Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2014

Biology

Assessment Unit AS 2
assessing
Organisms and Biodiversity

[AB121]

MV18

FRIDAY 20 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.
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 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.
This time may vary depending on any additional time allowance.
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 The rate of diffusion of gases across a membrane is calculated using Fick's Law. This involves a relationship between three factors:

- the surface area of the membrane
- the thickness of the membrane
- the concentration gradient across the membrane.

Complete the table below by placing a tick (✓) in the appropriate boxes to describe factors which would promote a **high** diffusion rate. [3 marks]

Factor	**Large**	**Small**
Surface area of the membrane		
Thickness of the membrane		
Concentration gradient across the membrane		

2 The land around Upper Lough Erne contains one of the largest areas of semi-natural woodland remaining in Northern Ireland. The woodland is dominated by mature oak, with occasional ash and birch. Hazel and holly often form a distinct shrub layer. The ground plant cover consists of a wide variety of species, including bluebell, sanicle, goldilocks buttercup, great wood-rush, and an abundance of the rare thin-spiked wood-sedge.

(a) Upper Lough Erne has the designation SAC. What do these letters represent? [1 mark]

_____

(b) With reference to the information given above, suggest **two** reasons why Upper Lough Erne has been designated as an SAC. [2 marks]

1. _____

_____

2. _____

_____

(c) The Department of Agriculture and Rural Development recommends that, to improve biodiversity, native species such as hawthorn are used when planting new hedgerows on farmland. Suggest why such species are preferred over non-native species. [1 mark]

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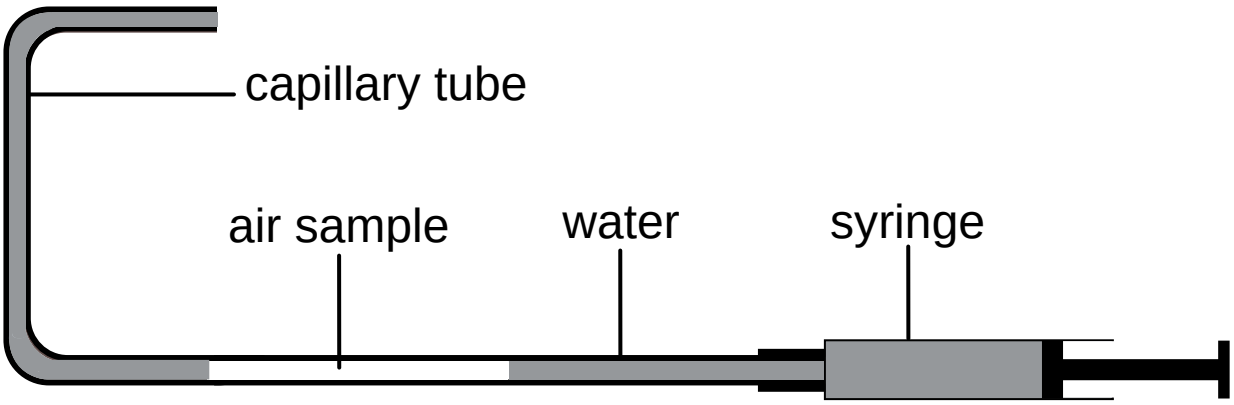
3 The J-tube, illustrated below, is used to analyse the gas composition of an air sample.



Describe how the J-tube would be used to determine the concentration of carbon dioxide in the air sample in the capillary tube. [5 marks]

4 A conservation agency wished to investigate the effect of grazing on biodiversity in a moorland habitat. Two equal-sized areas were marked out and one was then fenced off so that sheep could not graze there.
Every month over a period of two years, 20 quadrats were randomly placed in both areas. The percentage cover of plants present in each quadrat was recorded.

(a) Suggest **one** way of ensuring that the results obtained are as accurate as possible. [1 mark]

_____

_____

As a result of the two year study into the difference between the grazed and non-grazed areas, the following values for Simpson's Index (D) were calculated.

	Grazed area	**Non-grazed area**
Simpson's Index (D)	0.32	0.56

(b) Identify the area with the higher biodiversity and suggest how this might have arisen. [2 marks]

_____

_____

_____

_____

From June to September, the vegetation in both grazed and non-grazed areas was sampled with a sweep net, and several pitfall traps were also placed in each area. This was in order to monitor the presence of the parasite, **Ixodes ricinus.**
The female adults of this species pierce the skin of large mammals such as sheep, and feed on their blood for several days. They then fall off in order to lay eggs on the vegetation and so continue the life-cycle.

The occurrence of **Ixodes ricinus** was recorded in the table below.

Sampling method	**Mean monthly number of Ixodes ricinus collected**	
	Grazed area	**Non-grazed area**
Sweep net	11.2	1.3
Pitfall trap	0.8	0

(c) Suggest reasons for the results obtained in this study. [2 marks]

(d) People walking through long vegetation on moorland during the summer months can sometimes be bitten by **Ixodes ricinus**. As a result of this, a bacterium which causes Lyme disease can be transmitted into the blood. Describe **two** distinct ways in which the white blood cells might respond to the bacterial infection. [4 marks]

1. _____

_____

_____

_____

2. _____

_____

_____

_____

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(Questions continue overleaf)

5 **Photograph 2.5** shows a bracket fungus **(Trametes versicolor)** which is commonly found growing on dead woodland trees such as oak or beech. Like all fungi, **Trametes versicolor** is a lysotroph.

(a) Define the term 'lysotroph'. [1 mark]

(b) This bracket fungus is partially covered by another organism (**A**) which is a member of the genus, **Sphagnum**. Using a feature clearly visible in the photograph, identify the kingdom to which **Sphagnum** belongs and give a reason for your choice. [2 marks]

Most of the fungus is composed of many strands of thin hyphae which are found within the trunk of the tree stump. The externally observable 'bracket' is the reproductive structure, which produces spores in late summer and early autumn. The spores are blown away by the wind and, if they land on a suitable food source, will germinate in warm damp conditions.

(c) Using this information, explain **three** adaptations of this fungus. [3 marks]

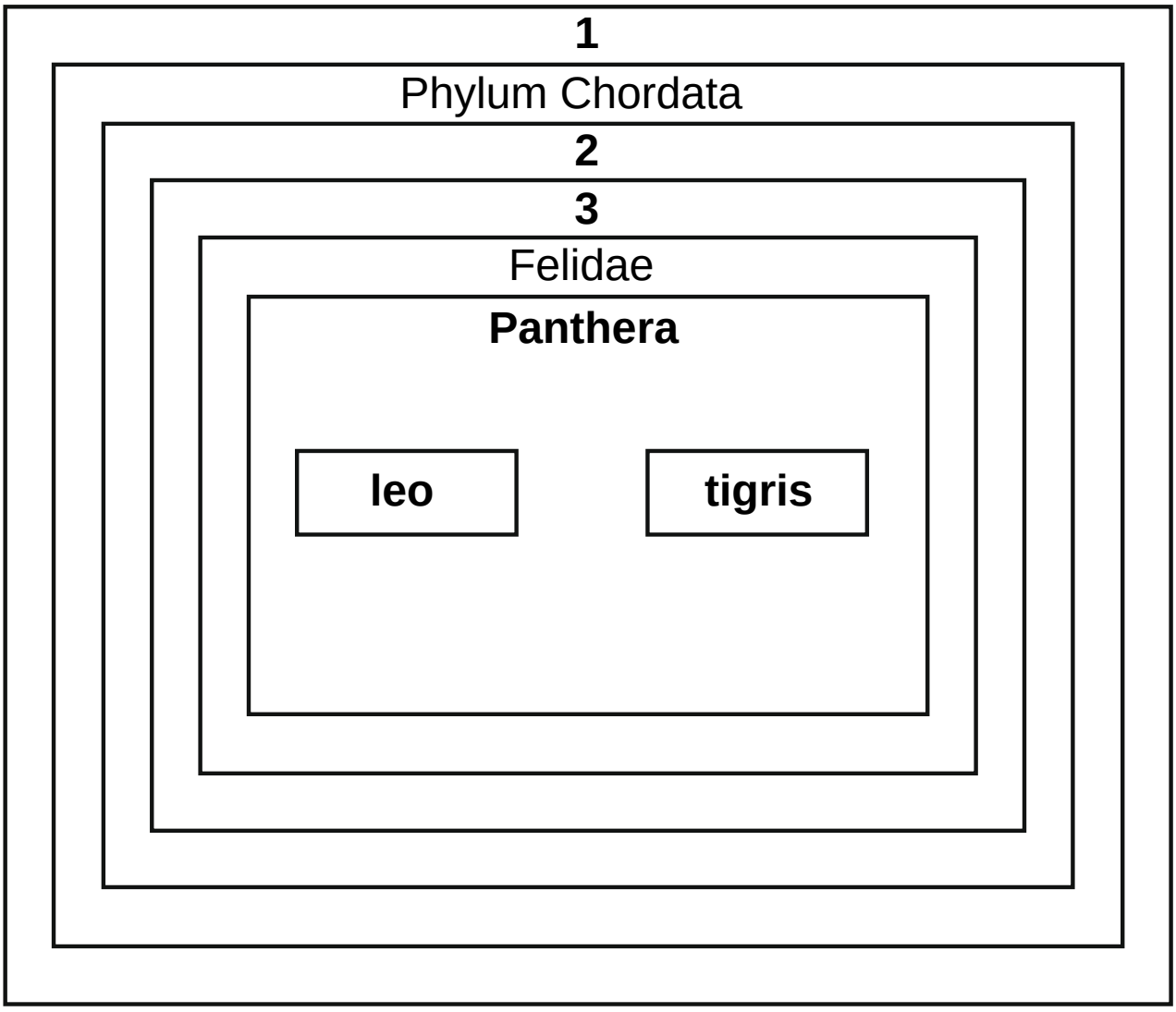
(d) There are several plant species at ground level in **Photograph 2.5** whose leaves have clearly visible veins. These veins contain xylem vessels.

Describe concisely the main features of the cohesion-tension theory which is proposed as the mechanism by which water flows through xylem vessels. [3 marks]

6 Under the binomial nomenclature system, the lion is classified as **Panthera leo** and the tiger as **Panthera tigris**. Both species are members of the family Felidae, the class Mammalia, and the order Carnivora.

(a) In the context of classification, define the term 'order'. [1 mark]

A diagrammatic representation of the taxonomy of the lion and tiger is shown below. Each box represents a different taxonomic grouping.



(b) Identify the taxonomic groupings represented by the numbers: [3 marks]

1 _____

2 _____

3 _____

(c) Captive male lions and female tigers in zoos and wildlife parks have been bred with each other producing offspring which are known as ligers. Suggest why no liger populations exist in the wild. [1 mark]

_____

_____

Classifying lions and tigers in this way is an example of phylogenetic taxonomy.

One method used to undertake phylogenetic taxonomy is to compare the primary structure of proteins.
Cytochrome-c is a protein involved in respiration, and is found in all eukaryotes. There are over one hundred amino acids in this protein and analysing the amino acid sequence can be used to suggest evolutionary relationships between organisms.

A partial amino acid sequence (amino acids from positions 60 to 69) of cytochrome-c in four organisms is shown in the table below.

	Amino acid									
Position / **Organism**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**
Human	Asp	Lys	Asp	Lys	Gly	Ile	Ile	Try	Glu	Asp
Rhesus monkey	Asp	Lys	Asp	Lys	Gly	Thr	Ile	Try	Glu	Asp
Chicken	Asp	Lys	Asp	Glu	Gly	Thr	Ile	Try	Glu	Asp
Silkworm	Asp	Lys	Ala	Phe	Gly	Thr	Ile	Try	Asp	Asp

(d) (i) Suggest **one** reason why cytochrome-c is a suitable protein to use for this type of study. [1 mark]

_____

_____

(ii) Identify the amino acid positions at which the sequences of the chicken and the silkworm differ. [1 mark]

_____

(iii) Calculate the percentage of amino acids which differ between the sequences of the chicken and the silkworm. [2 marks]
(Show your working.)

Answer _____ **%**

(iv) The amino acid sequences for the human and the Rhesus monkey differ by 10**%**, whilst there is a 20**%** difference between that of the human and the chicken. Suggest how these values would be interpreted to propose the evolutionary relationships between the three species. [1 mark]

_____

_____

_____

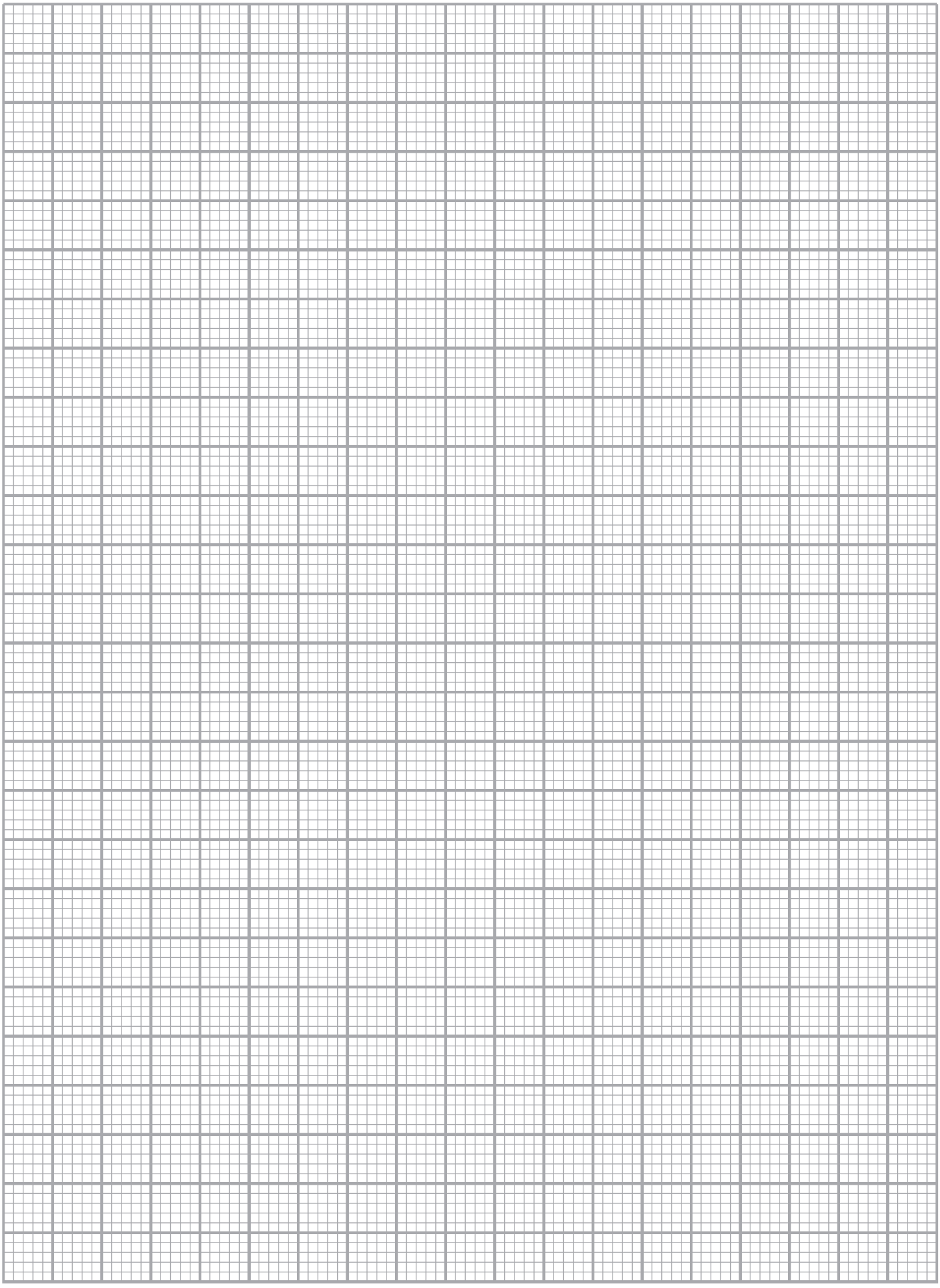
7 A bubble potometer was used to investigate the rate of water uptake by a leafy shoot from a young sycamore tree.

A hairdryer was used to investigate the effect of wind strength and environmental temperature on the rate of movement of the trapped bubble. The temperature was varied by selecting either the hot or cold setting on the hairdryer, and the wind strength was varied by changing the distance between the hairdryer and the shoot.

The results are shown in the table below.

Distance (d) of hairdryer from shoot/cm	**Wind strength (1/d)/arbitrary units**	**Rate of bubble movement /mm min^{-1}**	
		Cool setting on hairdryer	Hot setting on hairdryer
11	0.09	5.2	3.8
14	0.07	4.1	4.9
20	0.05	3.1	6.2
25	0.04	2.4	5.1
50	0.02	1.0	2.3

(a) Using the most appropriate graphical technique, plot the above data for the caption:
"**How the rate of bubble movement in a potometer containing a sycamore shoot is affected by wind strength at two different environmental temperatures"**.
(Use the graph paper opposite.)
Note: You do not need to include the caption on the graph. [4 marks]



(b) Describe and explain the trend shown by the results for the hairdryer on the cool setting. [3 marks]

(c) Describe **two** ways in which the trends shown for the two heat settings differ and give an explanation for each difference. [4 marks]

Difference **1**

Explanation

Difference **2**

Explanation

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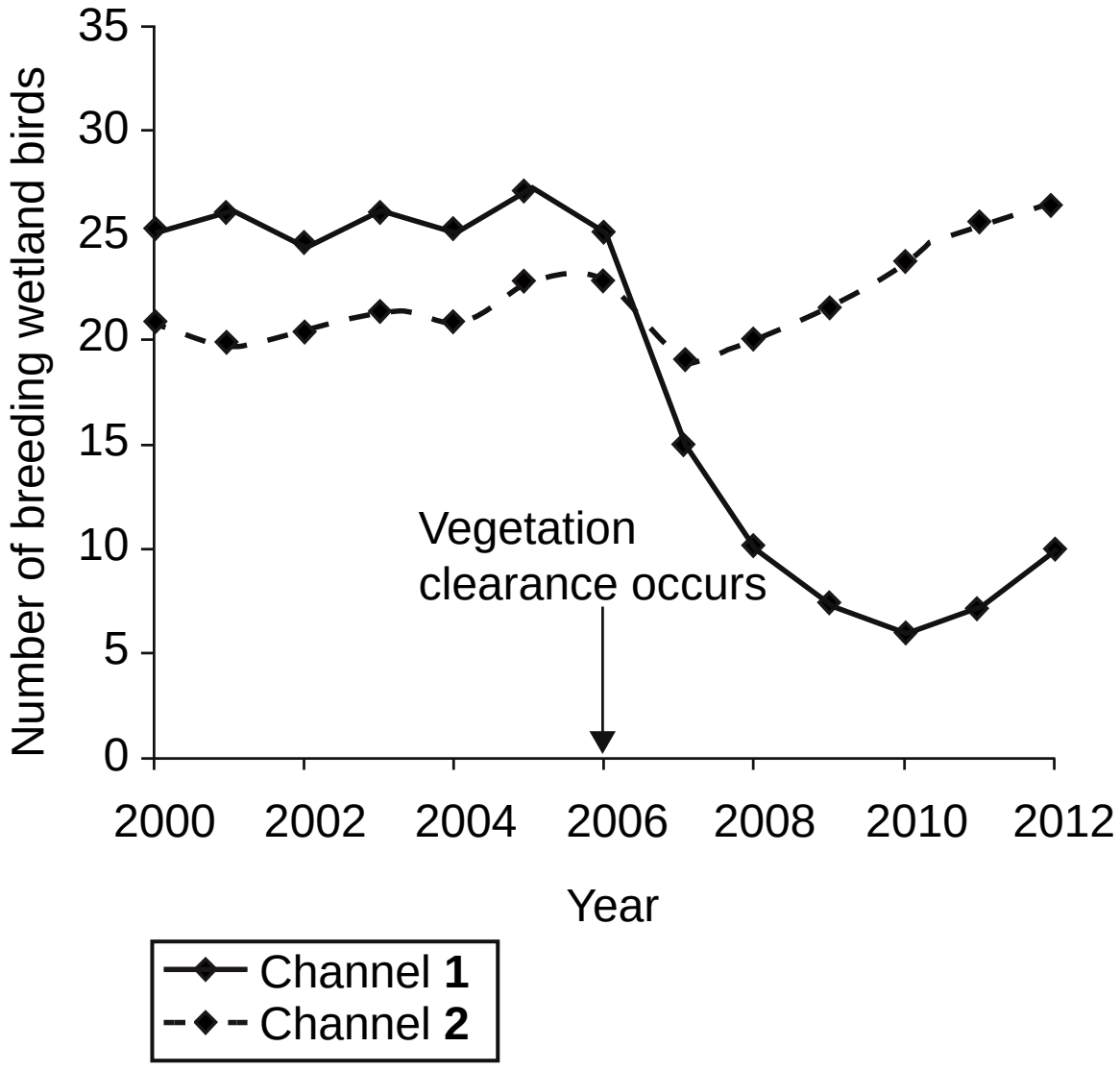
(Questions continue overleaf)

8 Drainage channels are important in preventing excessive waterlogging and flooding of low-lying farmland. Left undisturbed, they become overgrown with plants and function less effectively. However, such overgrown drainage channels form important wildlife habitats.

The sides of two overgrown drainage channels were cleared of vegetation using two different strategies:

- Channel **1** had both sides cleared
- Channel **2** had only one side cleared.

The total number of breeding wetland birds at each channel was surveyed for a number of years before and after clearance, which occurred in 2006.



(a) Describe the trends in bird numbers for both channels from 2000 to 2012. [3 marks]

(b) Suggest possible reasons for the changes in the number of birds in each channel after 2006. [2 marks]

Channel **1**

Channel **2**

(c) In order to promote biodiversity on farms, agri-environment schemes often suggest reducing the amount of artificial fertiliser used on farmland.

(i) Describe **two** ways in which excessive use of artificial fertiliser might have a negative effect on biodiversity on the land. [2 marks]

(ii) Using the information at the beginning of this question, suggest how the use of artificial fertilisers on low-lying farmland might actually increase biodiversity around drainage channels. [2 marks]

Section B

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

9 The mammalian circulatory system consists of different types of blood vessels which facilitate the transport and exchange of materials within the organism. In the event of a blood vessel becoming ruptured, a blood clotting mechanism is activated in order to protect against infection and prevent excessive blood loss.

(a) Describe the main structural adaptations found in mammalian blood vessels which facilitate their role in transport and exchange. Explain the purpose of these adaptations. [9 marks]

(b) Outline the sequence of events which leads to the formation of a blood clot following a minor cut to the skin. [4 marks]

Quality of written communication [2 marks]

(a) Describe the main structural adaptations found in mammalian blood vessels which facilitate their role in transport and exchange. Explain the purpose of these adaptations.

(b) Outline the sequence of events which leads to the formation of a blood clot following a minor cut to the skin.

Extra lined page

SOURCES

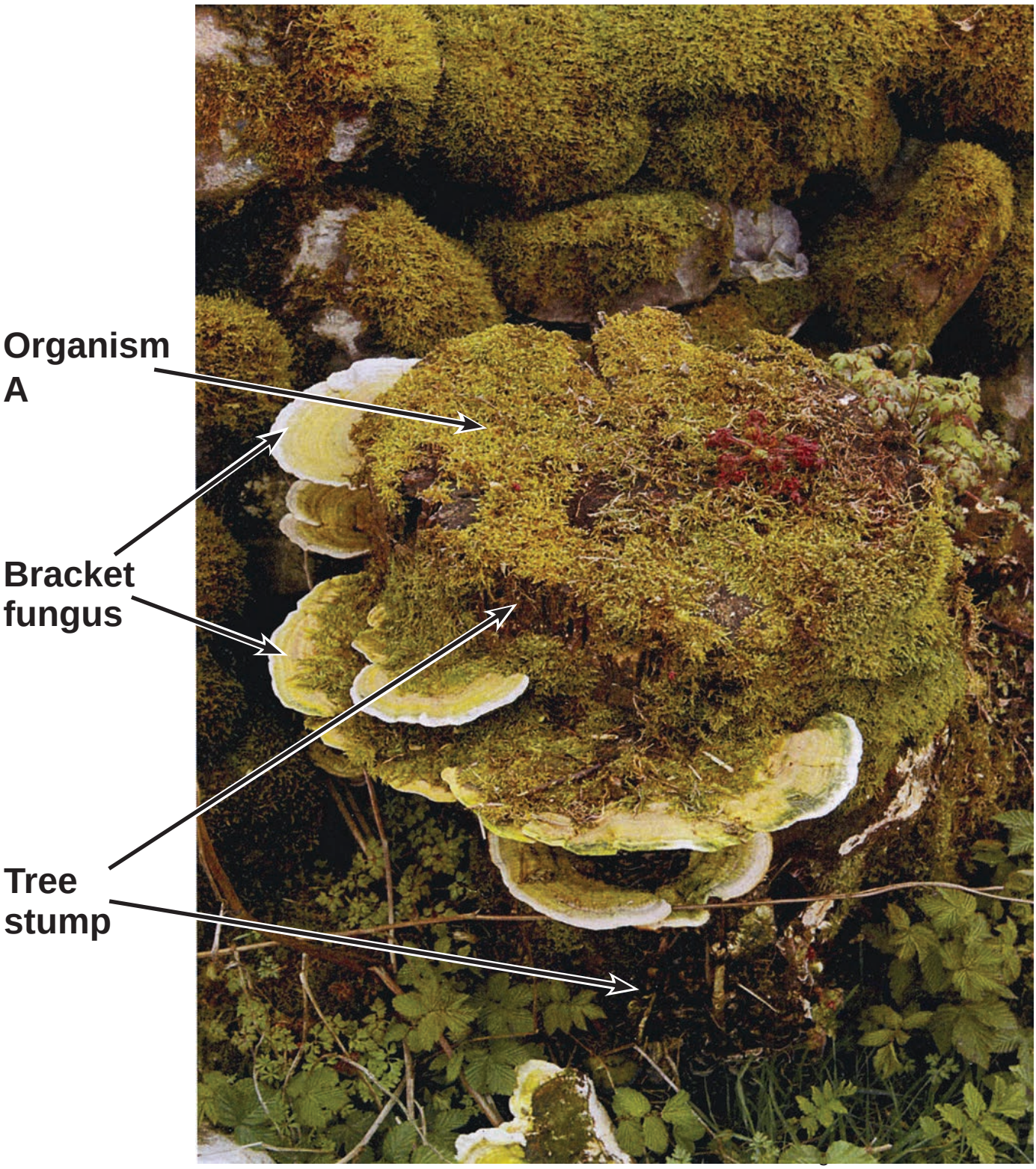
Q2.....Adapted from http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0016614

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

GCE Biology Advanced Subsidiary (AS)

Assessment Unit AS 2
Organisms and Biodiversity
Summer 2014

Photograph 2.5 (for use with Question 5)



Source: Chief Examiner