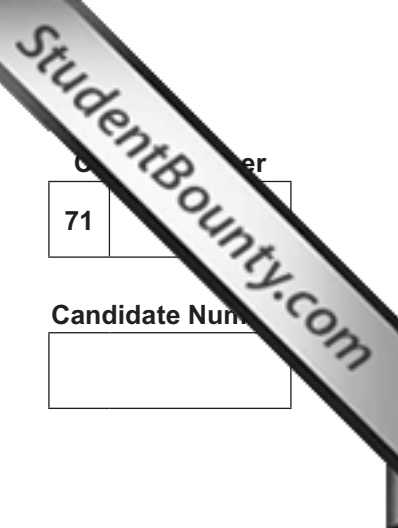




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ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2013



71	
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## Biology

Assessment Unit AS 2  
*assessing*  
Organisms and Biodiversity

[AB121]



MONDAY 17 JUNE, AFTERNOON

### 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.

Write your answers in the spaces provided in this question paper. There is an extra lined page at the end of the paper if required. Answer **all eight** questions.

You are provided with **Photographs 2.5A and B** for use with **Question 5** in this paper. Do not write your answers on these photographs.

### 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**, and awarded a maximum of 2 marks.

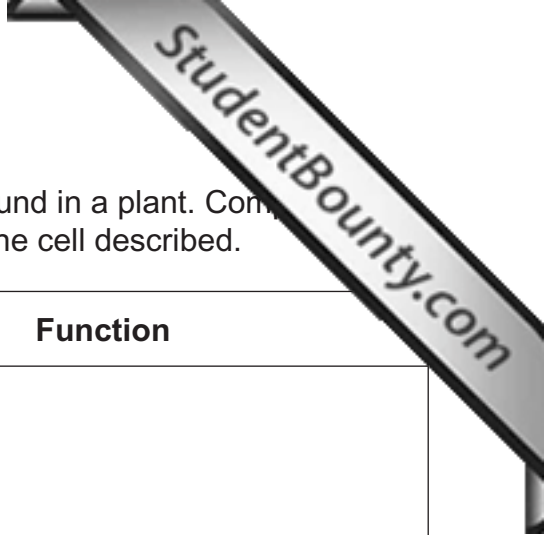


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Question Number	Marks
1	
2	
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8	
<b>Total Marks</b>	

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**Section A**



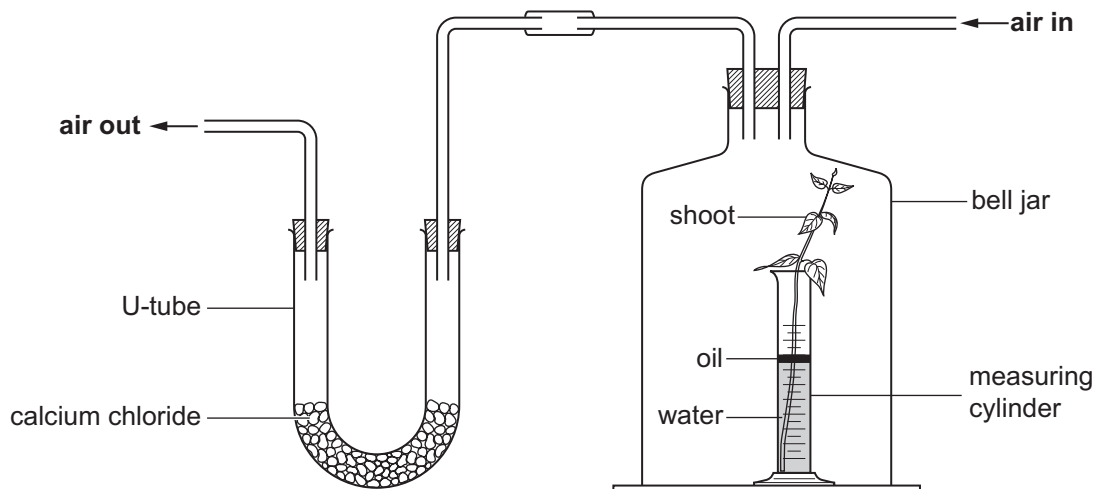
1 The table below contains descriptions of three types of cell found in a plant. Complete the table by identifying each cell type and outline the function of the cell described.

Description	Identification	Function
Cells located in the root, which contain deposits of suberin in their cell walls.		
Nucleated cells with dense cytoplasm located in phloem tissue.		
Specialised root epidermal cells with an extension into the soil.		

[6]

Examiner Only	
Marks	Remark

2 The apparatus below can be used to measure both the amount of water taken up and the amount of water lost through transpiration by a leafy shoot.



Air is drawn into the bell jar and passes through calcium chloride before leaving the apparatus. Calcium chloride absorbs water vapour from the air and increases in mass as it does so. The increase in mass is used as a measure of water loss by transpiration. The amount of water taken up by the shoot is measured by noting the decrease in the reading on the measuring cylinder.

(a) Air entering the bell jar does not pass through calcium chloride. Discuss how this will affect the validity of the experiment.

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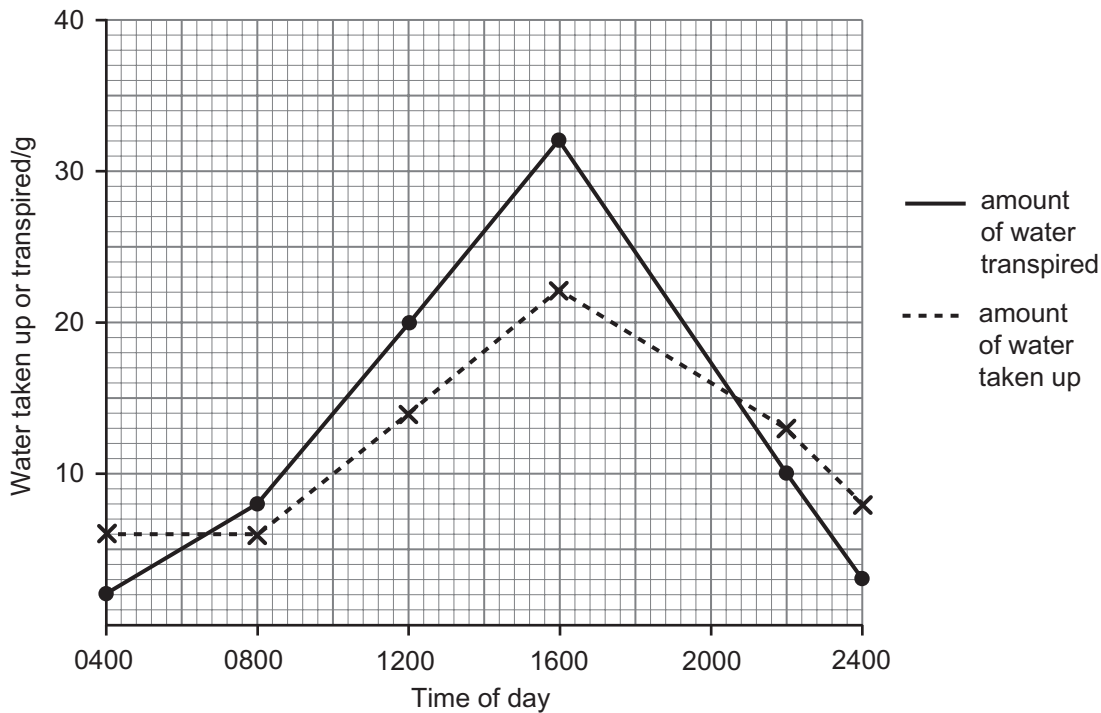
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[2]

The graph below indicates how the amount of water taken up and the amount of water transpired by a plant shoot changes over the course of a summer's day.



(b) Suggest reasons for the following observations from the graph.

(i) There are two periods of the day when the amount of water transpired is less than the amount of water taken up.

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[2]

(ii) At 1600, the amount of water transpired and the amount of water taken up are both at their maximum.

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[3]

3 Grenadier fish live in very deep oceanic waters. They swim slowly over the seabed at depths of 3000 metres where the oxygen levels are approximately 50% of the surface value.

In contrast to the grenadier, herring are fast-swimming fish located in the upper layers of the ocean, where the oxygen levels are at their highest.

Both types of fish use haemoglobin to transport oxygen around their bodies. However, they differ in the amount of haemoglobin carried in the blood and in the way their haemoglobin associates with oxygen.

(a) Grenadier fish have a haemoglobin level of  $6.4 \text{ g cm}^{-3}$  of blood and herring have  $14.0 \text{ g cm}^{-3}$ . Suggest a reason for this difference.

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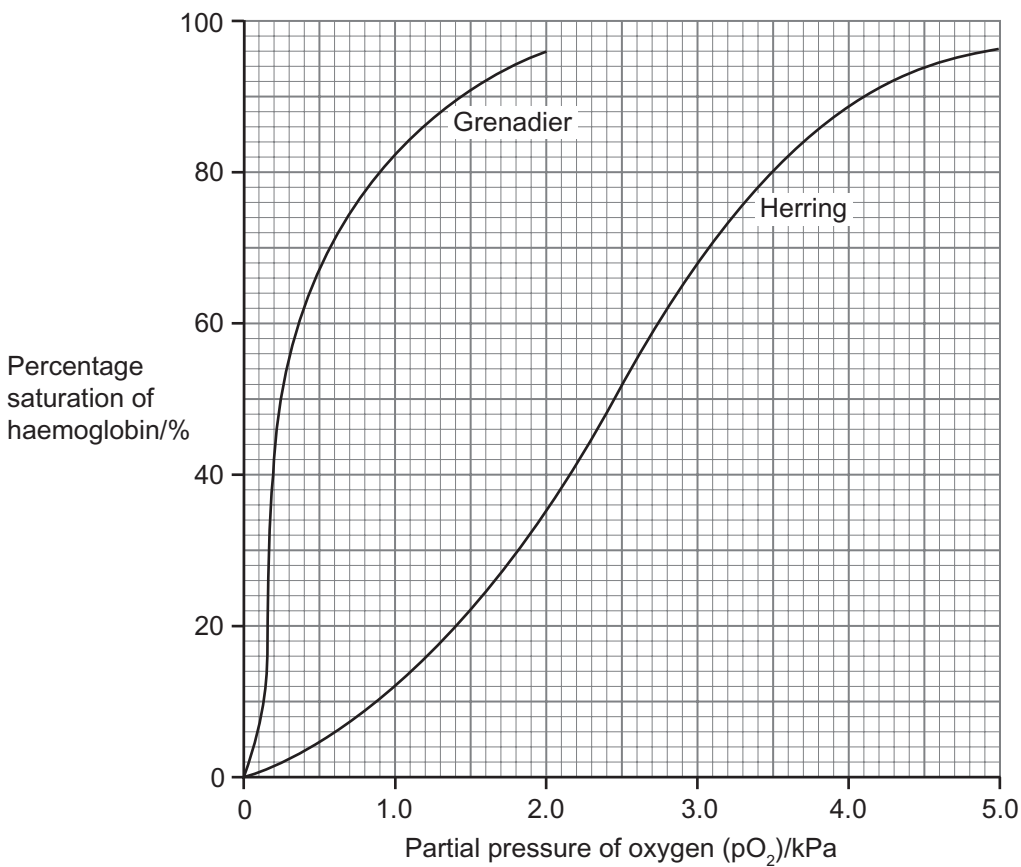
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[1]

The graph below shows the oxygen dissociation curves for the haemoglobin in each fish.



(b) Explain the sigmoidal shape of a typical oxygen dissociation curve, such as that of the herring.

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[2]

(c) Calculate the rise in percentage saturation of haemoglobin which would occur in herring, if the partial pressure of oxygen increased from 1 kPa to 2.5 kPa. (Show your working.)

\_\_\_\_\_ % [2]

(d) With reference to the loading of oxygen, account for the difference between the dissociation curves of the two fish.

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[2]

- 4 Jean-Baptiste Lamarck was a French botanist who proposed a theory of evolution prior to the theory of natural selection published by Charles Darwin in 1859.

Lamarck considered that, if an environmental change occurred, individual organisms would adapt in order to survive. For example, he suggested that if a giraffe stretched its neck to obtain leaves higher in a tree, this would directly result in its neck growing longer, i.e. the need to reach higher would cause the growth of the neck. Offspring from this giraffe would then inherit the longer neck and, over several generations, continued stretching would further enhance the length of the neck.

Lamarck's theory has now been largely discarded, because of our increased scientific knowledge.

- (a) State the type of selection which resembles the example of the giraffe given above. Give a reason for your choice.

Type of selection \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_ [2]

- (b) Describe **two** ways in which Lamarck's theory differs from the present theory of evolution by natural selection.

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_ [2]

- (c) Suggest how the above account of the theory of evolution illustrates the tentative nature of scientific knowledge.

\_\_\_\_\_

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



5 **Photograph 2.5A** shows a human blood smear from a person who is suffering from a form of anaemia. With this condition, there is a decreased concentration of haemoglobin in the erythrocytes causing them to appear pale pink.

(a) (i) State the functions of the components of blood labelled **A** to **C**.

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

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

**C** \_\_\_\_\_ [3]

(ii) The most common cause of anaemia is iron deficiency, since iron is essential for the formation of haemoglobin.

State precisely the part of the haemoglobin molecule which cannot be formed if there is a deficiency of iron.

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

**Photograph 2.5B** shows a transverse section through a human blood vessel. Two different types of blood cells are visible within the blood vessel lumen. The structure labelled **N** is a nucleus of a cell in the wall of the blood vessel.

(b) (i) Identify the type of blood vessel shown in **photograph 2.5B** and state **two** features, visible in the photograph, which enabled this identification.

Type of blood vessel \_\_\_\_\_ [1]

Features visible

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

\_\_\_\_\_

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

\_\_\_\_\_ [2]

(ii) There are three erythrocytes visible in the lumen of the blood vessel. From the evidence in the photograph, identify and explain **one** adaptation of erythrocytes which enables them to fulfil their role effectively.

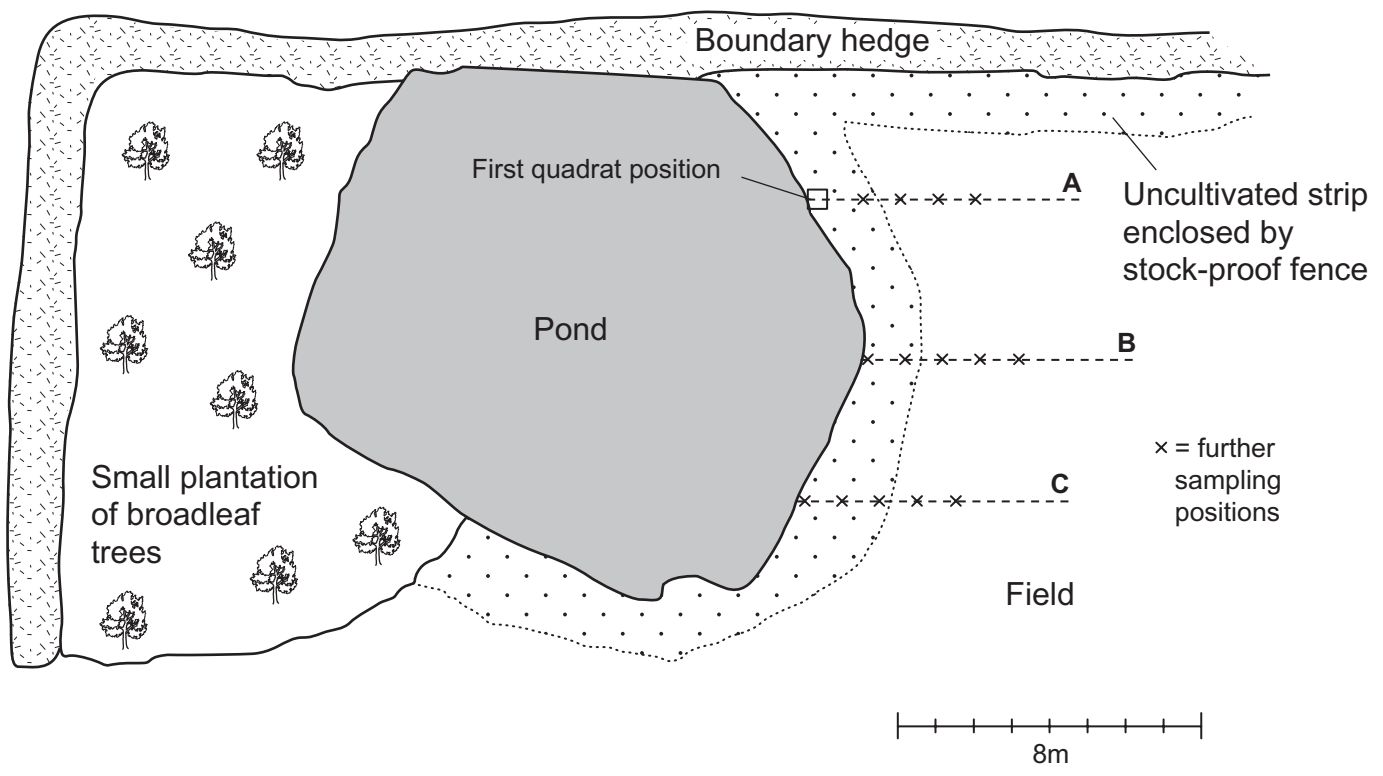
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\_\_\_\_\_ [1]

6 The Northern Ireland Countryside Management Scheme (NICMS) is a DAFF agri-environment scheme which pays grants to farmers who agree to manage according to certain restrictions.

One of the aims of the NICMS is to maintain species diversity through the positive management of farmland habitats. Farmers who enter the scheme must agree to manage their field boundaries in a certain way.

The map below shows a corner of a field which is being managed under this scheme.



(a) (i) Describe **two** ways in which the farmer would be required to manage the boundary hedge in order to maintain species diversity.

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

Examiner Only	
Marks	Remark

(ii) Describe how the uncultivated strip at the edge of the field increases biodiversity.

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[2]

The distribution of plant species around the pond and into the field was investigated to determine if there was a change in the number of species as the distance from the pond increases.

Ropes were placed at the water's edge and stretched along the ground leading away from the pond. The dashed lines on the map represent the positions of three such ropes at points **A**, **B** and **C**.

A square quadrat of side 50 cm was used to sample the vegetation along the length of the rope, with the first quadrat positioned at the edge of the pond (as shown on the map for rope **A**). The quadrat was then moved 1 m a further four times.

(b) Explain why the belt transect method described above was a more suitable sampling technique than random placing of quadrats.

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[1]

The number of plant species was recorded within each quadrat, positioned 1 m apart, along the length of each rope.

Along rope **A**, 2 plant species were recorded in the first quadrat, with 12 in the second, 4 in the third, 3 in the fourth and 3 in the fifth.

The number of plant species along rope **B** was 1 in the first quadrat, 11 in the second, 6 in the third, 2 in the fourth and 2 in the fifth.

There were 2 plant species recorded in the first quadrat at **C**, with 11 in the second, 10 in the third, 6 in the fourth and 3 in the fifth.

- (c) (i) Organise these results into a suitable table, using the caption given below.

***Variation in the number of plant species with distance from the edge of a farm pond***

[4]



- 7 (a) The jade plant (*Crassula ovata*) and starwort (*Callitriche palustris*) are plants which can be purchased from garden centres in the UK. Some of the features of the leaves of the plants are shown in the table below.

Feature	Jade plant ( <i>C. ovata</i> )	Starwort ( <i>C. palustris</i> )
Mean stomatal density (upper surface)/ number cm <sup>-2</sup>	1.6	22.6
Mean stomatal density (lower surface)/ number cm <sup>-2</sup>	7.4	10.1
Mean thickness of cuticle/μm	5.0	0.8
Mean depth of epidermis/μm	50	10

- (i) Using the information in the table and your understanding, determine which of the two plants is sold for use in garden ponds and, with reference to **two** features, explain how the data led you to this decision.

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[3]

- (ii) Apart from the features shown in the table above, describe and explain **one** adaptation of the leaves of xerophytic plants.

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[2]

- (b) (i) Part of the taxonomic hierarchy of the jade plant (*Crassula ovata*) is shown below.

Taxonomic group	Name
Kingdom	Plantae
Phylum/Division	Magnoliophyta
Class	Magnoliopsida
Order	Rosales
Family	Crassulaceae

Starwort is of a different order to the jade plant but shares the same class.

Identify **two** other taxonomic groups which are shared by the two plants.

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

Two plants which occur outside the UK include the spiderwort (*Tradescantia crassula*) and the swamp stonecrop (*Crassula helmsii*).

- (ii) Which of these plant species is probably most closely related to the jade plant? Explain your answer.

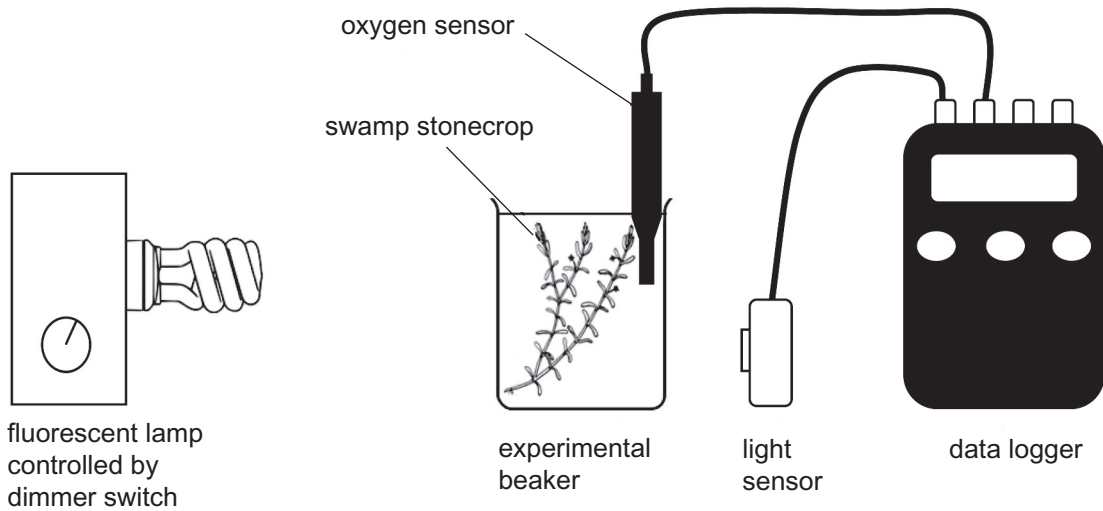
\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

- (iii) With reference to molecular structure, state **one** similarity which is expected in species which are closely related.

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

(c) Swamp stonecrop is an aquatic plant. In order to investigate its effect on pondwater oxygen level at different light intensities, the apparatus was set up as shown below in a darkened laboratory.

An oxygen sensor was used to measure the oxygen level around the plant and different light intensities were achieved by using a fluorescent lamp controlled by a dimmer switch.



(i) Suggest another means by which the intensity of the light could be varied.

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[1]

(ii) Explain fully why a fluorescent lamp, which has low heat emission, is preferred over an incandescent heat-emitting lamp in this investigation.

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[2]













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**THIS IS THE END OF THE QUESTION PAPER**

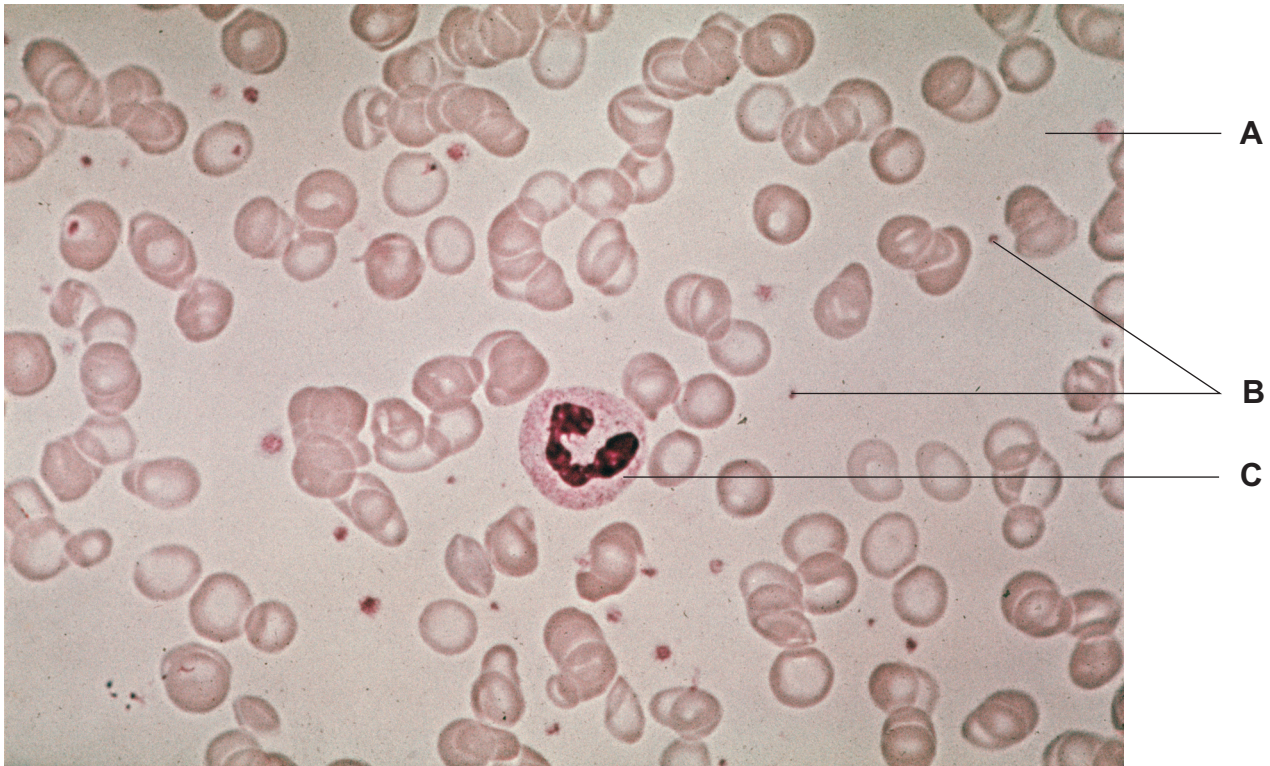
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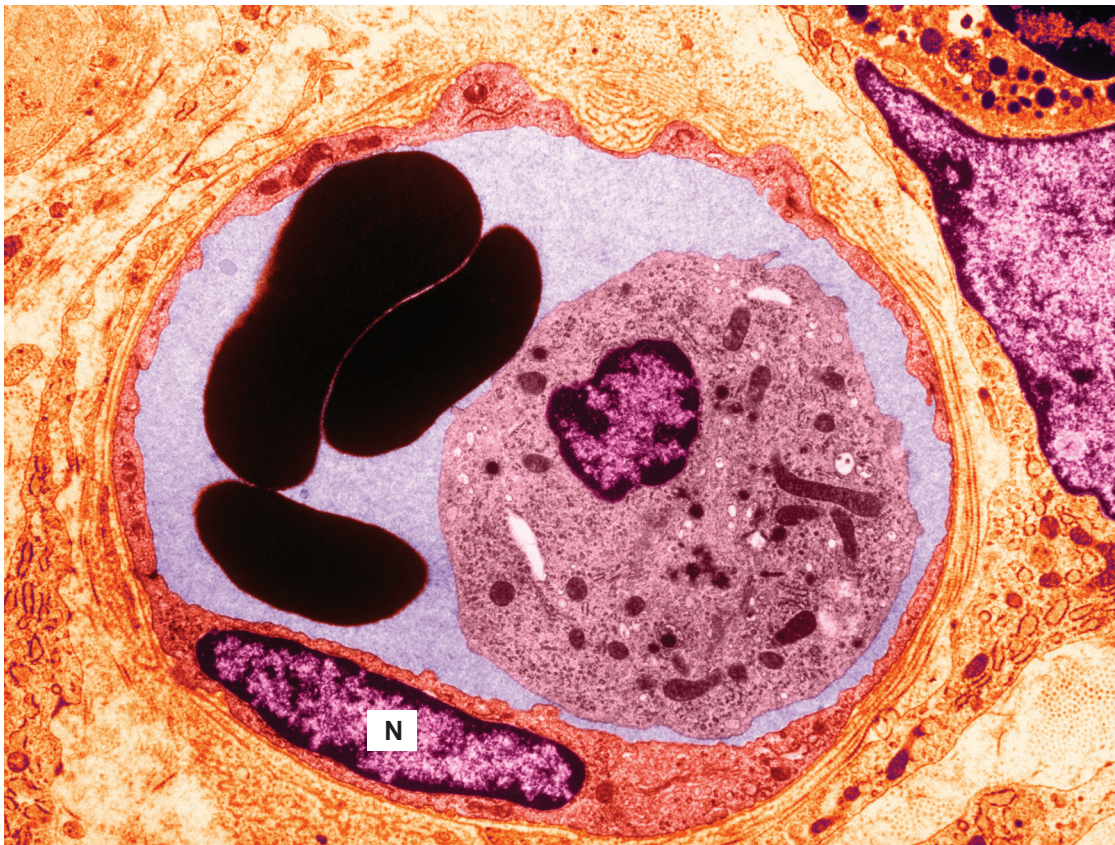


Photograph 2.5A (for use with question 5a)



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Photograph 2.5B (for use with question 5b)



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