



Rewarding Learning

ADVANCED SUBSIDIARY (AS)  
General Certificate of Education

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

# Biology

Assessment Unit AS 2

*assessing*

Organisms and Biodiversity



[SBY21]

\*SBY21\*

## Assessment

### Assessment Level of Control:

Tick the relevant box (✓)

#### TIME

1 hour 30 minutes.

Controlled Conditions	
Other	

#### 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.

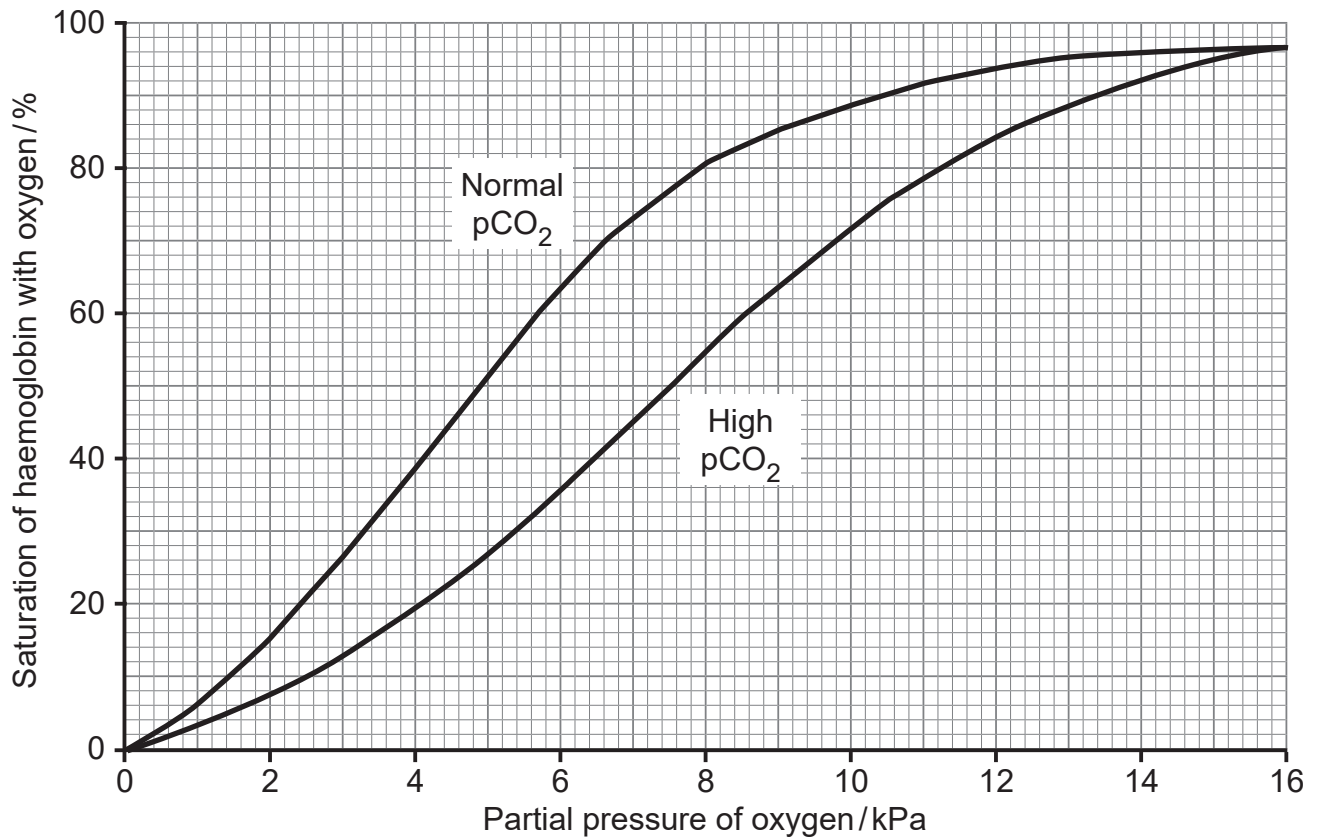
12642



\*32SBY2101\*

## Section A

- 1 The graph below shows oxygen dissociation curves for haemoglobin at two different partial pressures of carbon dioxide ( $p\text{CO}_2$ ).



- (a) (i) State the term used for the effect of increased  $p\text{CO}_2$  on haemoglobin's affinity for oxygen.

\_\_\_\_\_ [1]



(ii) Explain why the  $p\text{CO}_2$  increases during strenuous exercise and describe the advantage of the effect shown in the graph.

---

---

---

---

---

[2]

(b) Very rapid breathing is known as hyperventilation. This results in a significant reduction in the level of carbon dioxide in the body.

(i) On the graph, draw a line to represent the expected oxygen dissociation curve for someone who is hyperventilating. [1]

(ii) Describe how a reduction in the level of carbon dioxide affects haemoglobin's affinity for oxygen.

---

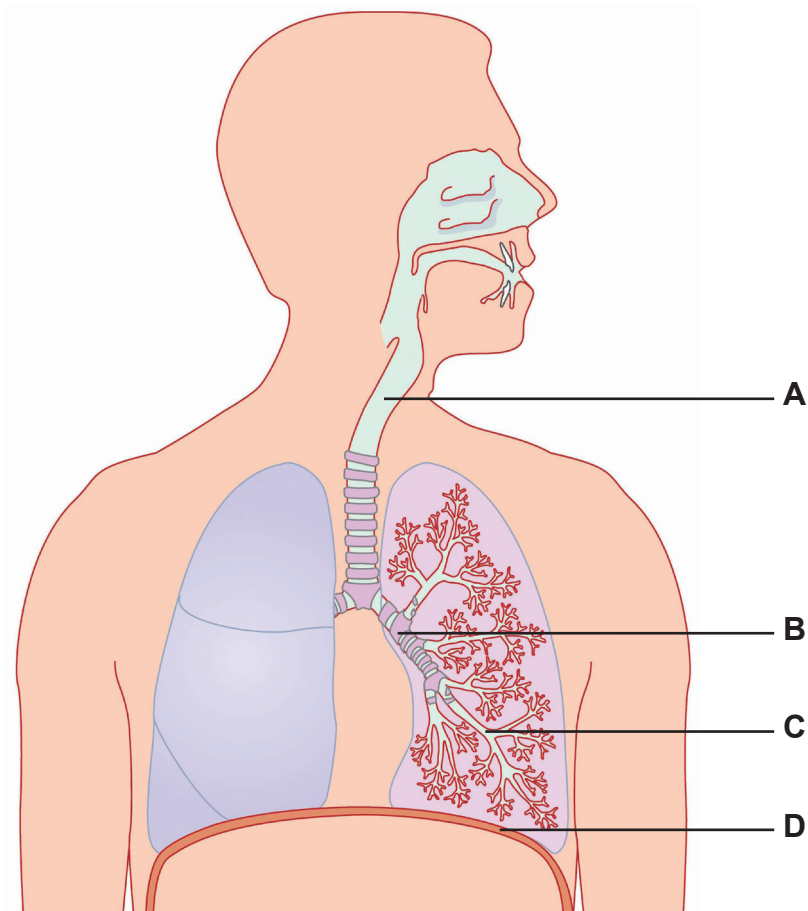
---

[1]

[Turn over



2 (a) The diagram below represents the structure of the respiratory system.



Source: © Peter Gardiner / Science Photo Library

Identify the structures labelled **A–D**.

**A** \_\_\_\_\_

**B** \_\_\_\_\_

**C** \_\_\_\_\_

**D** \_\_\_\_\_

[2]



(b) Describe fully the process of expiration.

---

---

---

---

---

---

---

---

---

---

---

[3]

[Turn over



(c) The rate of gas exchange by diffusion is described by Fick's law.

(i) State Fick's law.

[2]

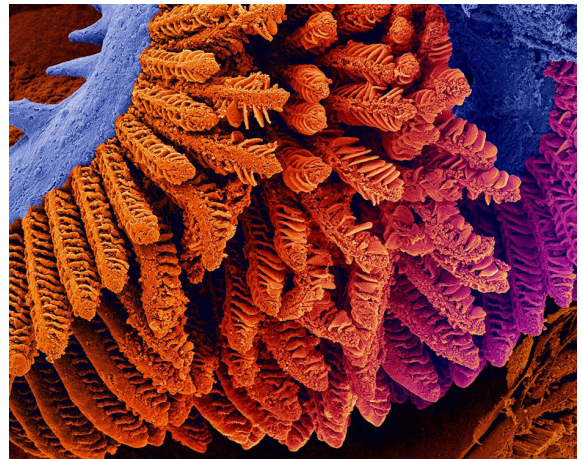
Many aquatic organisms use gills rather than lungs as their gas exchange organs.

Photograph X shows an axolotl (*Ambystoma mexicanum*) with external gills. Photograph Y shows a magnified view of the internal gills of a cichlid fish (*Cichlasoma nigrofasciatum*).



Photograph X

Source: © Claude Nuridsany & Marie Perennou / Science Photo Library



Photograph Y

Source: © Dennis Kunkel Microscopy / Science Photo Library

(ii) Using the photographs above, describe how gills are adapted for efficient gas exchange.

---

---

---

[1]



(iii) Suggest **one** advantage of gills being internal rather than external.

---

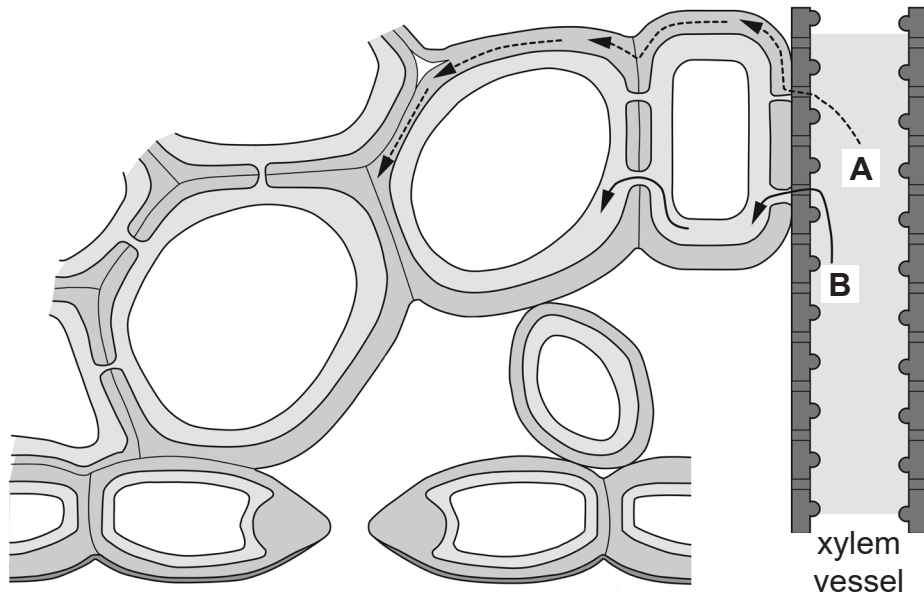
---

---

[1]



- 3 (a) In a mesophytic leaf, water moves from the xylem vessels to other parts of the leaf. The diagram below shows two possible pathways taken by water after leaving a xylem vessel.



- (i) Name the **two** pathways of water movement shown.

A \_\_\_\_\_

B \_\_\_\_\_

[2]





- (c) A student carried out an investigation into the rate of transpiration from tomato plant leaves with different surface areas.

The total water loss for each leaf was measured over a 10 minute period, and then the following formula was used to calculate the rate of transpiration per  $\text{cm}^2$ .

$$\text{Rate of transpiration} = \frac{\text{total water loss}}{\text{time} \times \text{leaf surface area}}$$

Surface area of leaf/ $\text{cm}^2$	Total water loss/g	Rate of transpiration/ $\text{g min}^{-1} \text{cm}^{-2}$
10	0.23	0.0023
13	0.78	0.0060
22	1.34	0.0061
27	2.35	0.0087
33	3.20	0.0097
40	4.10	

- (i) Calculate the rate of transpiration for the leaf with a surface area of  $40 \text{ cm}^2$ .

(Show your working.)

\_\_\_\_\_  $\text{g min}^{-1} \text{cm}^{-2}$  [2]



(ii) Describe the relationship between leaf surface area and total water loss.

---

---

---

[1]

(iii) In a similar investigation using leaves of different ages, it was concluded that the rate of transpiration decreased as age of leaf increased.

Suggest an explanation for this.

---

---

---

[1]

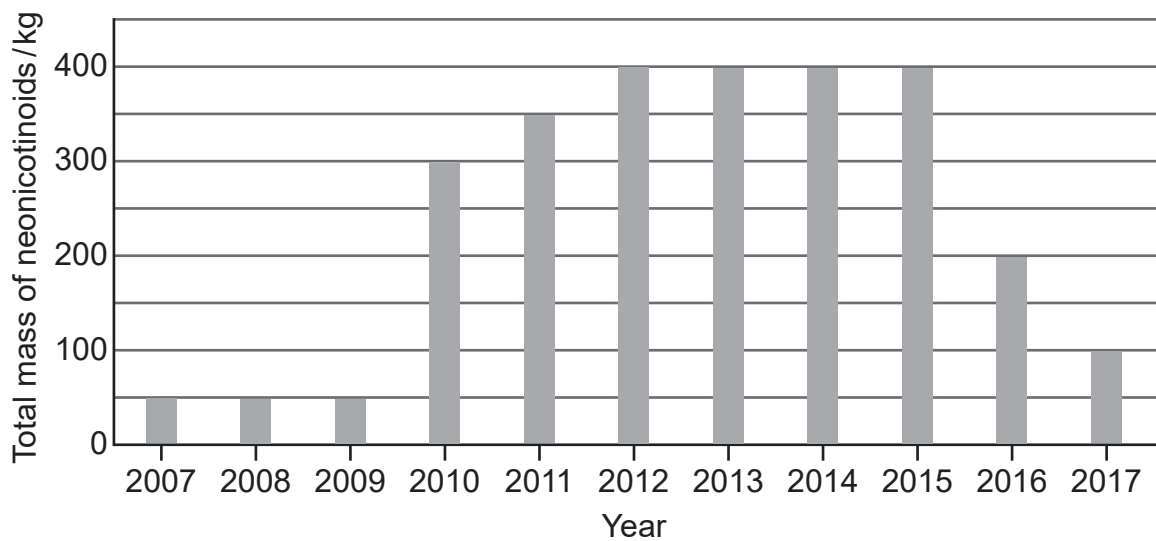


- 4 Pesticide use in agriculture has had a negative impact on biodiversity. Many pesticides kill insects from a wide variety of species in addition to the target pest species.

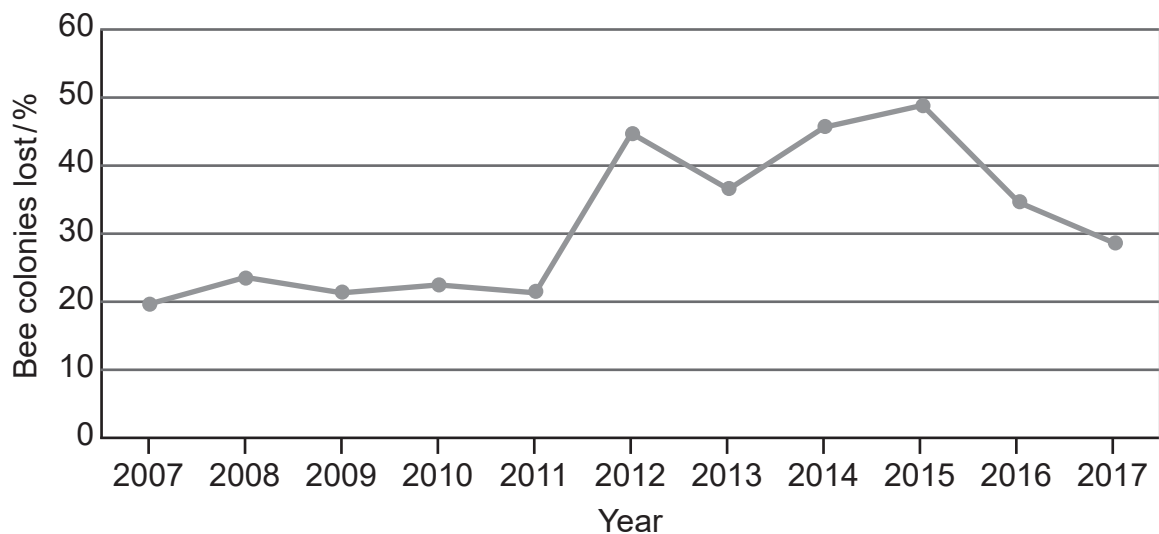
Recent research indicates that a group of pesticides called neonicotinoids are harmful to honeybees. Honeybees live in large groups called colonies. It is thought that neonicotinoids have been responsible for the death of many colonies in recent years.

Graph A below shows the total mass of neonicotinoids used over a 10 year period in Great Britain and Graph B shows the percentage of bee colonies lost over the same period.

Graph A



Graph B





(c) Farmers and commercial fruit growers are encouraged to use integrated pest management strategies.

(i) Explain what is meant by 'integrated pest management'.

---

---

---

[1]

(ii) The use of predator strips at field margins is a pest control strategy. Explain how this has a positive effect on biodiversity.

---

---

---

---

---

---

---

---

---

---

[3]





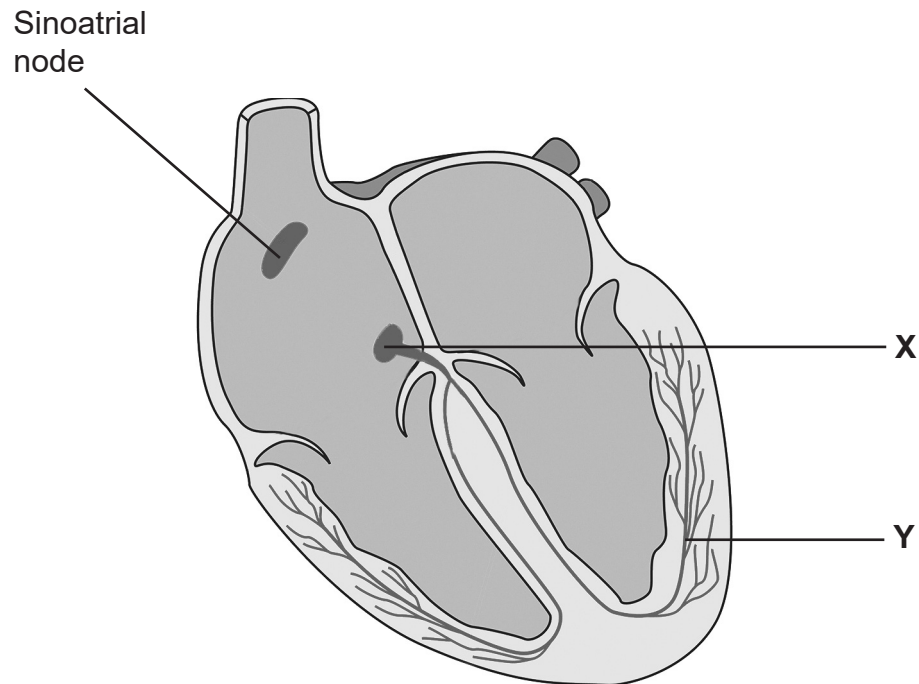
**BLANK PAGE**

**DO NOT WRITE ON THIS PAGE**

**(Questions continue overleaf)**



- 5 The diagram below shows some of the structures involved in conducting a wave of excitation through the heart muscle.



Source: © Peter Gardiner/Science Photo Library

- (a) (i) Identify the structures labelled X and Y.

X \_\_\_\_\_

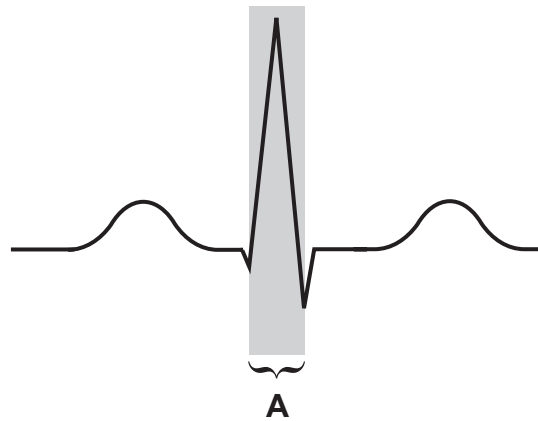
Y \_\_\_\_\_

[2]





(b) The diagram below shows a section of a heart trace from an ECG.



Source: *Life and Health Sciences for CCEA AS Level* by N. Henry, J. Napier J., E. Dougan. (ISBN: 978-1780731865) Published April 2019 © Colourpoint Educational

(i) Name the section labelled **A**.

\_\_\_\_\_

[1]

(ii) Identify the stage of the cardiac cycle that this corresponds to.

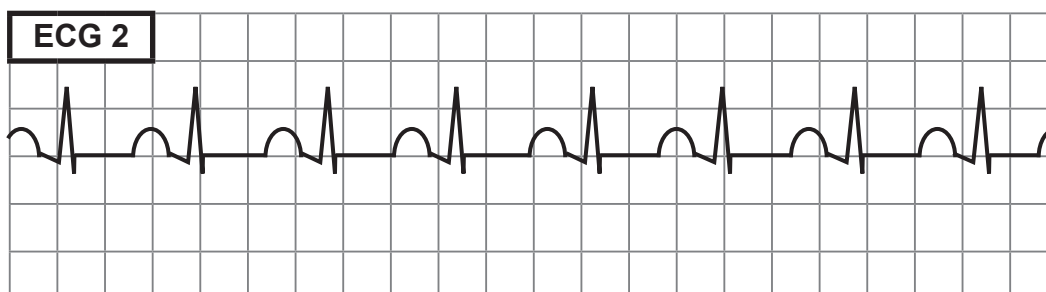
\_\_\_\_\_

[1]



Supraventricular tachycardia (SVT) is a heart condition where the heart beats much faster than normal. A normal heart rate ranges from 60 to 100 beats per minute, but it may be as high as 250 beats per minute in someone experiencing SVT.

**ECG 1** represents normal activity in the heart while **ECG 2** represents that of an individual experiencing SVT (referred to as an SVT 'episode').



Source: *Life and Health Sciences for CCEA AS Level* by N. Henry, J. Napier J., E. Dougan. (ISBN: 978-1780731865)  
Published April 2019 © Colourpoint Educational

(iii) Identify **two** ways in which **ECG 2** is different from **ECG 1**.

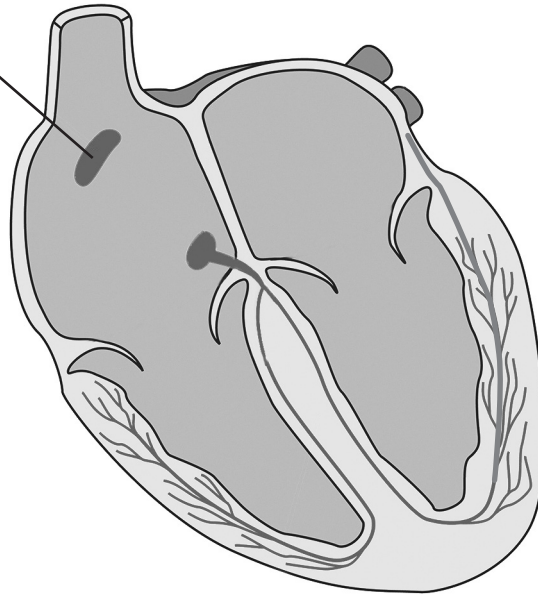
1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- [2]



- (c) Another heart condition which leads to unusual ECG traces is Wolff-Parkinson-White syndrome. This is caused by an additional area of conductive tissue known as the Bundle of Kent.

The diagram represents the heart of an individual with this syndrome.

Sinoatrial  
node



Source: © Peter Gardiner / Science Photo Library

- (i) With the letter **X**, label the additional conductive tissue. [1]

- (ii) Suggest the effect of this additional conductive tissue on heart function.

---

---

---

---

---

---

---

[2]



**6** Peatlands Park in Northern Ireland has the designations ASSI and SAC. There is a range of habitats within the area, including lowland raised bog, woodland and open water in the form of Derryadd Lough. The area supports rich animal and plant diversity, including a number of rare species.

**(a) (i)** State what the term SAC stands for.

\_\_\_\_\_ [1]

**(ii)** State the role of ASSIs and SACs in promoting biodiversity.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [1]

[Turn over



- (b) In Peatlands Park, large parts of the lowland raised bog have been cut for turf over many years. There are some areas within the site, however, where the bog has not been cut. These areas are considered to be actively growing bog and public access is prevented.

A survey was carried out to assess the biodiversity of both the cut and uncut bog areas within Peatlands Park. The abundance of 11 different plant species was estimated at several sites in each bog. Simpson's index was then calculated from the data collected.

The table below shows the total number (**n**) of the different species found in 10 sample areas in the **uncut** bog.

Plant Species	n	$n_i(n_i-1)$
Bog moss	987	973 182
Bog cotton	944	890 192
Ling heather	496	245 520
Bog myrtle	33	1056
Cranberry	739	545 382
Lichen	0	0
Birch	24	552
Pine	0	0
Rhododendron	0	0
Sundew	19	342
Cross-leaved heath	140	19 460

The formula for calculating Simpson's index is:

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

where N = the total number of all organisms

$n_i$  = the number of organisms of each individual species





Two species of heather are found in both the cut and uncut bogs: cross-leaved heath (*Erica tetralix*) and ling heather (*Calluna vulgaris*).

### Cross-leaved heath



Source: © Bob Gibbons / Science Photo Library

### Ling heather



Source: © Bob Gibbons / Science Photo Library

(d) Using **only** the photographs, describe two differences between the species which could help researchers classify them.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

[2]



(e) Sundew (*Drosera rotundifolia*) was only found on the uncut bog. The sundew is a carnivorous plant which most commonly grows in nutrient-deficient, acidic soils. Structures on the leaves release a sticky substance which attracts and traps insects. The leaf cells release digestive enzymes onto the insects and the products of digestion are then absorbed into the leaf.

(i) Suggest how being carnivorous helps the sundew plant survive in bog areas.

---

---

---

---

---

---

---

---

---

---

[2]

(ii) Sundew is **not** found in the woodland habitats of Peatlands Park. Suggest an explanation for this.

---

---

---

---

---

---

---

---

---

---

[1]

[Turn over











**BLANK PAGE**  
**DO NOT WRITE ON THIS PAGE**

12642



\*32SBY2130\*





**BLANK PAGE**  
**DO NOT WRITE ON THIS PAGE**

12642



\*32SBY2131\*

**DO NOT WRITE ON THIS PAGE**

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

<b>Total Marks</b>	
--------------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.  
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

12642/5



\*32SBY2132\*