Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2024

Centre Number

Candidate Number

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[SBY21]

SBY21

THURSDAY 23 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 Identify the terms described by the following statements which relate to the transport and exchange of oxygen in mammals:

- The liquid medium which bathes cells and enables the transport of oxygen to the cells.

  _____

- The conjugated protein in muscle which unloads oxygen when partial pressure of oxygen is very low.

  _____

- The specialised cells forming the alveolar wall which minimise distance for oxygen diffusion.

  _____

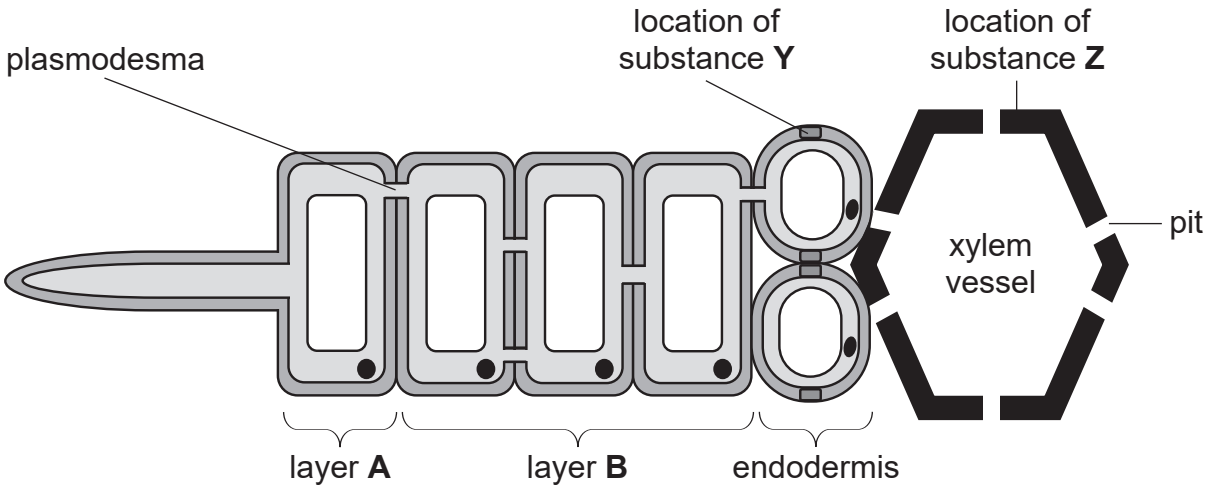
- The disease which reduces alveolar elasticity leading to a lower oxygen concentration gradient.

  _____

- The shift of a haemoglobin oxygen dissociation curve to the right due to increased temperature.

  _____ [5]

2 The diagram below represents some of the tissues in a plant root.



Source: Principal Examiner

(a) Identify layers **A** and **B**.

A _____

B _____ [2]

(b) As shown above, substance **Y** is found in the cell wall of endodermis cells and substance **Z** is found in the cell wall of xylem vessels. Both substances are waterproof.

Identify substances **Y** and **Z**.

Y _____

Z _____ [2]

(c) Using the diagram and your knowledge, describe **two** differences between a pit and a plasmodesma.

Difference 1 _____

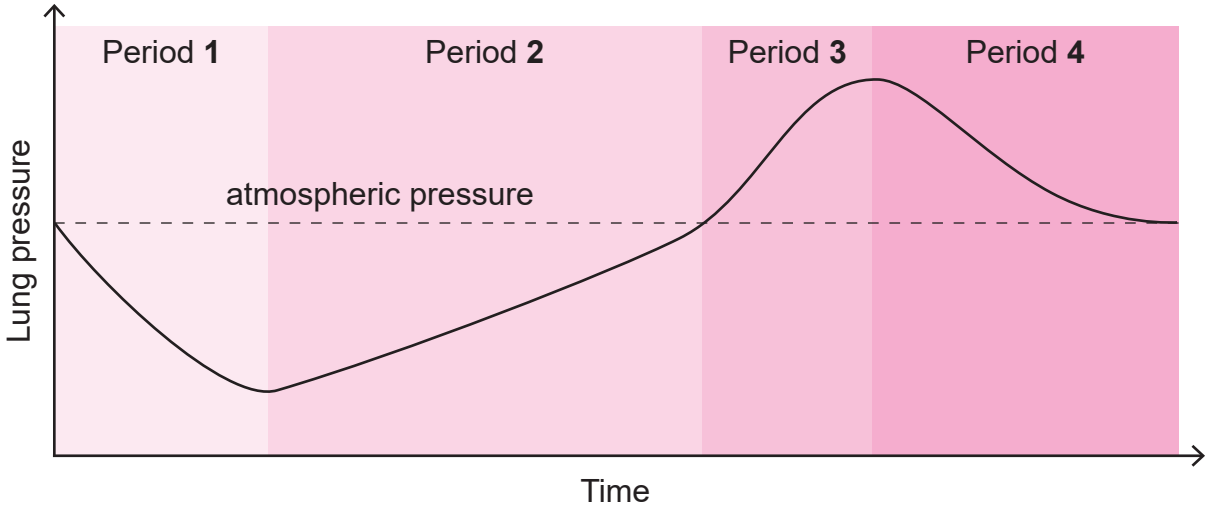
_____

Difference 2 _____

_____ [2]

3 The graph below shows changes in lung pressure relative to atmospheric pressure, over time.

Four distinct time periods (**1** to **4**) are labelled on the graph.



(a) Identify the period(s) during which exhalation is occurring.

_____ [1]

(b) Describe how structures of the respiratory system bring about a decrease in lung pressure during period **1**.

_____

_____

_____

_____

_____

_____ [3]

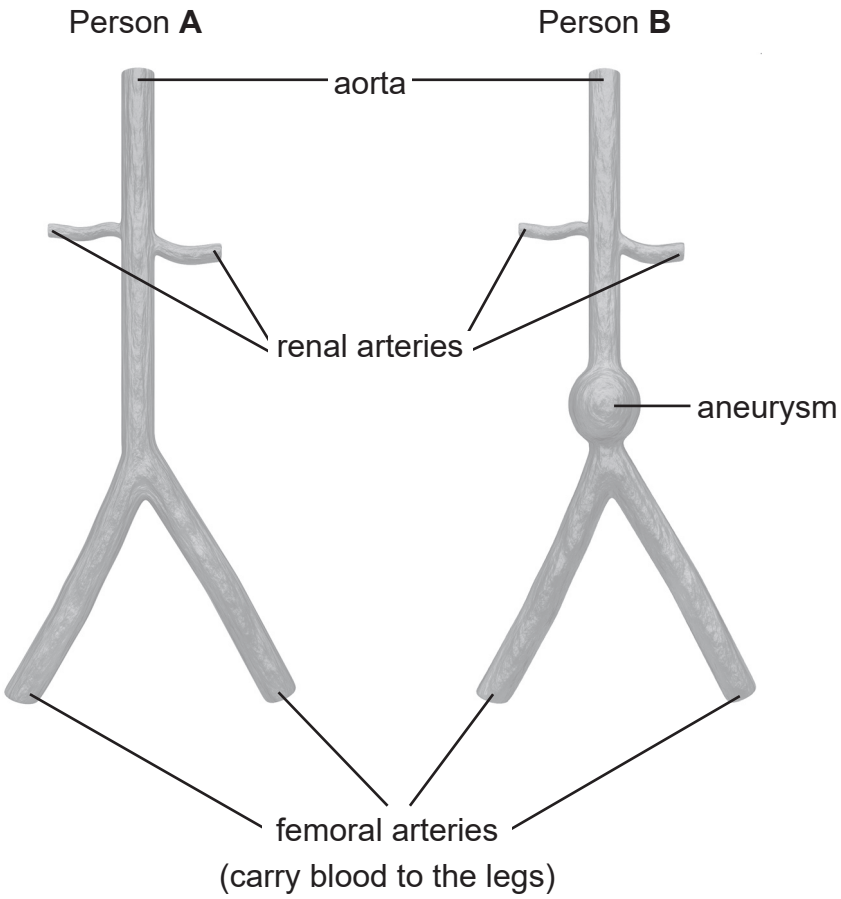
(c) State the term used to describe the movement of substances within an organism due to pressure differences.

_____ [1]

[Turn over

4 Some human diseases cause damage to blood vessels. An aneurysm is a swelling in an artery caused by a weakness in the artery wall.

The diagram below shows some of the major arteries in two people, person **A** and person **B**. Person **B** has been diagnosed with an aneurysm in their aorta.



Source: © Getty Images

(a) Name the organ which is supplied with blood from a renal artery.

_____ [1]

(b) If left untreated, an aneurysm in the aorta may burst (rupture) with fatal consequences. A ruptured aneurysm in another artery, such as the femoral artery, is less likely to cause death.

(i) Suggest and explain why a ruptured aneurysm in the aorta is more likely to cause death than a ruptured aneurysm in one of the femoral arteries.

_____

_____

_____

_____ [2]

(ii) The process of blood clotting may begin as a result of damage to blood vessels. Describe the process of blood clotting.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(iii) Suggest why blood clotting is ineffective at preventing blood loss from a ruptured aneurysm in the aorta.

_____

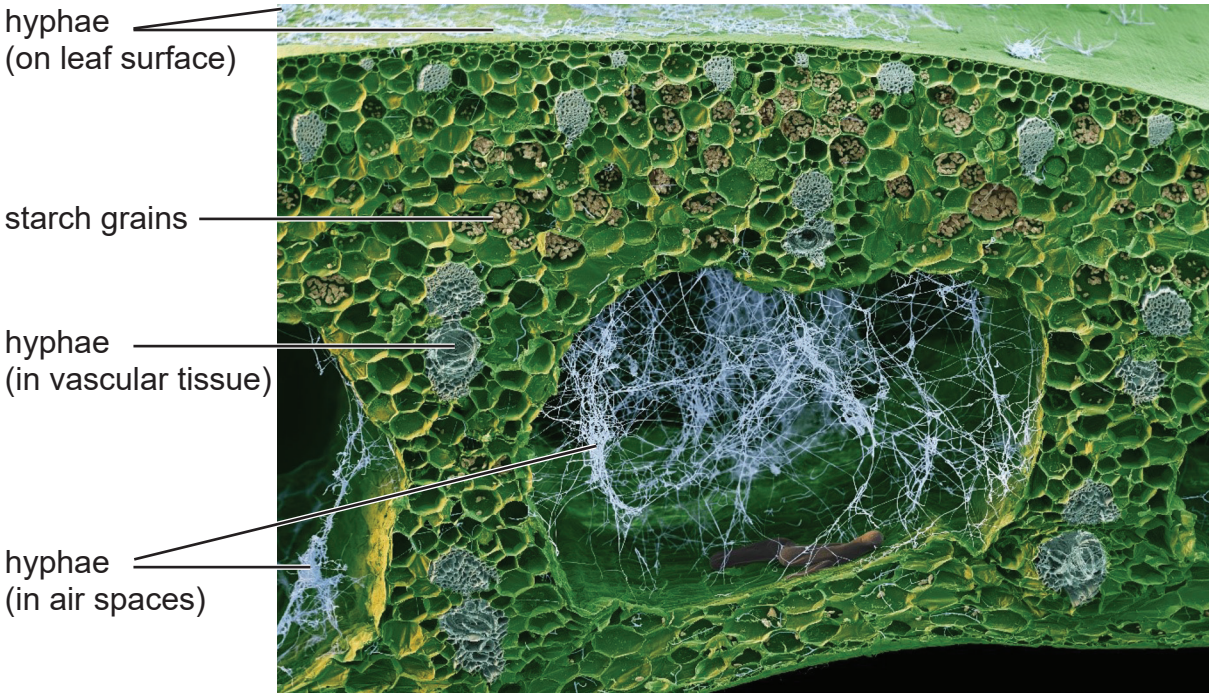
_____ [1]

[Turn over

5 Plant leaves can become infected with a range of disease-causing organisms.

Panama disease is caused by an organism (*Fusarium oxysporum*) which is made up of thread-like structures called hyphae.

The electron micrograph below shows a transverse section through part of a banana leaf infected with *F. oxysporum*. Hyphae can be observed spreading inside the leaf, as well as on the leaf surface.



Magnification ×50

Source: © Eye of Science / Science Photo Library

(a) (i) Using the information provided, identify the kingdom to which the organism that causes Panama disease belongs.

_____ [1]

(ii) Both the leaf and the hyphae are composed of cells.

State **one** similarity and **one** difference between the outer structure of plant cells and hyphae cells.

Similarity _____

_____

Difference _____

_____ [2]

(b) It can be seen in the electron micrograph that many hyphae are present in the air spaces of the leaf, as well as in the vascular tissue. Eventually the hyphae may completely fill the air spaces.

(i) With reference to the air spaces, suggest and explain how this could affect photosynthesis in the leaf.

_____

_____

_____

_____

_____ [2]

(ii) Panama disease is also known as Fusarium wilt. Using the information provided, suggest why leaves infected with this disease are likely to wilt.

_____

_____

_____

_____

_____ [2]

[Turn over

(c) Common ash (*Fraxinus excelsior*) is a tree species, often found in hedgerows and woodlands in Europe. Ash trees are an important food source for a range of invertebrates and birds. The trees shed their leaves in autumn, and these rapidly decompose, raising soil mineral levels.

In 2012, the first occurrence of ash dieback disease was recorded in Northern Ireland. This discovery led to further monitoring of ash trees over several years.

Results recorded over a five-year period are shown below.

Year	Number of inspected sites	Number of sites with infected trees
2012	1028	79
2013	1895	12
2014	1306	2
2015	1896	18
2016	2680	68

(i) Calculate the percentage of inspected sites which had infected trees in 2016.

Give your answer to 3 significant figures.

(Show your working.)

_____ % [2]

The organism which causes ash dieback disease is found in ash leaves. When infected trees shed their leaves, this organism remains in the decaying leaf litter. From here, it produces spores that can infect other ash trees.

(ii) When infected ash trees are being removed from hedgerows, it is often advised that they are replaced by native trees other than ash.

Suggest why replacement trees:

should **not** be ash _____

_____

should be native species _____

_____ [2]

Research has shown that temperatures above 35° C decrease the survival rate of the organism which causes ash dieback disease. Climate change modelling suggests that summer weather in southern Europe will become hotter and drier.

(iii) Suggest **one** advantage and **one** disadvantage of hotter, drier weather for ash trees in southern Europe.

Advantage _____

_____

Disadvantage _____

_____ [2]

6 Approximately 17% of the land in Ireland is composed of wetland habitats known as peatlands.

In such habitats, the surface layer of soil (peat) is very rich in dead organic matter.

Human activities which damage peatlands include:

- removing peat for use in gardening
- harvesting peat for fuel
- improving drainage to increase agricultural land area.

(a) Some of the plants found in peatlands have hydrophytic adaptations.

Identify and explain which of the human activities listed above would have the most direct negative effect on hydrophytic plants.

_____

_____

_____

_____ [2]

One method used to restore peatlands damaged by human activity is to block off drainage ditches so that more water is retained in the soil. The mineral levels in the soil are also affected by the increased water content.

(b) State the term which describes soil-related factors such as water content and mineral levels.

_____ [1]

(c) Over time, the biodiversity of restored peatlands is likely to improve.

Sampling of vegetation in three damaged peatland areas (**A**, **B** and **C**) was carried out. Simpson's index was calculated before and after each peatland area was restored.

The results are shown in the table below.

Peatland area	Simpson's index	
	Before restoration	After restoration
A	0.88	0.86
B	0.72	0.75
C	0.68	0.67

(i) Identify the peatland area which had the greatest increase in biodiversity after restoration.

Give a reason for your choice.

_____

_____

_____

_____ [2]

A different area of peatland was also sampled. This area had been designated as a SAC for 27 years.

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

Plant type	% cover (n_i)	(n_i – 1)	n_i (n_i – 1)
Moss	72	71	5112
Lichen	59	58	3422
Grass	46	45	2070
Woody shrub	14	13	182
Broadleaf species	28	27	756
	Total % cover (N) = 219		

(ii) Calculate Simpson's index (*D*) for this peatland using the formula:

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

(Show your working.)

D = _____ [3]

(iii) How does the biodiversity of this peatland differ from peatland areas **A**, **B** and **C**?

Suggest an explanation for this difference.

_____

_____

_____

_____ [2]

(d) Mullenakill Nature Reserve is part of the Peatlands Park ASSI in County Tyrone. Several animals on the NI priority species list can be found here, including the Large Heath Butterfly (*Coenonympha tullia*). A partially completed classification of this organism is shown in the table below.

Kingdom	**X**
Phylum	Arthropoda
Class	Insecta
A	Lepidoptera
B	Nymphalidae
Genus	**Y**
Species	**Z**

(i) Name the taxonomic groups represented by **A** and **B**.

A _____

B _____ [1]

(ii) Identify the missing information represented by **X**, **Y** and **Z**.

X _____

Y _____

Z _____ [2]

(iii) The binomial names of two other insects found in similar habitats are *Coenonympha pamphilus* and *Neurothemis tullia*.

Identify which of these insects is most closely related to the Large Heath Butterfly and give a reason for your answer.

_____

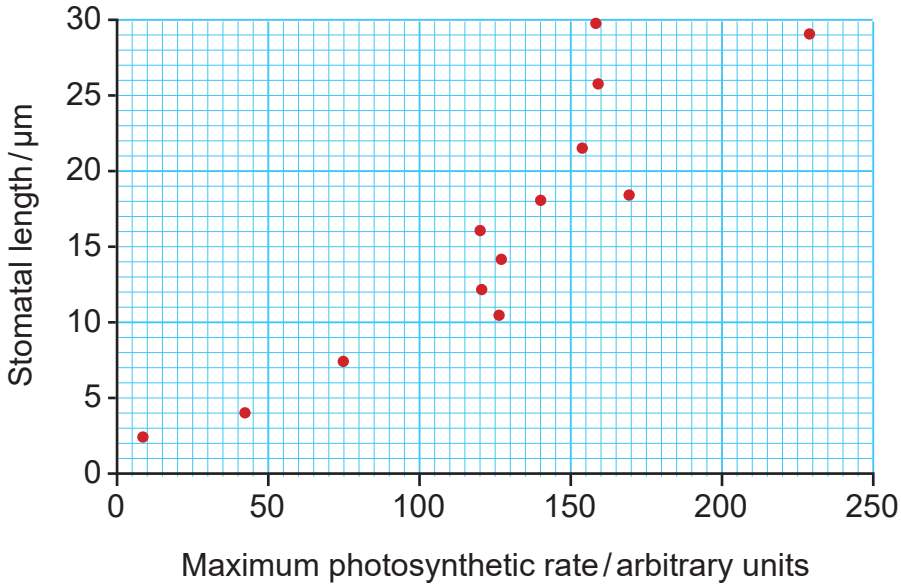
_____

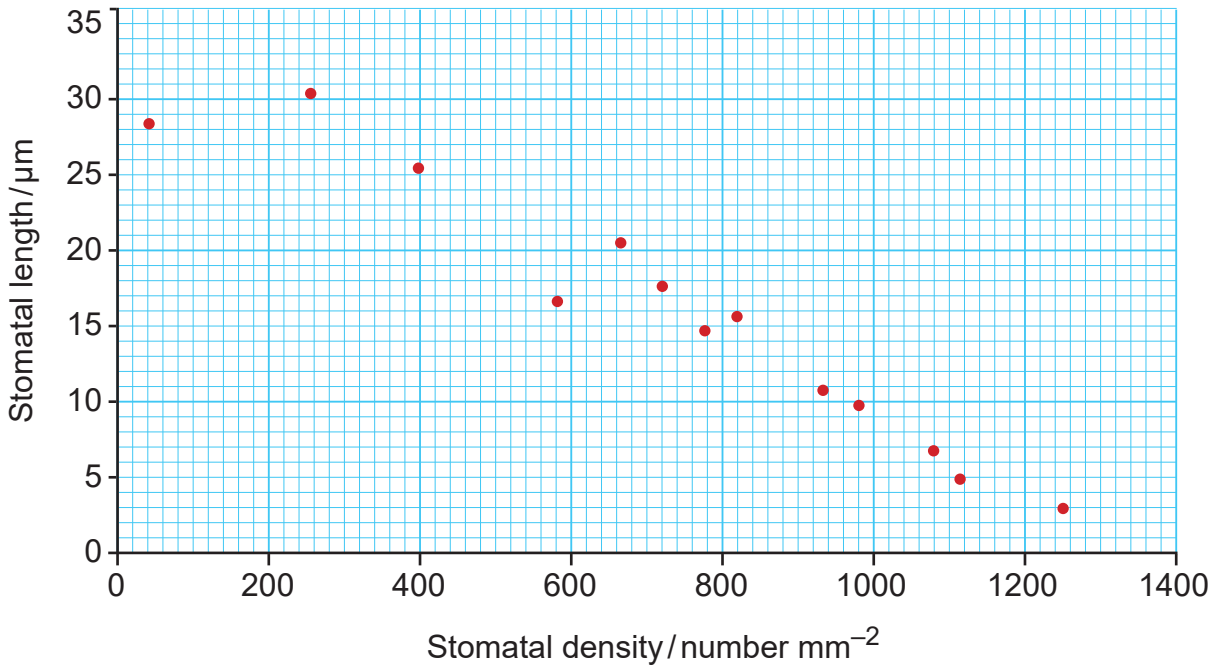
_____ [2]

[Turn over

7 **(a)** An investigation was carried out to determine whether a relationship exists between stomatal length, stomatal density, and maximum photosynthetic rate in 13 woody plants.

The data is shown in the graphs below. Use these graphs to answer the questions which follow.





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(i) Describe the relationship between maximum photosynthetic rate and stomatal length.

_____

_____

_____ [1]

(ii) Describe and suggest an explanation for the relationship between stomatal density and stomatal length.

_____

_____

_____

_____

_____ [2]

(iii) What does the data suggest about the relationship between stomatal density and maximum photosynthetic rate?

_____

_____

_____ [1]

(b) Gas exchange in a leaf occurs through stomata.

(i) Describe and explain **two** other adaptations which maximise gas exchange in leaves.

1. _____

_____

2. _____

_____ [2]

(ii) Specialised stomatal adaptations are observed in both xerophytes and hydrophytes. Outline the stomatal adaptations found in these types of plants.

Xerophytes _____

_____

Hydrophytes _____

_____ [2]

Section B

Quality of written communication will be assessed in this section.

8 Describe, in sequence, the pathway taken by blood as it makes one complete circuit of the body, beginning and ending with blood in the capillaries of the ileum.

You should include:

- the name of each blood vessel that blood moves through
- the cardiac cycle
- the ways in which unidirectional blood flow is maintained. [15]

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[Turn over

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THIS IS THE END OF THE QUESTION PAPER

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Examiner Number

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