Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2016

Centre Number

Candidate Number

Biology

Assessment Unit AS 2
assessing
Organisms and Biodiversity

MV18

[AB121]

THURSDAY 23 JUNE, MORNING

Time

1 hour 30 minutes, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Complete in blue or black ink only.
Answer **all eight** questions.
You are provided with **Photographs 2.3A** and **2.3B** for use with **Question 3** in this paper. Do not write your answers on these photographs.

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 at the end of each question 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.

Section A

1 **(a)** Morphology (external features) provides one source of evidence when classifying organisms.

State **two** other sources. [2 marks]

1. _____

2. _____

(b) Identify the taxonomic rank which is made up of a group of genera. [1 mark]

_____

(c) Organisms which are classified together are presumed to have a common ancestry.

State the term used to describe this type of classification (taxonomy). [1 mark]

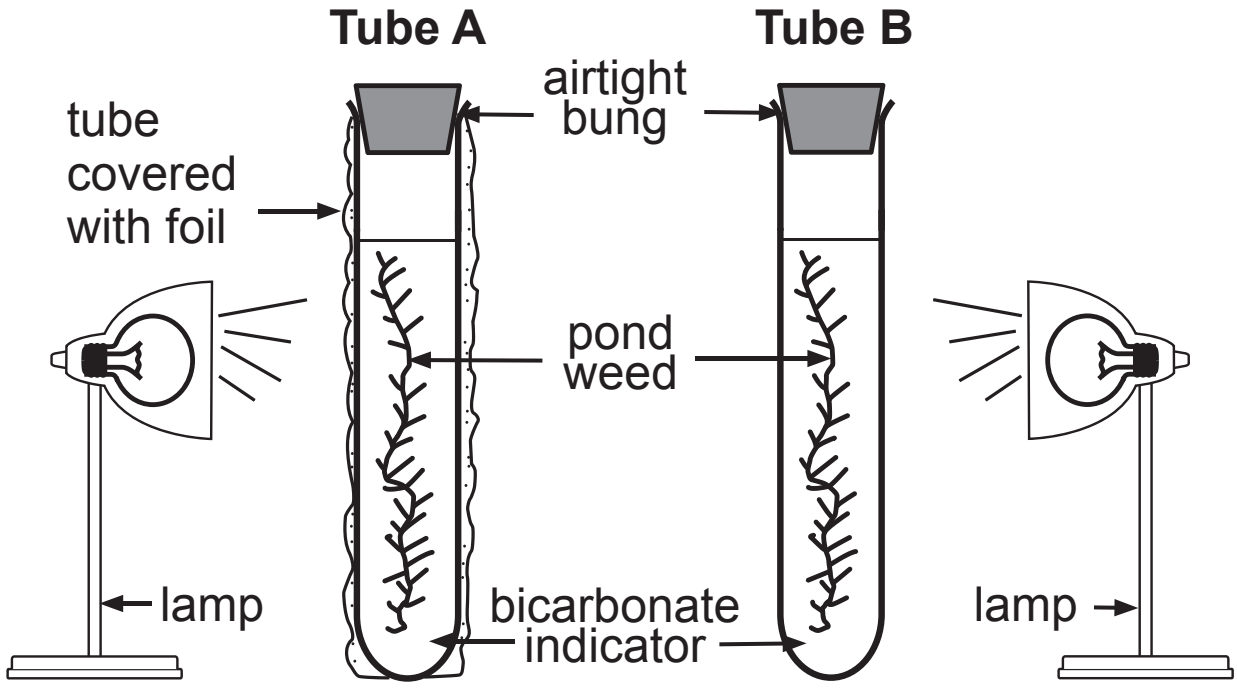
_____

2 **(a)** In mammals, the gas exchange surface is provided by the lung alveoli. In plants, the spongy mesophyll of the leaves performs this role.

(i) Identify **one** other difference between gas exchange in mammals and plants. [1 mark]

(ii) Describe **one** way in which a diffusion gradient is maintained in the mammalian lungs. [1 mark]

(b) An investigation of gas exchange in plants was carried out, using bicarbonate indicator. The apparatus used is shown in the diagram below.



(i) Complete the table below to show the expected colour of the bicarbonate indicator in each tube after three hours in bright light. [1 mark]

	Colour of bicarbonate indicator	
Tube	**At start**	**After three hours**
A	red	
B	red	

(ii) Explain fully the result for Tube **B**. [2 marks]

(c) Describe how you would extend the investigation to demonstrate the compensation point of the pondweed. [3 marks]

3 Lichen species and rocky shore plants such as samphire **(Crithmum maritimum)** are common on the upper zones of rocky shores. They are most common in the spray zone above the high tide mark.

(a) **Photograph 2.3A** shows two different species of lichen growing on the vertical face of a rock beside a coastal path. These lichens grow very close to the rock surface. This means that, once established, further growth can only take place on parts of the rock surface that are not already colonised by other lichens. Most lichens are very slow growing and grow best when their habitat is undisturbed.

Using the information provided, answer the following questions.

(i) Suggest **one** way in which the rock face in the photograph provides a suitable habitat for these lichen species. [1 mark]

_____

_____

(ii) Suggest the main resource these species of lichens compete for on the rock face. [1 mark]

_____

_____

(iii) Suggest what is represented by the irregular lines on the lichens, labelled **X**. [1 mark]

_____

_____

(b) Photograph 2.3B shows samphire **(Crithmum maritimum)**, growing just above the high tide mark on the same rocky shore. The soils in this habitat are salty as a result of sea spray. This makes it difficult for plants to absorb water by osmosis. Consequently, samphire and many other plants found in this zone have xerophytic adaptations.

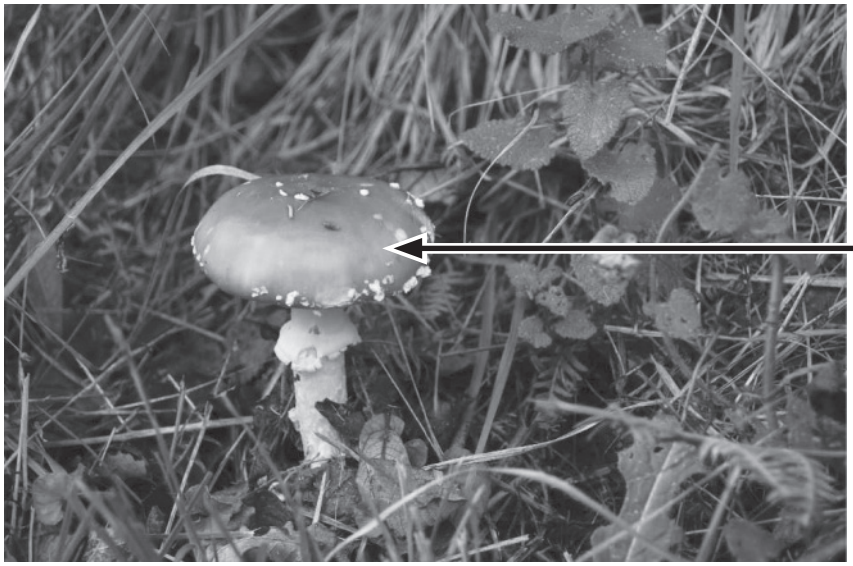
(i) Using the photograph, state **one** xerophytic adaptation present in samphire. [1 mark]

_____

(ii) Suggest **one** other xerophytic adaptation that samphire would be expected to have. [1 mark]

_____

4 The Fly Agaric **(Amanita muscaria)** is a common fungus found throughout most of Britain. It is easily recognised by the toadstool's bright red cap.



The cap develops in autumn and releases spores for reproduction and dispersal. However, most of the fungus exists as a network of microscopic underground hyphae that decomposes dead plant material in the ground.

(a) The Fly Agaric has a lysotrophic mode of nutrition. Explain what is meant by the term 'lysotrophic'. [3 marks]

(b) The Fly Agaric is toxic to mammals, with particularly high levels of toxin in the cap.

(i) Suggest the advantage to the Fly Agaric of having particularly high levels of toxin in the cap. [2 marks]

(ii) Using your understanding of selection, explain how high levels of toxin might have evolved in the cap of this species. [4 marks]

(c) Until recently, it was assumed that fungi were relatively small organisms. This was partly due to only a small part of the fungus being visible above ground. However, DNA analysis has now shown that some individual fungi can grow beyond 100 metres in length.

Suggest why it would have been difficult before DNA analysis to determine that fungi could reach this size. [2 marks]

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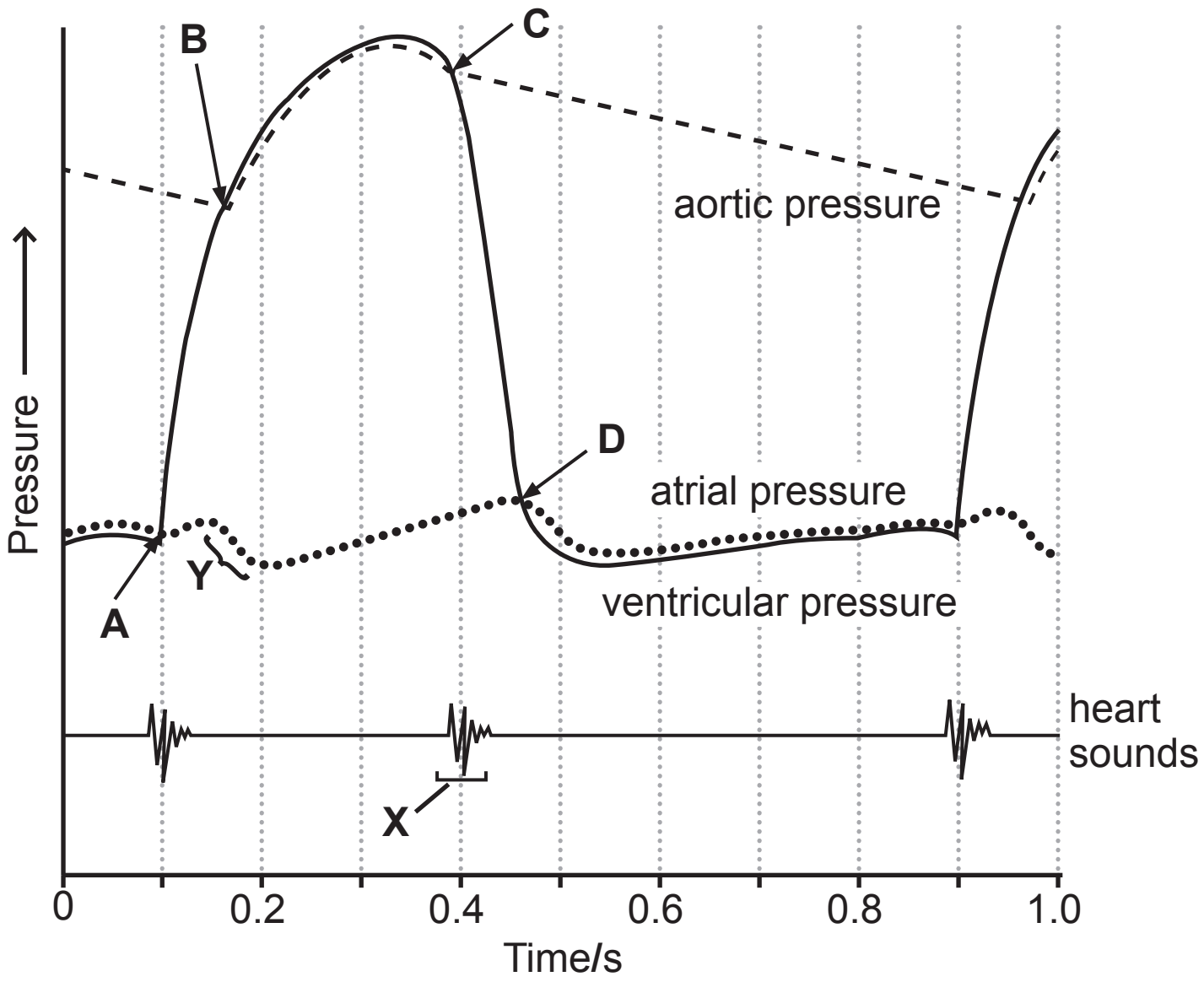
(Questions continue overleaf)

5 **(a)** The graph below shows pressure changes which take place in the left side of the heart during the cardiac cycle.



(i) Using information in the graph on page 12, determine the length of one complete cardiac cycle. [1 mark]

_____ s

(ii) State which letter **A**, **B**, **C** or **D**, represents the following events in the cardiac cycle: [2 marks]

- the closing of the atrio-ventricular valve _____
- the opening of the aortic (semi-lunar) valve _____

(iii) Explain what causes the heart sound shown at **X**. [1 mark]

_____

_____

(iv) Explain the decrease in atrial pressure shown at **Y**. [1 mark]

_____

_____

_____

(b) Blood leaves the right ventricle by the pulmonary artery and the left ventricle by the aorta. Suggest and explain **one** major difference between the structure of the wall of the aorta and the wall of the pulmonary artery.
[2 marks]

(c) The circulatory system of a mammalian foetus is different in some important ways from that of an adult mammal. The foetus exchanges respiratory gases and receives nutrients from its mother via the placenta.

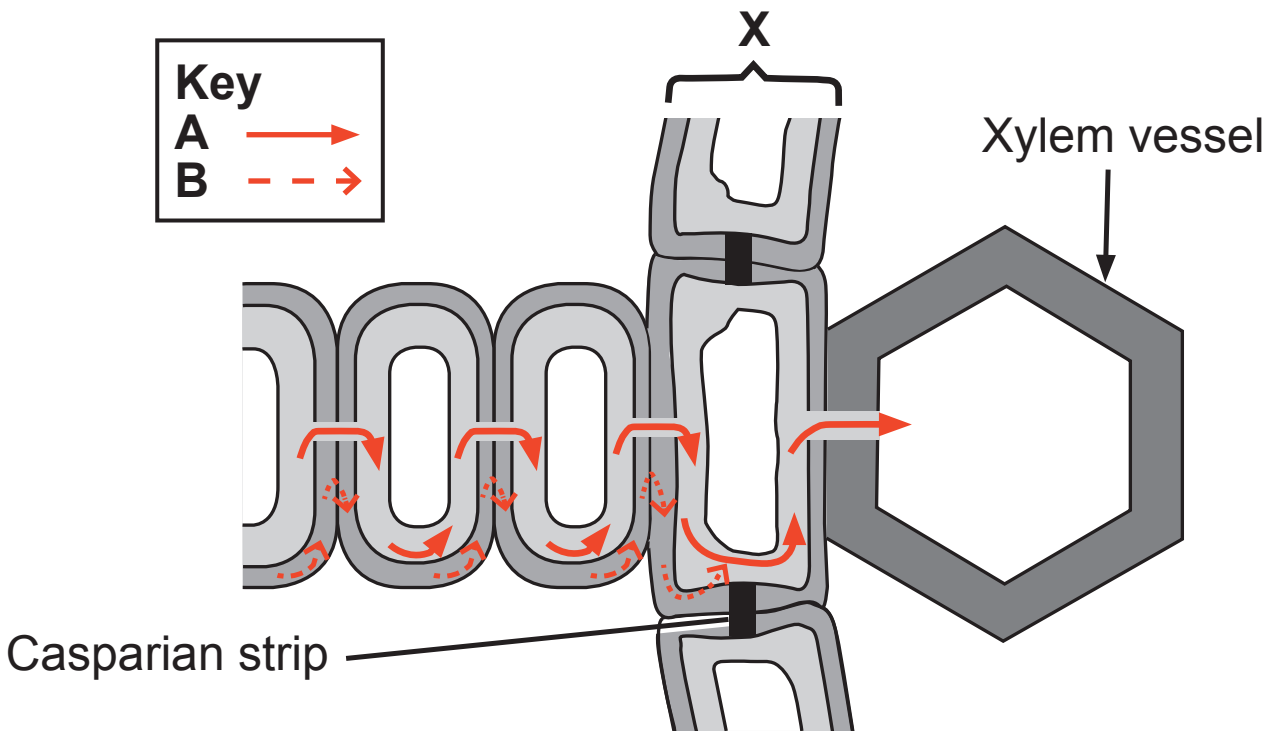
In addition, in the foetal heart, most of the blood moves directly from the right atrium to the left atrium, through a small opening in the septum (wall) between these chambers. This means that in the foetus, very little blood enters the right ventricle.

(i) Suggest and explain why blood moves directly from the right atrium into the left atrium in the foetus. [2 marks]

(ii) In most babies, the small opening in the septum between the right and left atria closes soon after birth. However, in a small number of cases, the opening does not close fully. These babies often suffer from oxygen shortage in their body organs.

Suggest why these babies often suffer from oxygen shortage in their body organs. [2 marks]

6 **(a)** The diagram below shows a cross section through part of a plant root. The arrows represent two pathways of water through the root.



(i) Identify the **two** pathways of water movement, labelled **A** and **B**, as shown in the diagram. [2 marks]

A _____

B _____

(ii) Name the cell layer labelled **X**. [1 mark]

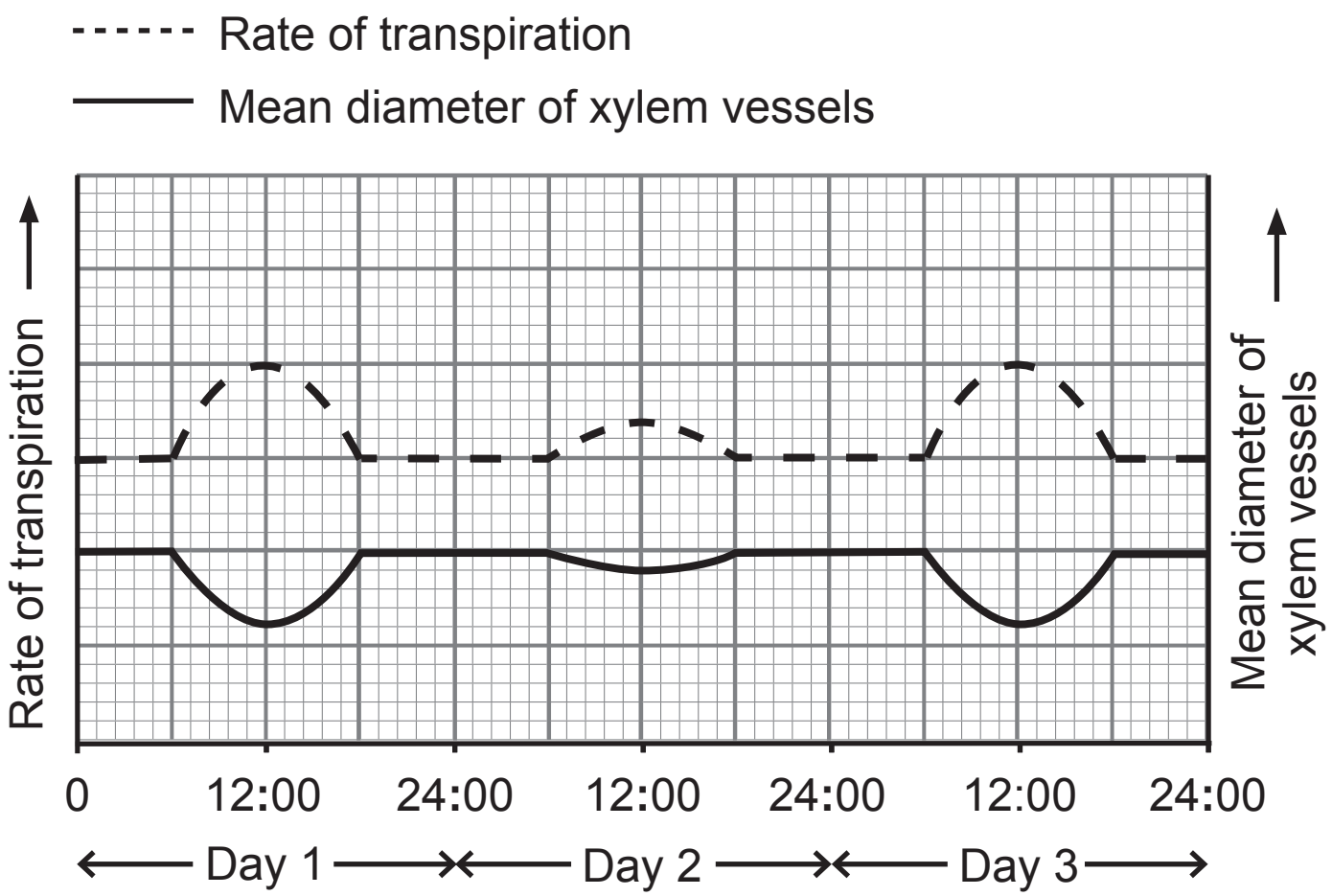
_____

(iii) Using the diagram on page 16 and your knowledge, explain fully the function of the Casparian strip. [2 marks]

(b) The diagram in **(a)** shows water entering a xylem vessel.

(i) Describe and explain **one** way in which xylem vessels are adapted for their function. [2 marks]

The relationship between rate of transpiration and mean diameter of xylem vessels over three days (in warm weather) is shown in the diagram below.



(ii) Describe and explain the relationship between rate of transpiration and mean diameter of xylem vessels. [3 marks]

7 **(a)** Orchids are small and delicate plants, which are rare in most Northern Ireland habitats. The different species are most easily identified by their distinctive flowers.

As each plant usually produces one spike (flower stalk), counting the number of spikes is a quick and relatively accurate way of counting the number of orchid plants in a particular habitat.

The numbers of plants for a range of orchid species in two different Northern Ireland habitats were counted in the summer of 2014. One habitat was an unimproved grassland, the other was a deciduous wood. The results (including Simpson's Index (**D**) for the unimproved grassland) are shown in the table on page 21.

(i) Using the information provided in the table on page 21, suggest why each habitat had to be sampled more than once to collect the orchid data. [1 mark]

		Number of plants recorded		
Orchid species	**Flowering period**	**Unimproved grassland**	**Deciduous wood**	**Comments**
Common spotted-orchid	May–August	25	7	Very common
Heath spotted-orchid	May–August	20	0	Common
Broad-leaved helleborine	July–October	0	27	Scattered distribution but common in some woods
Lesser twayblade	April–September	8	4	Not common
Bird's-nest orchid	April–June	0	5	Rare and declining in N Ireland
		D = 0.38		

[Turn over

(ii) Calculate the value for Simpson's Index (**D**) for the deciduous wood. [2 marks]

The formula for calculating **D** is presented as:

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

n_i = the total number of orchids of each individual species in the habitat

N = the total number of orchids of all species.

(Show your working.)

Answer _____

(iii) The unimproved grassland has no specific protection measures but the deciduous wood has been designated an ASSI. Using information from the table on page 21, suggest why the deciduous wood has been designated an ASSI. [1 mark]

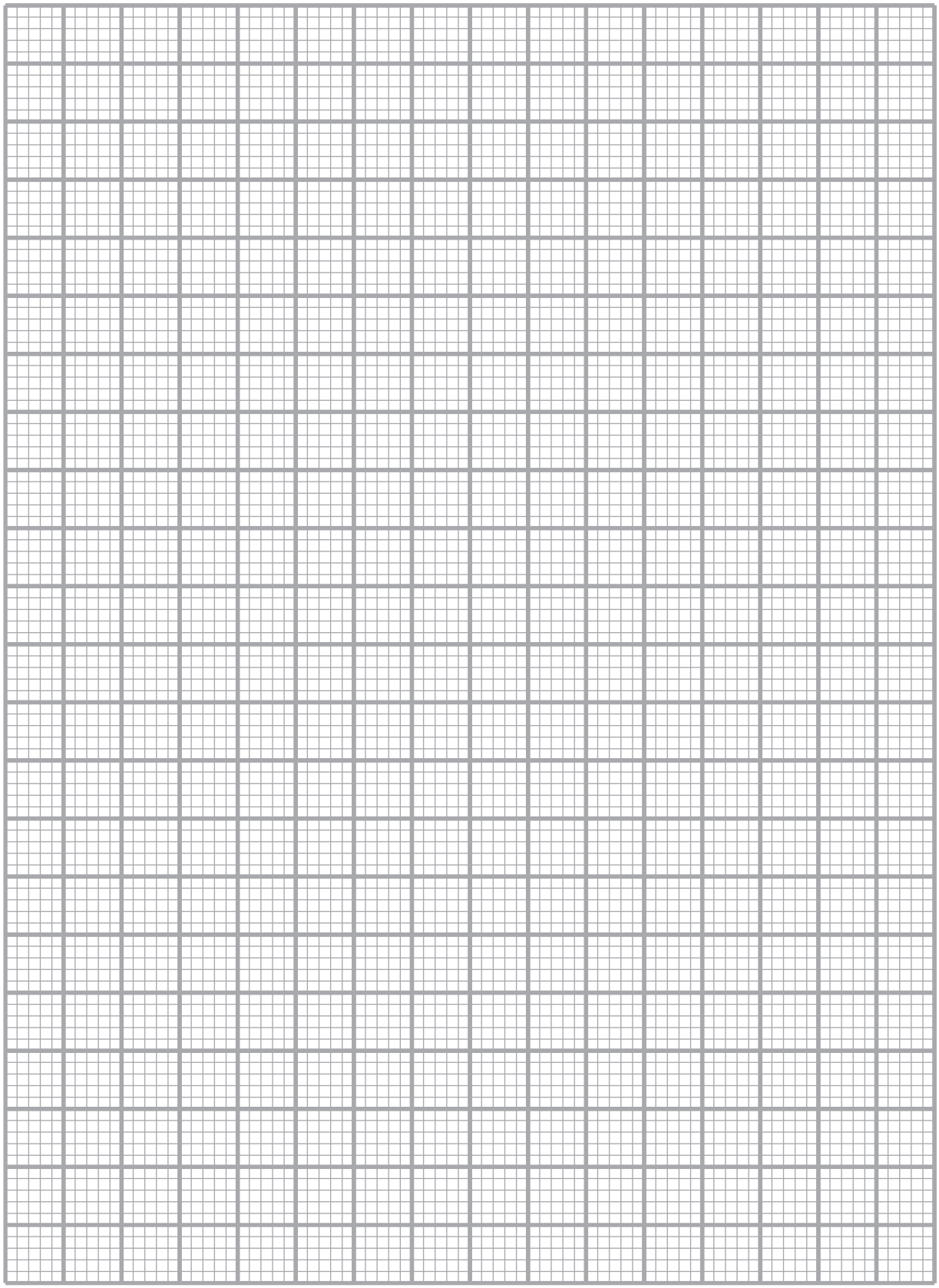
(iv) The addition of fertiliser to unimproved grassland increases the nutrient content of the soil. This favours the growth of fast-growing grass species.

Suggest and explain how the **D** value for orchids of the unimproved grassland would be affected if the grassland was treated with fertiliser. [2 marks]

(b) (i) Using the information provided, draw a graph showing orchid numbers in the two habitats on the graph paper on page 25. [4 marks]
(The relevant information from page 21 is repeated below.)

	Number of plants recorded	
Orchid species	**Unimproved grassland**	**Deciduous wood**
Common spotted-orchid	25	7
Heath spotted-orchid	20	0
Broad-leaved helleborine	0	27
Lesser twayblade	8	4
Bird's-nest orchid	0	5

(ii) Which orchid species shows the largest difference between the numbers found in the two habitats? [1 mark]



Section B

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

8 Haemoglobin is a protein which is highly adapted for transporting oxygen in the blood. In addition, its affinity for oxygen can change ensuring that sufficient levels of oxygen are delivered to, and released in, respiring tissues at times of high respiratory needs, e.g. during exercise, and for individuals living at high altitude.

(a) Describe and explain how the structure and properties of haemoglobin allow it to absorb oxygen and deliver it to respiring tissues. [6 marks]

(b) Describe and explain how haemoglobin is able to maximise the delivery and release of oxygen during strenuous exercise and at high altitudes. [7 marks]

Quality of written communication [2 marks]

(a) Describe and explain how the structure and properties of haemoglobin allow it to absorb oxygen and deliver it to respiring tissues.

(b) Describe and explain how haemoglobin is able to maximise the delivery and release of oxygen during strenuous exercise and at high altitudes.

THIS IS THE END OF THE QUESTION PAPER

SOURCES

Q2(b).....© Chief Examiner

Q4.....Source: Principal Examiner

Q5(a).....© Biology for CCEA AS Level by Dr James Napier. Published by Colourpoint Educational, 2012. (ISBN: 9781780730097)

Q6(a) .....© Biology for CCEA AS Level by Dr James Napier. Published by Colourpoint Educational, 2012. (ISBN: 9781780730097)

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

Examiner Number

Photograph 2.3A
(for use with Question 3(a))

Source: Chief Examiner

Photograph 2.3B
(for use with Question 3(b))

Source: Chief Examiner