Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2025

Centre Number

Candidate Number

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[SBY21]

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THURSDAY 22 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 questions in black ink and use a dark HB pencil for drawings and graphs.
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 may use a scientific calculator.
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 table below contains statements which relate to various components of the blood.

(a) Complete the table by placing a tick (✔) in the correct box to indicate the blood component described by each statement.

Some rows may have more than one tick.

	Component of blood			
Statement	Plasma	Monocyte	Polymorph	B-lymphocyte
Contains fibrinogen				
Produces antibodies				
Contains a nucleus				

[3]

Some components of plasma can pass through capillary walls, forming a substance which bathes cells within tissues.

(b) Name this substance and explain its role.

_____

_____

_____

_____ [2]

2 The photographs below show two organisms from the kingdom Animalia.

All members of this kingdom can be classified in the domain Eukarya.

Source: © Getty Images

Source: © Getty Images

(a) Identify **one** piece of evidence shown in the photographs which represents a feature found only in the kingdom Animalia.

_____ [1]

(b) Organisms can be classified based on various features, including:

- anatomy;
- biochemistry;
- cell structure; and
- morphology.

(i) From the list above, select **one** feature which:

- can be observed in these photographs

_____

- is used to classify organisms as domain Eukarya

_____ [2]

Humans have attempted to classify organisms for thousands of years. In more recent years, comparison of DNA has become increasingly important.

(ii) Suggest **two** reasons why the DNA analysis of organisms has become increasingly important.

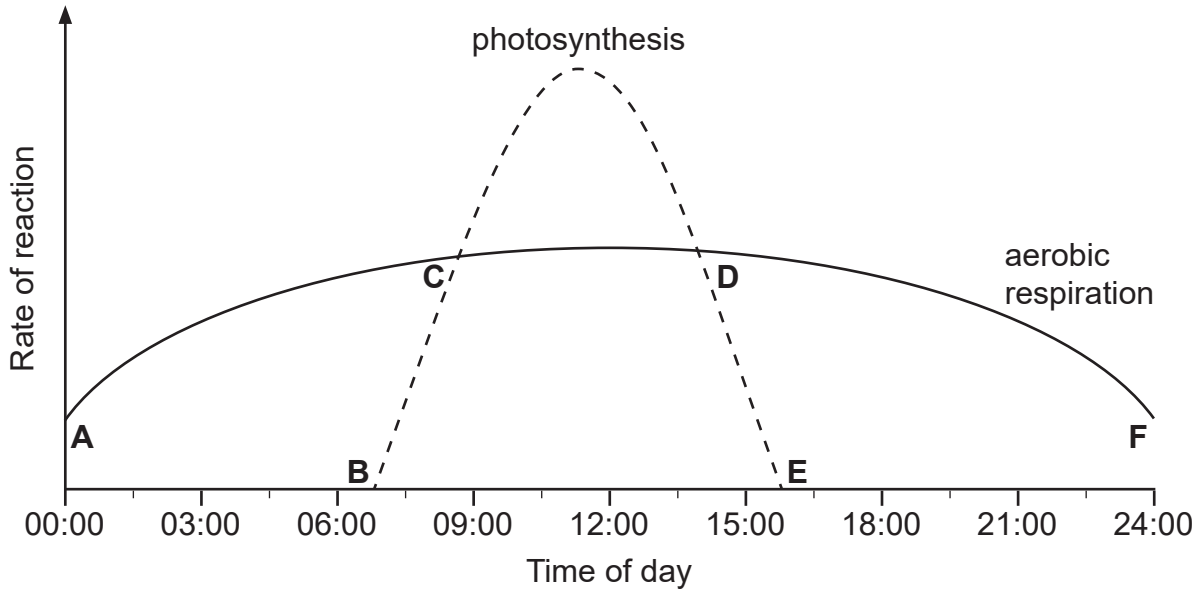
1. _____

_____

2. _____

_____ [2]

3 The graph below shows the rate of photosynthesis and the rate of aerobic respiration in a plant over a 24-hour period.



(a) Identify the letter(s) which indicate the compensation point(s).

_____ [1]

The rate of photosynthesis is affected by abiotic factors.

(b) Suggest how **two** abiotic factors could cause the increase in photosynthetic rate in the morning, as shown in the graph.

1. _____

_____

2. _____

_____ [2]

(c) On the graph above, shade the region where there will be a net intake of carbon dioxide by the plant. [1]

Aerobic respiration can still occur at night even though the stomata are closed.

(d) Using the graph opposite and your understanding, suggest how aerobic respiration still takes place at night.

_____

_____

_____

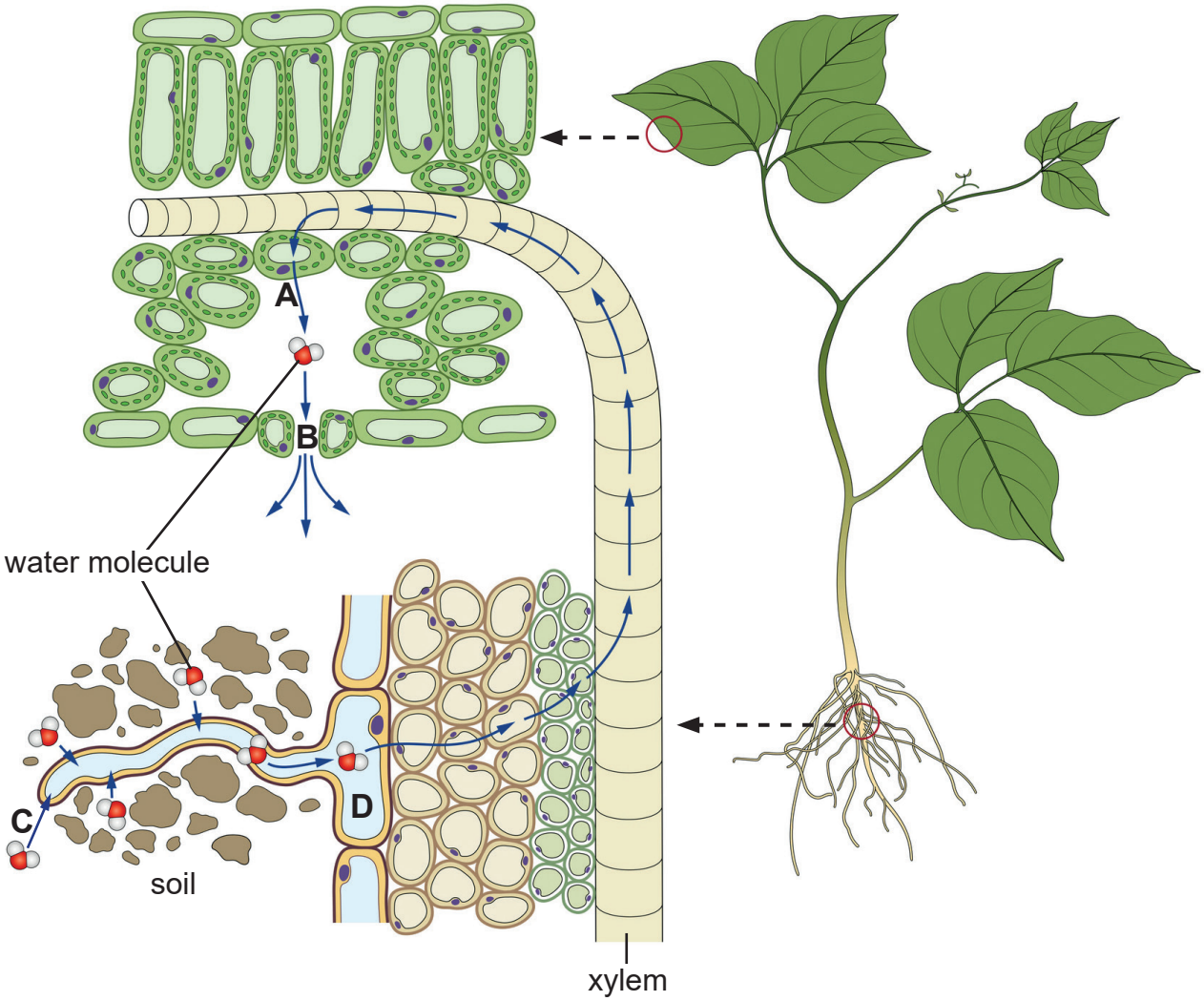
_____

_____ [2]

[Turn over

4 **(a)** The diagram below represents the transpiration stream in a plant. An area of the leaf and root has been enlarged (represented by the dashed arrows) to show the tissue layers present in these parts of the plant.

The solid arrows show the direction of water movement into and through the plant. Several water molecules are also represented in the diagram.



Source: © Getty Images

(i) Identify the processes occurring at **A** and **C**.

A _____

C _____ [2]

(ii) Identify structure **B** and cell **D**.

B _____

D _____ [2]

Water moves through root tissue by two pathways.

(b) Name and describe these pathways.

1. _____

_____

_____

2. _____

_____

_____ [4]

A student carried out an investigation to determine the effect of air temperature on stem diameter of a plant.

The results are shown in the table below.

Air temperature / °C	Stem diameter at midday / mm
0	37
5	36
10	34
15	31
20	29
25	36

The student concluded that increasing air temperatures caused a greater rate of transpiration. This resulted in a decrease in stem diameter due to greater negative pressure inside the xylem vessels.

However, the student was unable to explain why the diameter at 25 °C did not follow the trend, despite repeated readings at this temperature to rule out the possibility of an anomalous result.

(c) Suggest and explain a reason for the diameter of the stem at 25 °C.

_____

_____

_____

_____

_____

_____

_____ [3]

5 The supply of blood to organs can be controlled by a range of factors in the circulatory system. These include changing the heart rate and vasoconstriction / vasodilation of the blood vessels to organs.

(a) **(i)** Name the type of blood vessel which can undergo vasoconstriction and vasodilation, and identify the tissue present in the blood vessel walls which enables this.

Type of blood vessel _____

Tissue _____ [2]

(ii) Vasoconstriction and vasodilation can occur in the blood vessel supplying the lung.

Name the blood vessel which supplies blood to the lung.

_____ [1]

Both vasoconstriction and vasodilation affect blood pressure. Dangerously low blood pressure can be caused by vasodilation, and this is what occurs in a severe allergic reaction to peanuts.

Following a severe allergic reaction, an 'EpiPen' is used to inject the individual with a substance called epinephrine.

(b) Suggest the effect of epinephrine on blood pressure and how this effect is achieved.

_____

_____

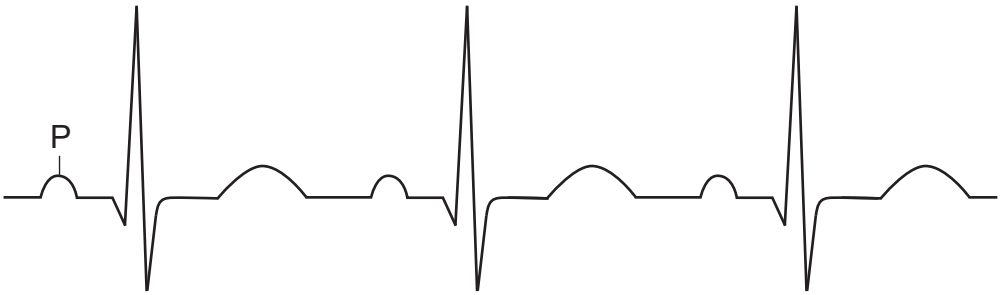
_____

_____ [2]

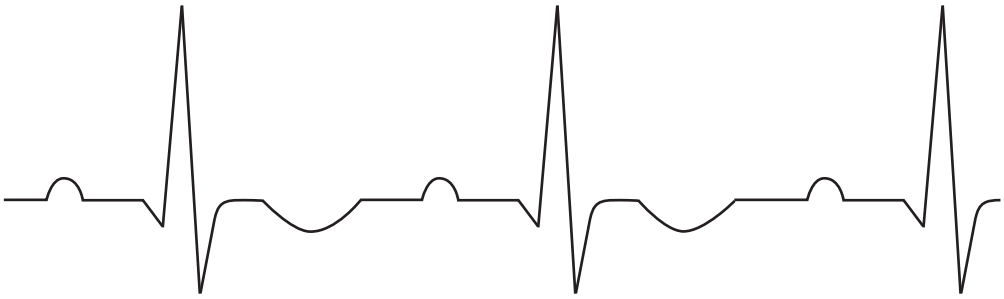
Hypothermia is a condition which occurs when the body temperature drops below 35 °C.

The effect of hypothermia on heart activity can be seen by comparing a normal ECG with one from a person suffering from hypothermia. One P wave has been labelled on the normal ECG.

Normal ECG



ECG from a person suffering from hypothermia



Source: Principal Examiner

(c) Using only the ECGs opposite, describe the effect, if any, of hypothermia on:

- The heart rate

_____

- The P wave

_____

- The QRS complex

_____

- The T wave

_____ [4]

The P wave on an ECG represents electrical activity which causes atrial systole. Atrial systole occurs before ventricular systole.

(d) State the location of the origin of this electrical activity and explain the advantage of atrial systole occurring before ventricular systole.

_____

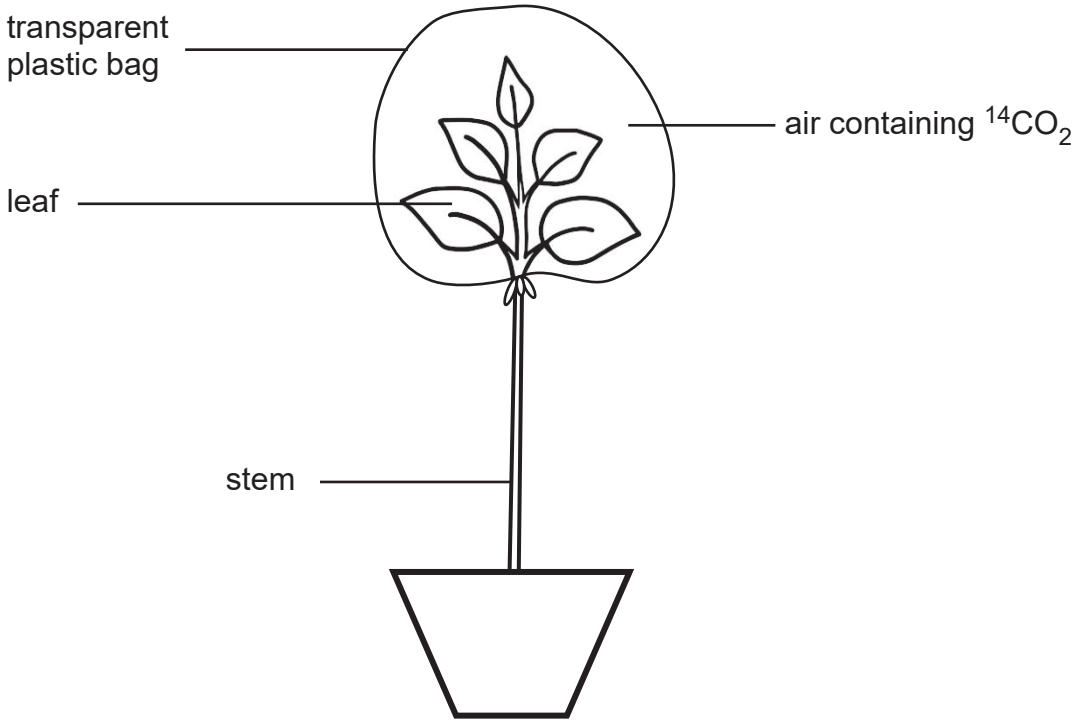
_____

_____

_____

_____ [2]

6 An investigation into the translocation of sugar through phloem tissue was carried out by enclosing leaves of a plant in a transparent plastic bag in light. The air inside the bag contained radioactive carbon dioxide ($^{14}CO_2$) as shown in the diagram below.



Source: Principal Examiner

The radioactive carbon dioxide was absorbed by the leaf and used for photosynthesis.

(a) (i) Explain why some of the leaves of the plant shown would absorb more carbon dioxide than others.

_____

_____ [1]

(ii) Explain why carbon dioxide diffuses into the leaves of a photosynthesising plant.

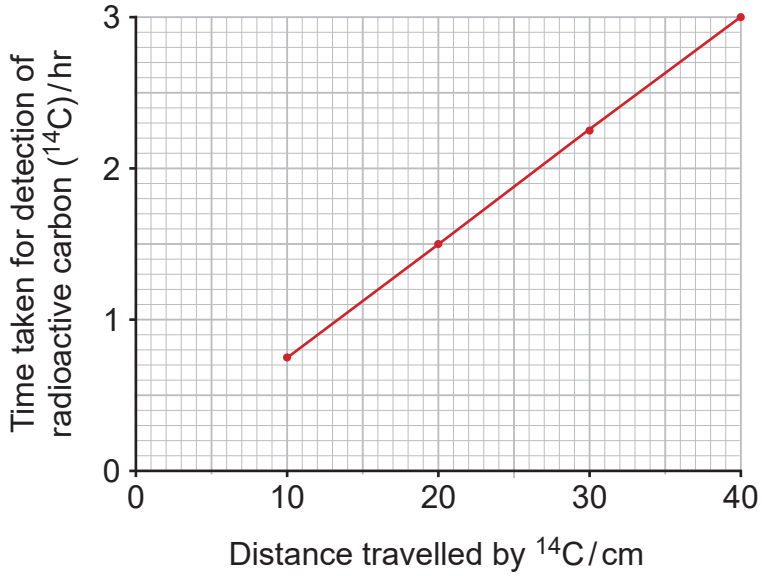
_____

_____ [1]

Sugar produced by photosynthesis using $^{14}CO_2$ contains radioactive carbon (^{14}C).

(b) The movement of this sugar was traced by removing and analysing some contents from the phloem sieve tubes at 10 cm intervals down the stem.

The graph below shows the time taken for ^{14}C to be detected at various distances down the stem.



(i) Calculate the rate of movement of ^{14}C down the stem in centimetres per hour.

Give your answer to 2 significant figures.

Show your working out.

_____ cm hr^{-1} [2]

[Turn over

The results show that phloem tissue transports sugar away from the leaves and down the stem towards the root. Cells in the root endodermis use the sugar as a source of energy.

(ii) Explain why endodermal cells have a high energy demand.

_____

_____ [1]

Translocation of sugar and other organic solutes through the phloem tissue also requires energy. However, the phloem sieve tubes have very few organelles and are unable to respire to release the energy that is required.

(iii) Describe how the phloem sieve tubes obtain the energy required for translocation.

_____

_____

_____

_____ [2]

7 The photograph below shows a field which is used to grow grass as a crop.
The photograph was taken 10 days after the grass was harvested.

Source: Principal Examiner

(a) Region **A** is a strip of undisturbed ground around the edge of the field which extends approximately 2 metres into the field.

(i) State the term used to describe region **A**.

_____ [1]

(ii) Suggest **one** way in which the presence of region **A** could lead to a reduction in the amount of pesticides needed on the field.

_____

_____

_____ [1]

[Turn over

This field is surrounded by a thick, mature hedge which has been carefully managed to promote biodiversity.

The hedge is maintained by trimming in late winter every three years. It contains a variety of shrub plants including beech, blackthorn and hawthorn, and some trees have been allowed to grow to maturity.

At ground level, there are various types of grasses and other plants such as nettles, dandelions and ivy.

(b) Using the information provided, explain **two** features of this hedge which promote biodiversity.

1. _____

_____

_____

2. _____

_____

_____ [2]

(c) To promote increased biodiversity on farms, the government introduced a scheme to pay farmers throughout Northern Ireland to plant new hedges around fields.

In one such scheme, the length of new hedges planted was recorded over a five-year period.

The table below shows the data for counties Antrim and Armagh.

	Length of new hedge planted each year / km	
Year	County Antrim	County Armagh
2018	4.7	8.6
2019	14.8	18.9
2020	19.3	23.4
2021	21.6	22.8
2022	15.2	17.1

(i) Identify **two** trends in the data over the five-year period.

1. _____

_____

2. _____

_____ [2]

The data indicates that uptake of the scheme by farmers was low in its first year (2018).

(ii) Suggest an explanation for this.

_____

_____

_____ [1]

The payment to farmers in 2020 was £12.00 per metre of new hedge planted.

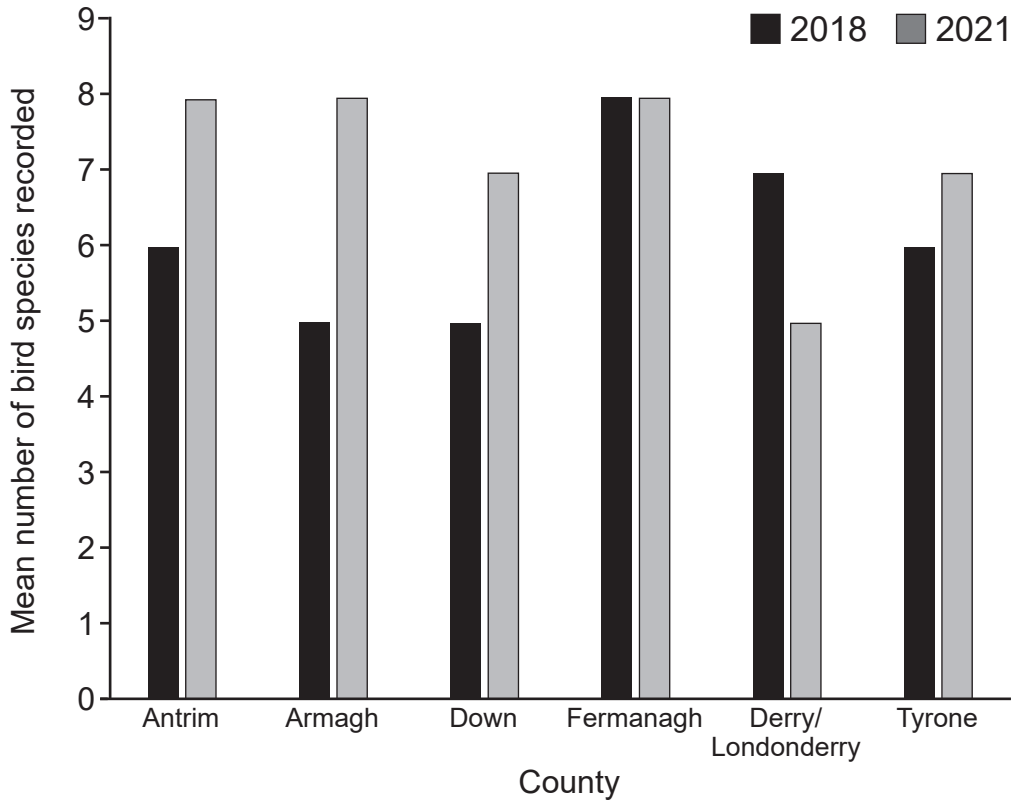
(iii) Calculate the **total** payment made to farmers in these two counties in 2020.

Show your working out.

£ _____ [3]

(d) Government researchers surveyed the number of bird species on farms which had planted new hedges. Surveys were carried out in 2018 and 2021.

The results for all six counties of Northern Ireland are shown in the graph below.



(i) Summarise the changes in mean number of bird species recorded from 2018 to 2021.

_____

_____

_____

_____

_____

_____ [2]

The bird surveys were carried out at several different times throughout each year.

(ii) Suggest why this was necessary.

_____

_____ [1]

In a related scheme, farmers have been encouraged to place a fence along the banks of streams and rivers (waterways) so that a 2 m-wide strip of natural vegetation between the field and the waterway could grow undisturbed. This strip is called a 'riparian buffer' and it protects waterways from pollution.

(e) Suggest **one** agricultural pollutant which is less likely to enter waterways protected by riparian buffers and explain how this protection is achieved.

_____

_____

_____

_____ [2]

Section B

In this question you will be assessed on the quality of your written communication skills including the use of specialist scientific terms.

8 Haemoglobin is a mammalian respiratory pigment, with a role in supplying oxygen to respiring tissue. Myoglobin is another molecule with a similar role but in a different location to haemoglobin.

(a) Describe the structure and location of haemoglobin and the conditions which promote unloading of oxygen from it. In addition, outline the role of myoglobin, with reference to its location. [9]

The oxygen which is attached to both haemoglobin and myoglobin is taken into the blood by diffusion through the alveoli of the lungs. Alveoli have several features which enable efficient gas exchange, such as their large surface areas and rich blood supply.

(b) Describe and explain three other features of the mammalian lung which enable efficient gas exchange. [6]

(a) Describe the structure and location of haemoglobin and the conditions which promote unloading of oxygen from it. In addition, outline the role of myoglobin, with reference to its location.

[Turn over

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[Turn over

(b) Describe and explain three other features of the mammalian lung which enable efficient gas exchange.

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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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