Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2019

Centre Number

Candidate Number

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[SBY21]

SBY21

FRIDAY 24 MAY, MORNING

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.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all eight** questions.

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.

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Section A

1 The five-kingdom classification system consisting of kingdoms Prokaryotae, Protoctista, Fungi, Plantae and Animalia is widely used by many scientists.

(a) Describe **three** features of kingdom Prokaryotae.

1. _____

2. _____

3. _____ [3]

(b) State the term for a group of similar and closely related species.

_____ [1]

(c) **(i)** Cell structure is one source of evidence used to classify organisms. State **two** other sources used for this purpose.

1. _____

2. _____ [2]

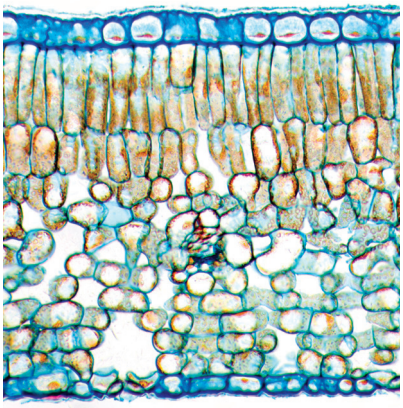
(ii) Suggest **one** reason why the classification of organisms can change.

_____

_____ [1]

2 Organisms are adapted to survive in different environments. The photomicrographs below (**A**, **B** and **C**) show transverse sections through xerophytic, mesophytic and hydrophytic plant leaves.

A



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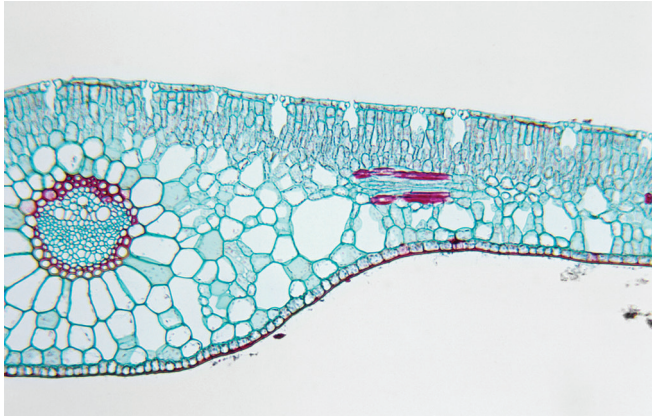
B



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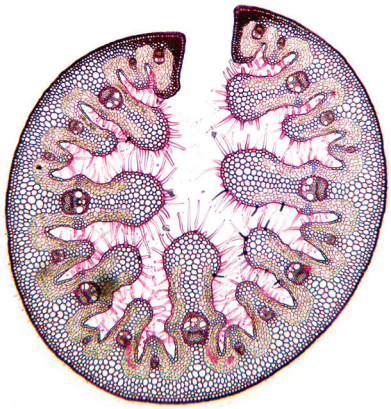
C



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(a) **(i)** Identify the photomicrograph (**A**, **B** or **C**) which shows a xerophytic leaf.

_____ [1]

(ii) Identify **two** adaptations of xerophytic leaves visible in the photomicrograph.

1. _____

2. _____ [2]

(iii) Explain how **one** of these adaptations can reduce water loss.

_____

_____

_____ [1]

Many animals exhibit behavioural adaptations to their environment.

(b) Suggest **one** behavioural adaptation of an animal and explain how it is beneficial to the animal.

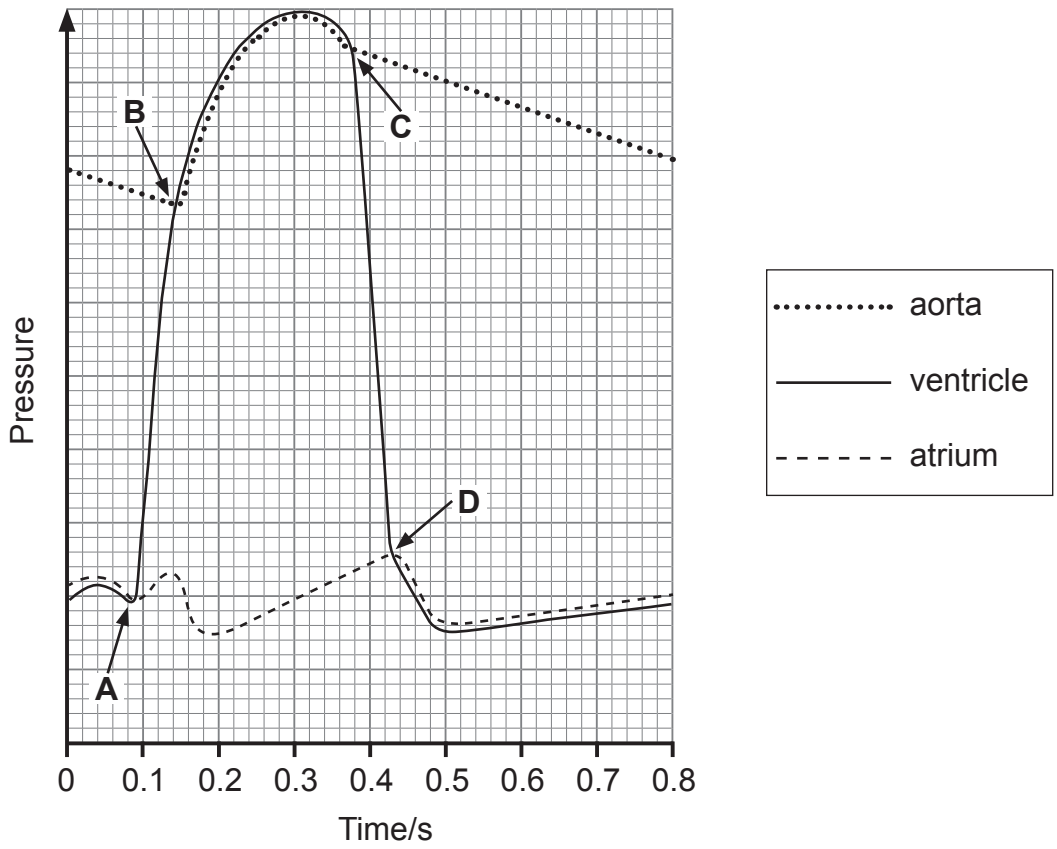
_____

_____

_____

_____ [2]

3 The graph below shows pressure changes which take place in the left side of the heart during one complete cardiac cycle.



(a) (i) State which letter, **A**, **B**, **C** or **D**, represents the following events in the cardiac cycle:

- the closing of the atrioventricular valves _____
- the opening of the semilunar valves_____ [2]

(ii) Explain the following:

- the increase in ventricular pressure between 0.1 and 0.3s

_____

_____ [1]

- the increase in atrial pressure between 0.1 and 0.14s

_____

_____ [1]

Contraction of the heart is initiated by electrical activity within the cardiac muscle. To enable ventricular contraction, the wave of excitation passes down the septum of the heart to the bottom of the ventricles.

(b) Explain why it is important that ventricular contraction begins at the bottom of the ventricles.

_____

_____

_____ [1]

4 Cuilcagh Mountain in Co. Fermanagh has a range of habitats and species. One such habitat is blanket bog, which is a rare habitat with specific ecological niches.

Walking is a popular activity and a wooden boardwalk has recently been constructed to span the blanket bog, as shown in **Photograph 1** below.

Photograph 1

Source: Principal Examiner

(a) **(i)** Define the term 'ecological niche'.

_____

_____

_____ [1]

(ii) The function of the boardwalk is to protect the blanket bog habitat. Suggest why it is particularly important to protect this habitat.

_____

_____ [1]

(b) There are several initiatives in Northern Ireland to conserve habitats and promote biodiversity. Name **one** of these initiatives.

_____ [1]

(c) **Photograph 2** below shows sphagnum moss (*Sphagnum papillosum*) and hare's-tail cotton grass (*Eriophorum vaginatum*). These plant species thrive in the waterlogged conditions of the blanket bog.

Photograph 2

Source: Principal Examiner

(i) Name **two** edaphic factors which may affect the distribution of plant species in the bog.

_____

_____ [2]

(ii) Suggest how **one** of these factors results in a limited variety of plant species thriving in the blanket bog.

_____

_____

_____

_____

_____

_____ [2]

Cuilcagh Mountain is also an important breeding site for the golden plover (*Pluvialis apricaria*). These birds make shallow nests on the ground, usually in a patch of vegetation lined with grasses and moss. Conservation scientists monitored the number of breeding pairs of birds over a 12-year period.

The table below shows some of their results. The boardwalk was completed in 2015.

Year	Number of breeding pairs
1995	12
2006	4
2017	7

(d) (i) Calculate the percentage decrease in the number of breeding pairs of golden plover in the area from 1995 to 2006.
(Show your working.)

_____% [2]

(ii) Using all the information provided, describe and explain the trends shown by the results.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

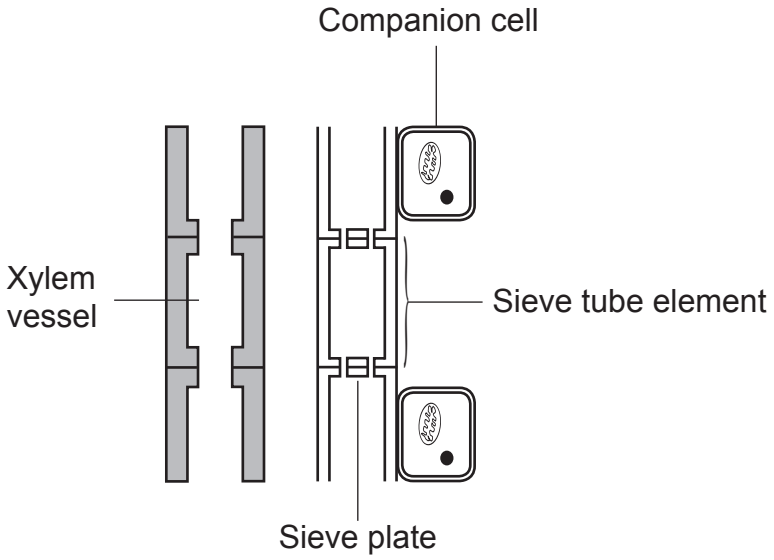
(iii) Suggest why the results shown would not allow a firm conclusion to be made about the effect of the boardwalk on golden plover breeding populations.

_____

_____

_____ [1]

5 Transport of water and organic solutes in flowering plants is carried out by two types of vascular tissue, xylem and phloem. The diagram below represents a longitudinal section from the stem of a flowering plant.



(a) **(i)** State the function of companion cells.

_____

_____

_____ [1]

(ii) State **two** ways in which the process of transport in the xylem differs from that in the phloem.

1. _____

_____

_____

2. _____

_____

_____ [2]

Sieve plates are modified cell walls containing pores and are an important feature of phloem tissue. They affect the flow of organic solutes within the phloem.

If the phloem wall is damaged, the plant responds by blocking the sieve plates around the site.

(b) Suggest **one** advantage and **one** disadvantage to the plant of this response.

Advantage _____

_____

_____

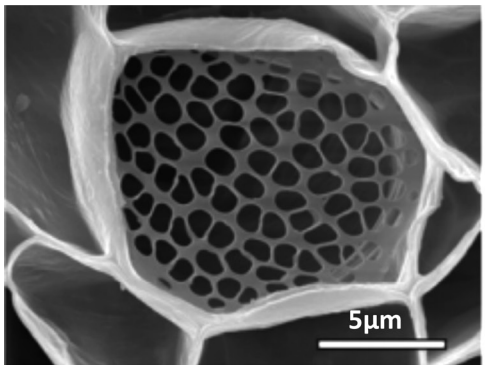
Disadvantage _____

_____

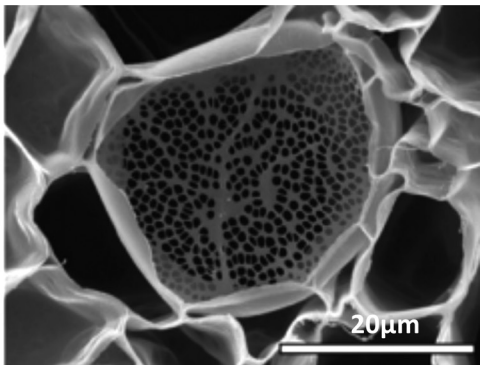
_____ [2]

(c) The scanning electron micrographs below show sieve plates from two different plant (bean) species. As shown, the images do not have the same magnification.

The number and size of sieve plate pores affect the rate of translocation within phloem tissue.



Phaseolus vulgaris
× 4000



Ricinus communis
× 1500

© American Society of Plant Biologists. Article by Daniel L. Mullendore, Carel W. Windt, Henk Van As, Michael Knoblauch. http://www.plantcell.org/content/22/3/579

The table below provides additional information on structure and function of phloem tissue in the two species.

Species	Average pore radius/µm	Average number of pores per sieve plate	Average length of one sieve tube element/µm	Time taken for contents to flow through sieve tube element/s
P. vulgaris	0.7	95	200	
R. communis	0.5	372	302	1.01

(i) The contents of the sieve tube elements travel at an average rate of $300\,\mu m\,s^{-1}$. Using the information provided in the table, calculate the time taken for the contents to flow through a sieve tube element of *P. vulgaris*. (Show your working.)

_____ s [2]

(ii) *P. vulgaris* and *R. communis* are similar sized plants and, despite the difference in their phloem tissue, they maintain similar rates of translocation around the plant. Using the information from the table, suggest how the features of their phloem tissue result in similar rates of translocation.

_____

_____

_____

_____

_____

_____ [2]

6 Global warming is associated with increased atmospheric carbon dioxide (CO_2) concentration and can cause disruption to weather patterns.

The island of Mauritius is inhabited by the Mauritian kestrel (*Falco punctatus*), a bird of prey which is found in the evergreen forests on the island and feeds on other small birds, mammals, lizards and insects.

On the island, spring is traditionally a relatively dry season, and this is when the kestrels usually breed. This ensures the offspring are at least several months old by summer, when heavy rain and storms are common.

Recently, rainfall in early spring has increased on the island, and it has been noted that kestrel breeding has been delayed until late spring or early summer. This results in the offspring being very young when the summer storms arrive.

(a) Suggest how increased early spring rainfall may affect the size of the kestrel population on Mauritius. Explain your answer using information from the passage and your knowledge of factors that affect population size.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Evidence suggests that atmospheric CO_2 concentration remained relatively stable for millions of years.

Between 1960 and 1970, the atmospheric CO_2 concentration increased by an average of 0.7 ppm (parts per million), whereas between 2015 and 2016 it increased by an average of more than 2.0 ppm.

There is evidence that the last time the Earth experienced atmospheric CO_2 levels similar to 2016 was 3–5 million years ago, when global temperatures were 2–3°C higher than at the present time.

(b) It is widely accepted by the scientific community that human activity has caused the recent dramatic increase in atmospheric CO_2. However, there are some who believe that the increase is a natural occurrence. Select information from the passage above which provides evidence for each point of view.

Evidence that human activity is the cause of increased CO_2 levels

_____

_____

_____

Evidence that increased CO_2 levels is a natural occurrence

_____

_____

_____ [2]

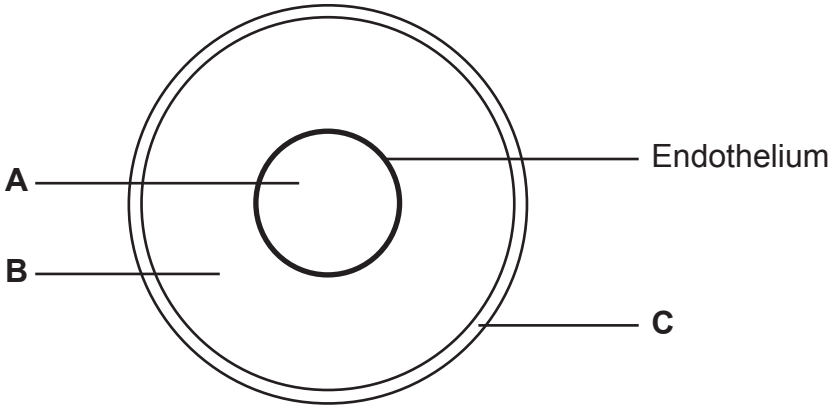
(c) Outline how global warming could result in a shift of the ecological range of a species.

_____

_____

_____ [1]

7 The diagram below represents a transverse section of the aorta of a mammal.



(a) **(i)** Identify **A**, **B** and **C**.

A _____

B _____

C _____ [3]

(ii) Vasodilation alters the size of the part labelled **A** on the diagram. Describe how vasodilation occurs and explain its effect on blood flow.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Histamine is a chemical that causes vasodilation and can be used to treat high blood pressure. Histamine receptors can be found within the endothelium of arteries.

An experiment was carried out to investigate the effect of increasing histamine concentration on vasodilation in the aorta.

Sections of rat aorta, some with the endothelium removed, were suspended in a bath of sodium hydrogencarbonate. Two types of stimulus were applied to the aorta sections. The extent of vasodilation which occurred in the aortas was measured.

(b) (i) Suggest the role of sodium hydrogencarbonate in this experiment.

_____ [1]

(ii) Other than ethical reasons, suggest why rat aorta sections were used instead of mouse aorta sections.

_____ [1]

The results of the experiment are shown in the table below.

Histamine concentration /M	Average vasodilation/arbitrary units			
	Stimulus A		Stimulus B	
	With endothelium	Without endothelium	With endothelium	Without endothelium
10^{-7}	64	0	0	0
10^{-6}	72	0	3	0
10^{-5}	75	0	10	0
10^{-4}	75	1	25	1
10^{-3}	75	2	32	2

Increasing concentration ↓

(iii) Identify the trends shown by these results.

_____

_____

_____

_____

_____

_____

_____

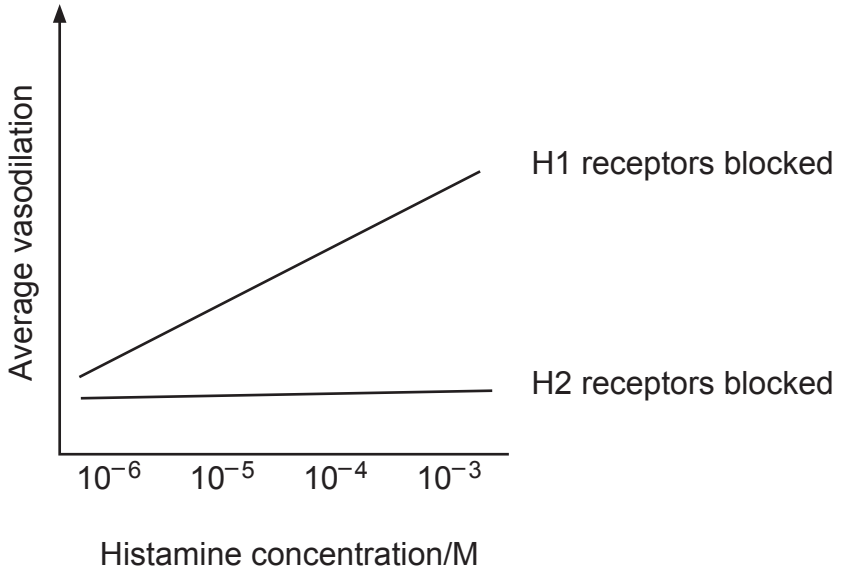
_____

_____

_____

_____ [4]

(c) In the endothelium, histamine binds to two receptors, H1 and H2. When each of these receptors was blocked with inhibitors, investigators were able to determine its importance for the vasodilation of the aorta when histamine was present. During the experiment the aorta received stimulus A only. The results are summarised below.



(i) Describe the effect of increasing histamine concentration on average vasodilation when H1 receptors are blocked.

_____

_____

_____ [1]

(ii) State **one** conclusion that can be drawn from these results regarding the role of histamine receptors in vasodilation.

_____

_____

_____ [1]

[Turn over

Section B

Quality of written communication will be assessed in this section.

Fick's Law describes the relationship between the factors that affect the rate of diffusion.

The gas exchange structures of plants and mammals are adapted to maximise the rate of diffusion leading to high rates of gas exchange. However, smoking can reduce gas exchange by affecting the factors described in Fick's Law.

8 State Fick's Law and describe how the gas exchange structures of **plants** and **mammals** are adapted to maximise diffusion of gases. Your answer should include the effect of smoking on the lungs with reference to the factors in Fick's Law. [15]

State Fick's Law and describe how the gas exchange structures of **plants** and **mammals** are adapted to maximise diffusion of gases. Your answer should include the effect of smoking on the lungs with reference to the factors in Fick's Law.

[Turn over

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Question Number	Marks
1	
2	
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Total Marks	

Examiner Number

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