Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2022

Centre Number

Candidate Number

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[SBY21]

SBY21

MONDAY 30 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 seven** 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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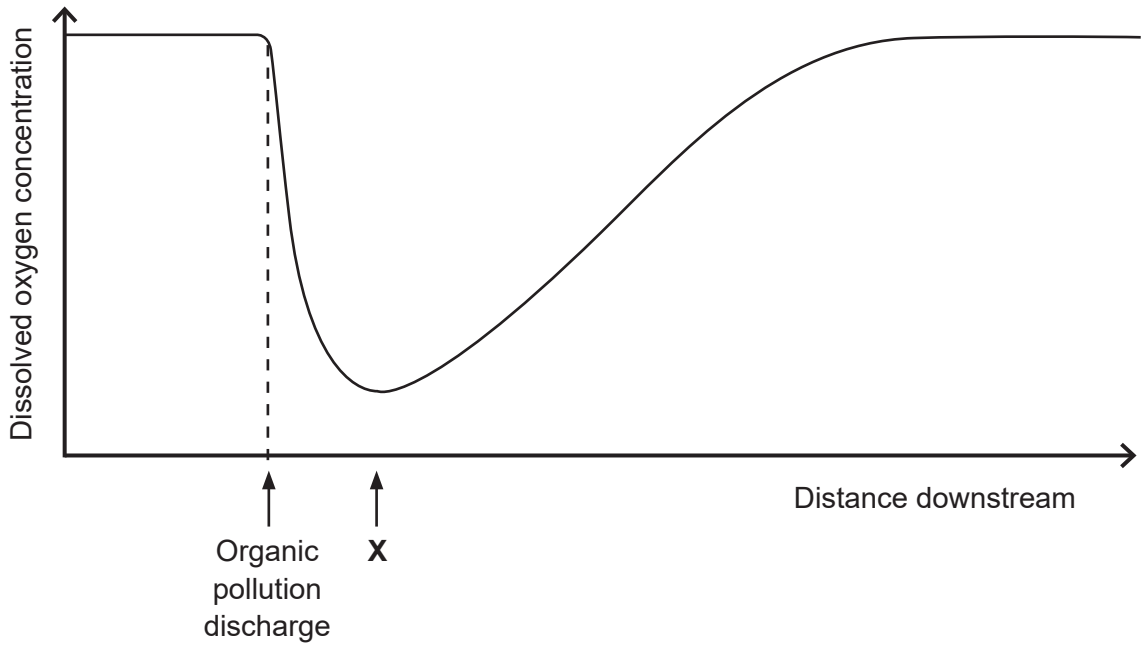
Section A

1 Organic matter can pollute waterways. The graph below represents the concentration of dissolved oxygen in the water upstream and downstream from an organic pollution discharge.



Source: Chief Examiner

(a) State **one** source of organic pollution.

_____ [1]

(b) Explain the low dissolved oxygen concentration at **X**.

_____

_____

_____

_____

_____

_____ [2]

(c) Describe **one** way in which organic pollution differs from eutrophication.

_____

_____

_____ [1]

(d) Describe **one** way in which water pollution can be reduced.

_____

_____

_____ [1]

2 **(a)** Taxonomy involves classifying organisms according to presumed ancestral relationships. Systems of classification involve the organisation of species into increasingly large groups.

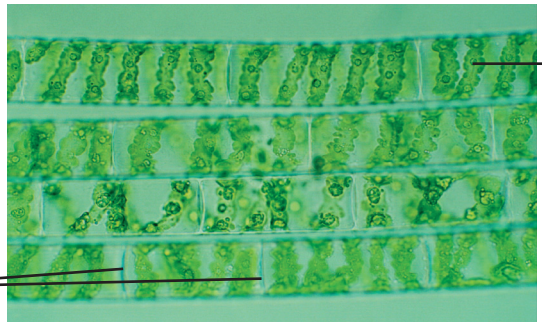
Complete the table below using the most appropriate terms.

Species
Class
Kingdom

[2]

(b) This five-kingdom classification system includes the Kingdom Protoctista. The photomicrographs below show two examples of organisms classified in Kingdom Protoctista.

Spirogyra



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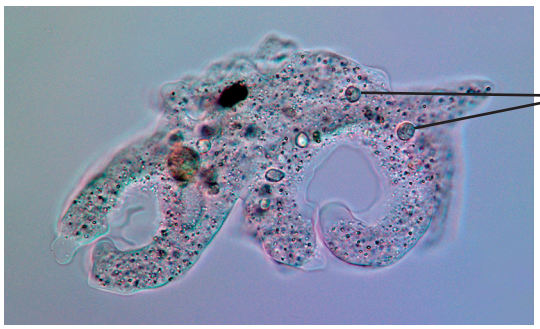
Amoeba



© Marek Mis / Science Photo Library

(i) State **two** features common to all members of Kingdom Protoctista.

1. _____

_____

2. _____

_____ [2]

(ii) Members of Kingdom Protoctista may be heterotrophic or autotrophic.

Using the photomicrographs, suggest which of the two organisms shown is autotrophic.

Explain your answer.

Organism _____

Explanation _____

_____

_____ [2]

(c) Using the photomicrograph, state **one** reason why Amoeba is not classified in Kingdom Prokaryotae.

_____

_____ [1]

3 **(a)** For gas exchange to occur at a sufficient rate, an organism's gas exchange surfaces must be adapted for the process. A moist surface is one of these adaptations.

Explain the importance of this adaptation and suggest how this is achieved in mammals.

_____

_____

_____

_____

_____

_____ [2]

(b) Scientists discovered that plants growing in air with abnormally high levels of CO_2 have more cells in their spongy mesophyll than plants growing in normal air. This increased density of cells in the spongy mesophyll tissue leads to a reduced rate of photosynthesis.

(i) Suggest why photosynthesis rate is reduced if there is an increased number (density) of cells in the spongy mesophyll layer.

_____

_____

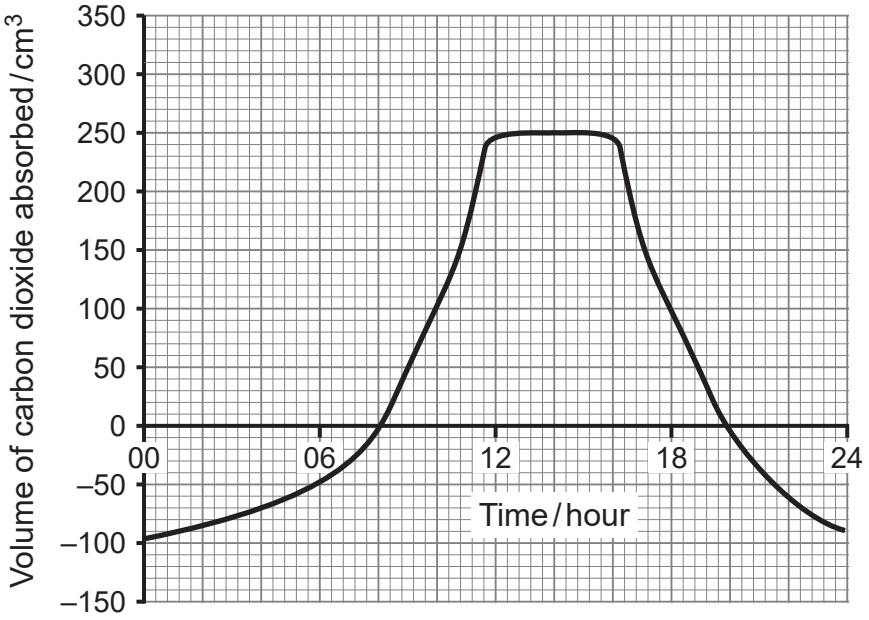
_____

_____

_____

_____ [2]

The graph below shows the net volume of carbon dioxide absorbed by a **normal** plant over a 24-hour period.



Source: Chief Examiner

(ii) On the graph, sketch a line to show the carbon dioxide absorbed when a plant with increased cell density in its spongy mesophyll was studied. [2]

(iii) Twice a day, the volume of carbon dioxide absorbed is 0 cm^3.

State the term used to describe this and explain precisely what is happening at these times.

_____

_____

_____

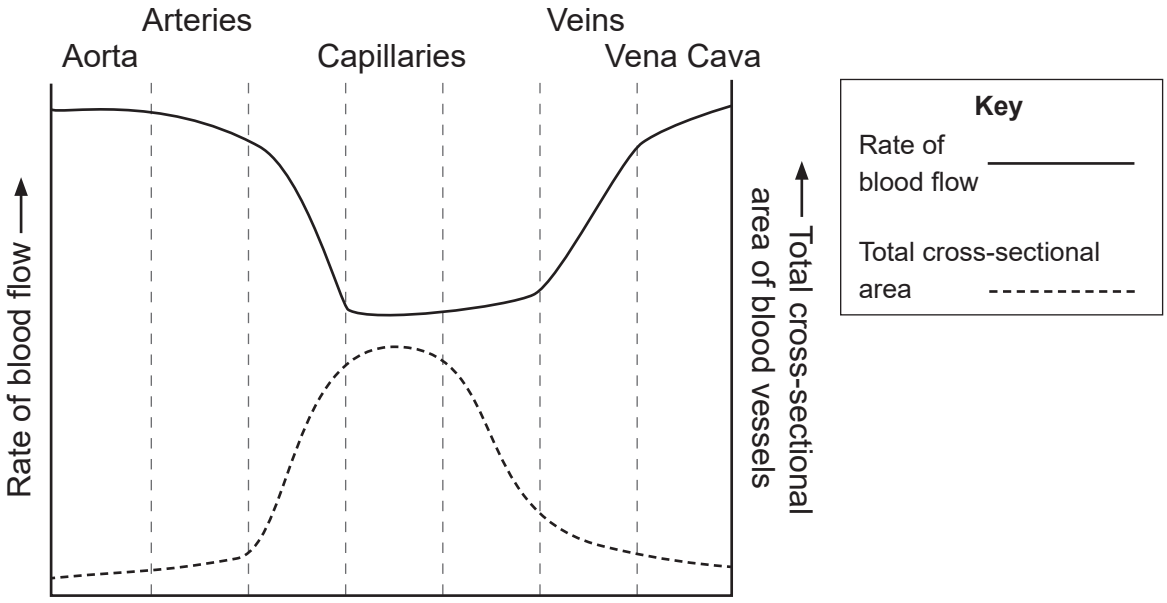
_____

_____

_____ [2]

[Turn over

4 **(a)** The graph below represents the total cross-sectional area of blood vessels within the body and the rate of blood flow through them.



(i) Using the graph and your knowledge, describe and explain the relationship between total cross-sectional area and rate of blood flow.

_____

_____

_____

_____

_____

_____ [2]

(ii) Capillaries have a very small diameter (approximately 0.5μm) in comparison to arteries and veins (4–5mm). However, the graph shows that capillaries have a greater total cross-sectional area.

Suggest an explanation for this.

_____

_____

_____ [1]

(b) An artery may become partially blocked by an atheroma.

Describe the role of each of the following in the formation and development of an atheroma.

High blood pressure

_____

_____

Cholesterol

_____

_____

Macrophages

_____

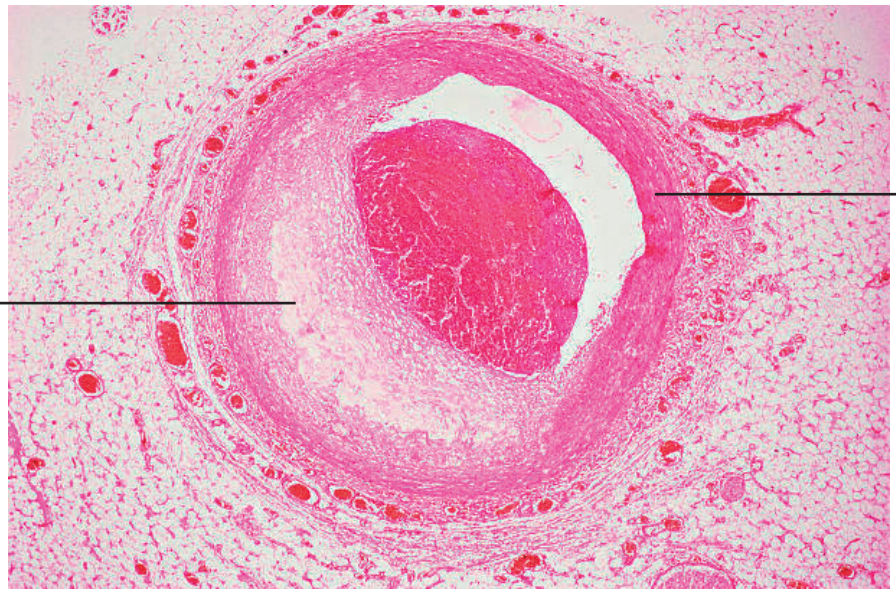
_____

Plaque

_____

_____ [4]

(c) The photomicrograph below shows an atheroma in a coronary artery.



© Getty Images

(i) Name the **two** main components of the artery wall at position **X**.

_____ and _____ [1]

(ii) Explain the role of each of these components in an artery.

_____

_____

_____

_____

_____

_____

_____ [2]

The presence of an atheroma slows the blood flow in the artery. The rate of blood flow can be calculated as follows:

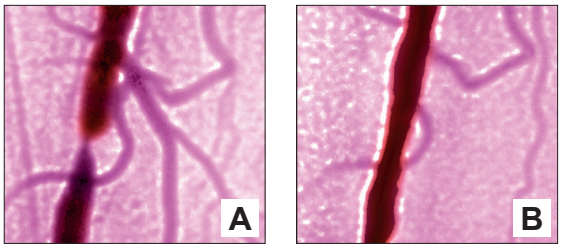
rate of blood flow = cross-sectional area of vessel lumen × velocity of blood

The following results were recorded during an investigation into the effect of an atheroma on blood flow in coronary arteries.

	Cross-sectional area of vessel lumen / mm^2	**Velocity of blood / mm s^{-1}**	**Rate of blood flow / _____**
Normal coronary artery	4.1	640	2624
Coronary artery with atheroma	2.4	410	

(iii) Using the formula above, calculate the rate of blood flow for the artery with atheroma **and** write your answer and the units of blood flow in the table above. [2]

(d) The images below show an artery of a person suffering from atherosclerosis. The narrowing of the artery can be seen in image **A**. Image **B** shows the same artery following treatment for the condition.



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(i) Name the medical imaging technique which would have been used to see this artery.

_____ [1]

(ii) Suggest how the narrowing of the artery has been reduced (image **B**).

_____

_____

_____ [1]

(iii) In one patient treated in this way, the value for the rate of blood flow was found to be 1872.

Compare this to the rate of blood flow in a normal artery and suggest an explanation for the difference.

_____

_____

_____

_____

_____

_____ [2]

5 Rathlin Island is a large inhabited island 4 km off the coast of Co. Antrim. Vehicle access is restricted, although each year thousands of tourists visit the island.

Rathlin has high sea cliffs which provide nesting sites for a variety of seabird species. There are three species of seabird whose numbers reach internationally important levels. Some uncommon and rare plant species are also present on the island.

The island has been designated as both SAC and ASSI. The SAC designation means certain species present in the area must be left undisturbed. The ASSI is awarded to areas with high conservation value, the aim being to manage them in a way that promotes high biodiversity.

(a) (i) Using the information provided, state **one** reason why Rathlin Island has been awarded the SAC designation.

_____

_____ [1]

(ii) Maintaining the standards required for an SAC/ASSI designation can be difficult in some circumstances.

Suggest a reason why this may be the case on Rathlin Island and describe **one** practice put in place which is helping conservation on the island.

_____

_____

_____

_____

_____

_____ [2]

Corncrakes (*Crex crex*) are small birds which hide in tall vegetation. They have a very distinctive call and arrive in the UK from Africa in the summer. The corncrake's breeding habitat is grassland, particularly meadow. They build a nest of leaves in a hollow in the ground.

The corncrake is in steep decline across much of the UK due to modern farming practices. As a ground-nesting bird, the corncrake is also vulnerable to predators such as rats and stoats. The Royal Society for the Protection of Birds (RSPB) has 'red-listed' the corncrake which means it is of high conservation concern.

(b) Suggest **one** way in which modern farming practices have contributed to the decline of the corncrake in the UK.

_____

_____

_____ [1]

In 2019, two corncrake pairs were recorded on Rathlin Island, which is the only place in Northern Ireland where they still survive. In order to help increase the population, a bird protection organisation planted nettles and brambles around field margins.

(c) Using the information provided, describe and explain how planting vegetation around field margins can help increase the corncrake population.

_____

_____

_____

_____

_____

_____ [2]

(d) Corncrakes can lay eggs twice in one year, producing a first and second 'clutch' of eggs. On average they lay 12 eggs in the first clutch and 8 in the second.

(i) In some circumstances, 50% of the first clutch and 60% of the second clutch do not survive. Calculate how many chicks are likely to survive if these losses occur.

(Show your working.)

_____ [2]

(ii) Suggest **two** reasons why fewer chicks survive in the second clutch than in the first.

1. _____

_____

2. _____

_____ [2]

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(Questions continue overleaf)

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

_____

_____

_____ [1]

(b) An investigation was carried out into the effect of some environmental factors on the rate of transpiration. The effects of increased wind, heat and light were investigated and the results, along with the normal rate of transpiration for the plants, are shown in the table below. Five plant species were used.

Plant species	Rate of transpiration / cm^3 min^{-1}			
	Normal	Increased wind	Increased heat	Increased light
Arrowhead	3.6	7.5	6.6	4.0
Devil's Ivy	2.9	4.1	4.6	3.0
Geranium	1.2	4.7	5.8	2.4
Weeping Fig	3.3	6.1	4.9	3.3
Zebra Plant	4.2	7.6	6.1	4.2

(i) Summarise the results of the investigation.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(ii) Explain the effect of increased wind on the rate of transpiration.

_____

_____

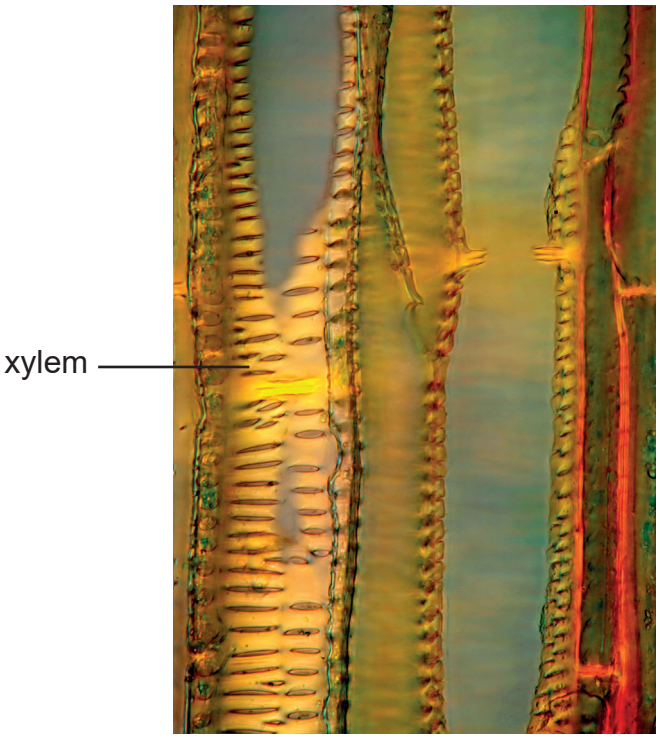
_____

_____

_____

_____ [2]

(c) Xylem vessels transport water from the roots to the leaves in a plant. The photomicrograph below shows a longitudinal section from part of a stem. A xylem vessel has been labelled.



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(i) Identify the type of lignification shown on the xylem in the photomicrograph and state what this suggests about the age of the vessel.

_____

_____

_____

_____ [2]

(ii) Water moves up through the plant's xylem in an unbroken column.

Explain how this occurs.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(d) Phloem tissue transports organic solutes.

(i) Describe **one** feature which would allow phloem tissue to be identified in a photomicrograph.

_____

_____ [1]

An experiment was carried out to determine the effect of potassium cyanide, which inhibits respiration, on the rate of translocation in pea plants. It was found that as the level of potassium cyanide increased, the rate of translocation decreased and eventually stopped.

(ii) Suggest an explanation for this.

_____

_____

_____

_____

_____

_____ [2]

Section B

Quality of written communication will be assessed in this section.

7 Oxygen is transported by haemoglobin in red blood cells.

(a) Describe and explain how the structure of haemoglobin and the partial pressure of oxygen affect how oxygen is absorbed, transported and released to the tissues. [9]

(b) Increased carbon dioxide levels and altitude can both affect the carriage of oxygen by haemoglobin. Describe how these two factors affect the carriage of oxygen and the adaptations that are found in organisms that live at high altitudes. [6]

(a) Describe and explain how the structure of haemoglobin and the partial pressure of oxygen affect how oxygen is absorbed, transported and released to the tissues.

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(b) Increased carbon dioxide levels and altitude can both affect the carriage of oxygen by haemoglobin. Describe how these two factors affect the carriage of oxygen and the adaptations that are found in organisms that live at high altitudes.

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Question Number	Marks
1	
2	
3	
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5	
6	
7	
Total Marks	

Examiner Number

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