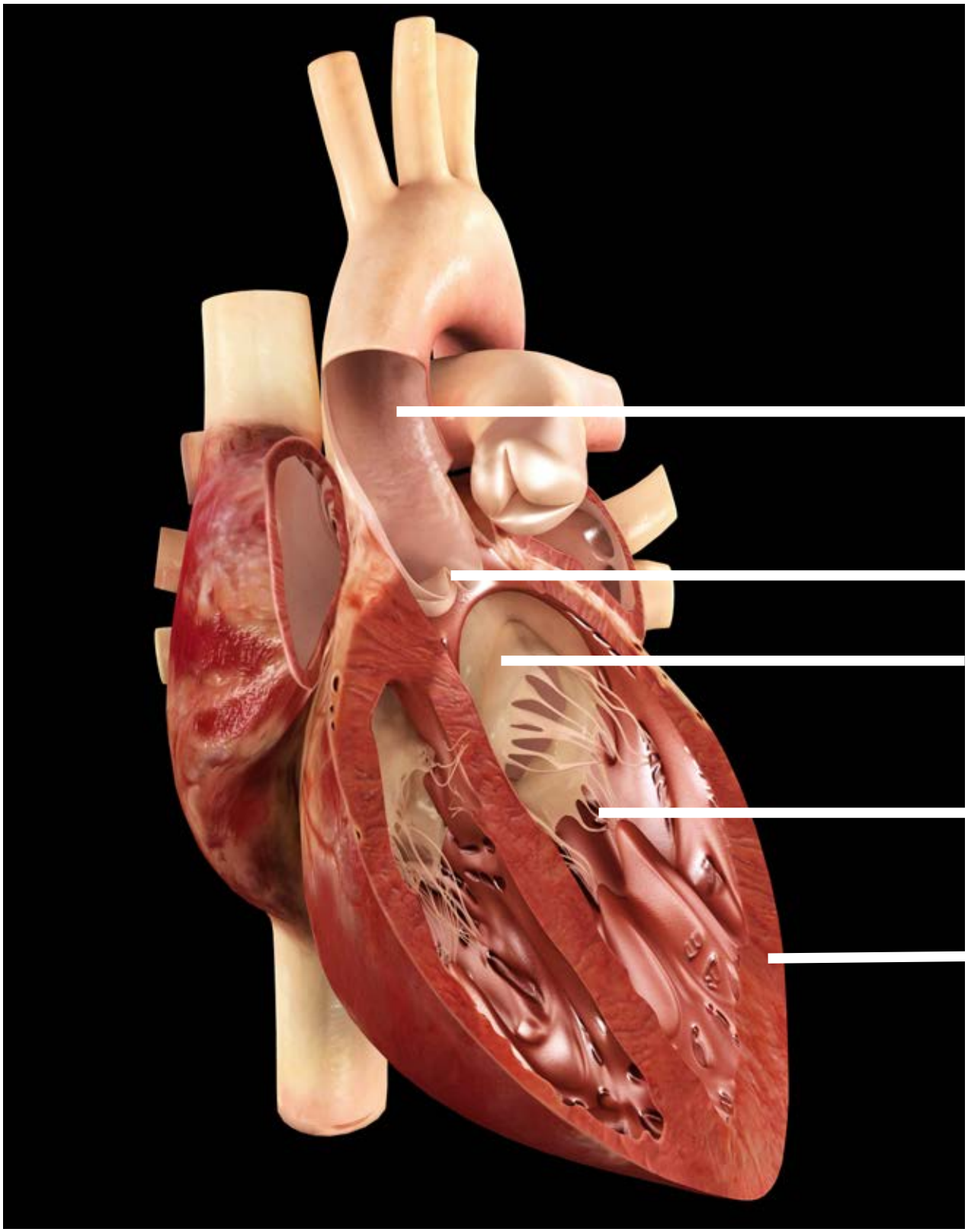
GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 2: Organisms and Biodiversity
January 2013

Photograph 2.5
(for use with Question 5)



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