Rewarding Learning

Centre Number	
71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2014

Biology

Assessment Unit AS 2

assessing

Organisms and Biodiversity

[AB121]

AB121

TUESDAY 14 JANUARY, 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.

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.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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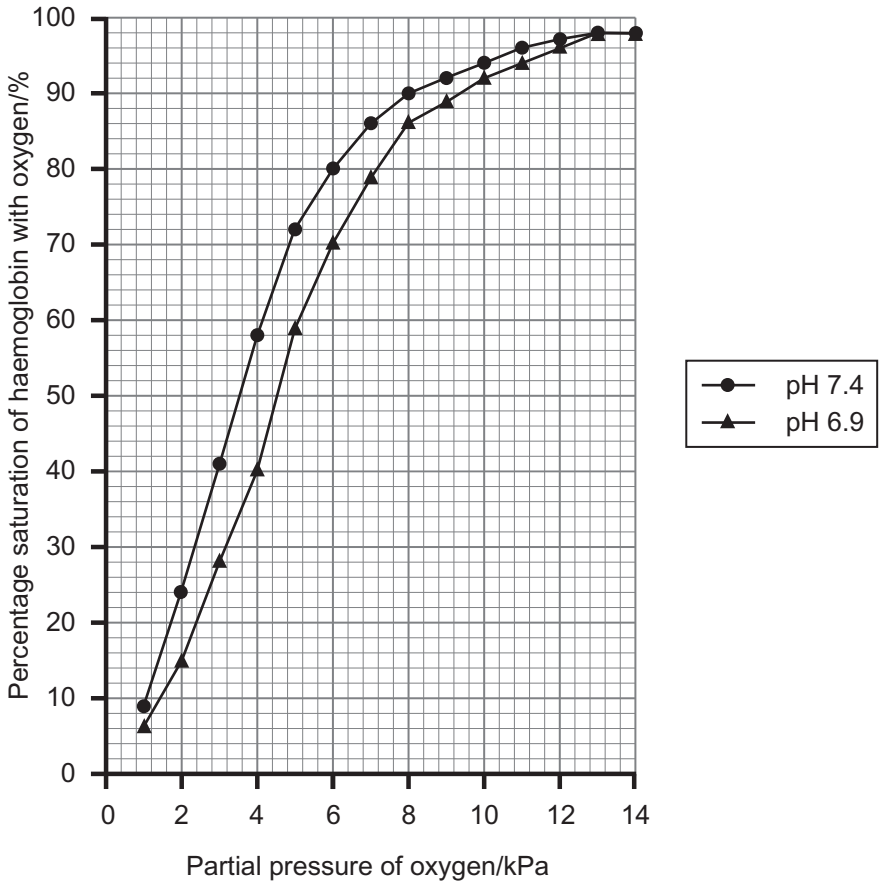
Section A

1 Read the following passage on classification, and write the most appropriate word in the blank spaces to complete the account.

All organisms can be grouped into one of five kingdoms namely Animalia, Plantae, Fungi, _____ and _____. Organisms in four of the kingdoms have cells containing membrane-bound organelles, and are therefore classified as _____. Both plant and fungal cells are surrounded by a cell wall which, in the kingdom Fungi, is composed of _____. The cells in kingdom Plantae possess chlorophyll to enable the _____ mode of nutrition, which is typical of this kingdom. [5]

2 **(a)** The oxygen dissociation curve of human haemoglobin at two different pH values is shown in the graph below.



(i) State how haemoglobin's affinity for oxygen is affected by a decrease in pH.

_____

_____ [1]

(ii) Explain how a decrease in pH is brought about in respiring tissue.

_____

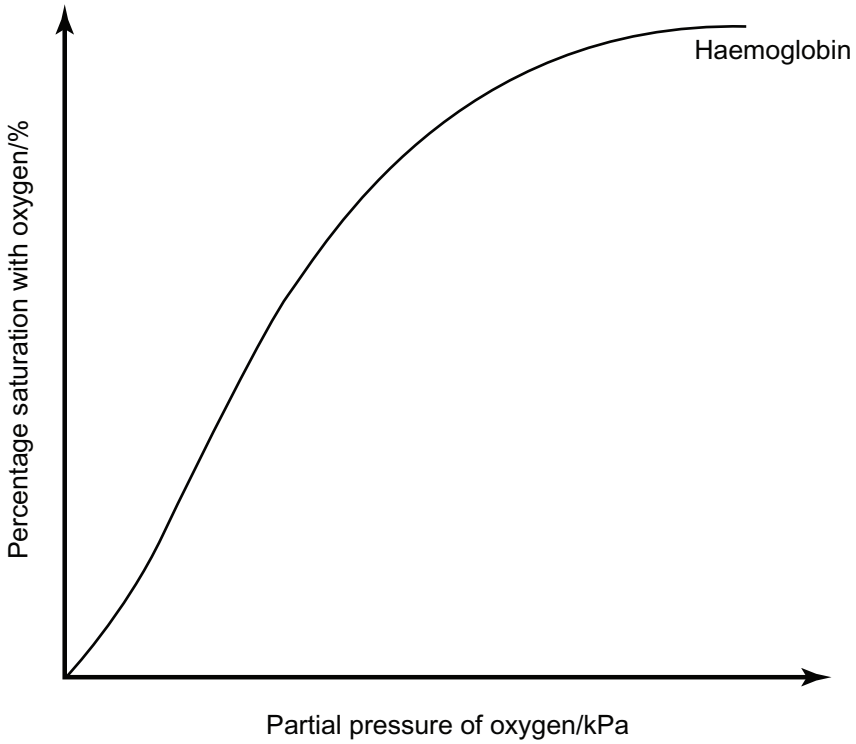
_____ [1]

(iii) Identify **one** other change, which occurs in respiring tissue, that affects haemoglobin saturation in the same way as a decrease in pH.

_____ [1]

(b) The oxygen dissociation curve for myoglobin differs from that of haemoglobin.

(i) Sketch the dissociation curve for myoglobin on the following graph, which already shows the dissociation curve for haemoglobin.



[1]

(ii) The bottlenose dolphin can dive and remain submerged for up to ten minutes.

The level of myoglobin in the muscle tissue of diving mammals, such as the bottlenose dolphin, is higher than that of similarly-sized terrestrial (land) mammals. Suggest a reason for this.

_____

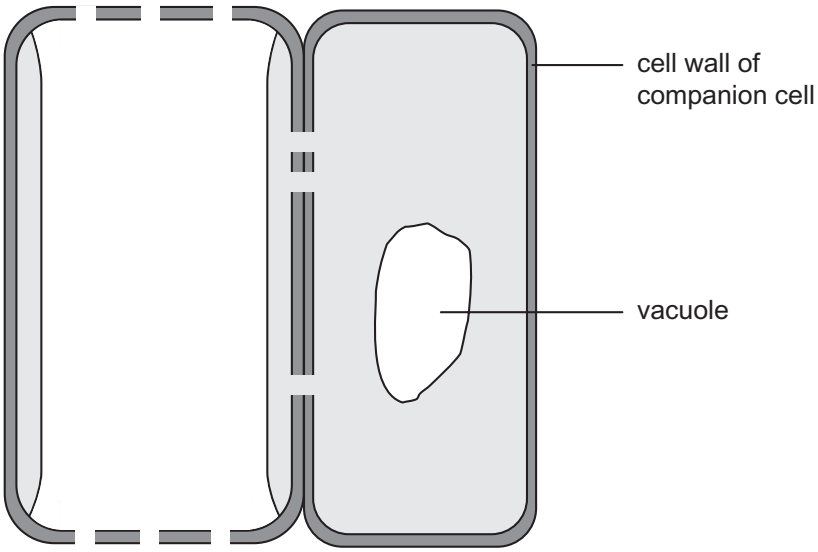
_____

_____

_____

_____ [2]

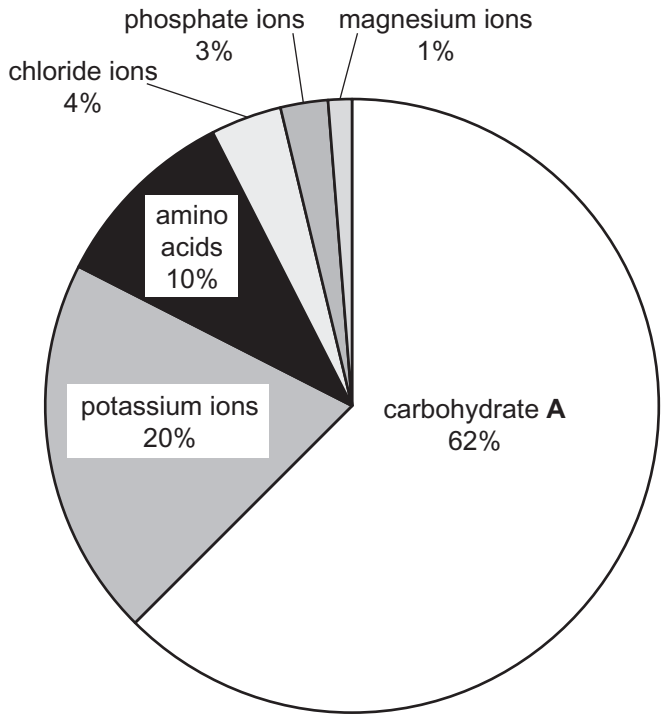
3 A phloem sieve tube element in the vascular bundle of a plant stem, with its associated companion cell, are represented in the diagram below.



(a) On the diagram:

- clearly indicate the position of a sieve plate by labelling with the letter **S**
- use an arrow, or arrows, to clearly indicate the direction of translocation of organic solutes [2]

(b) The percentage composition of the sieve tube contents in barley plants is shown in the pie chart below.



(i) Suggest the identity of carbohydrate **A**.

_____ [1]

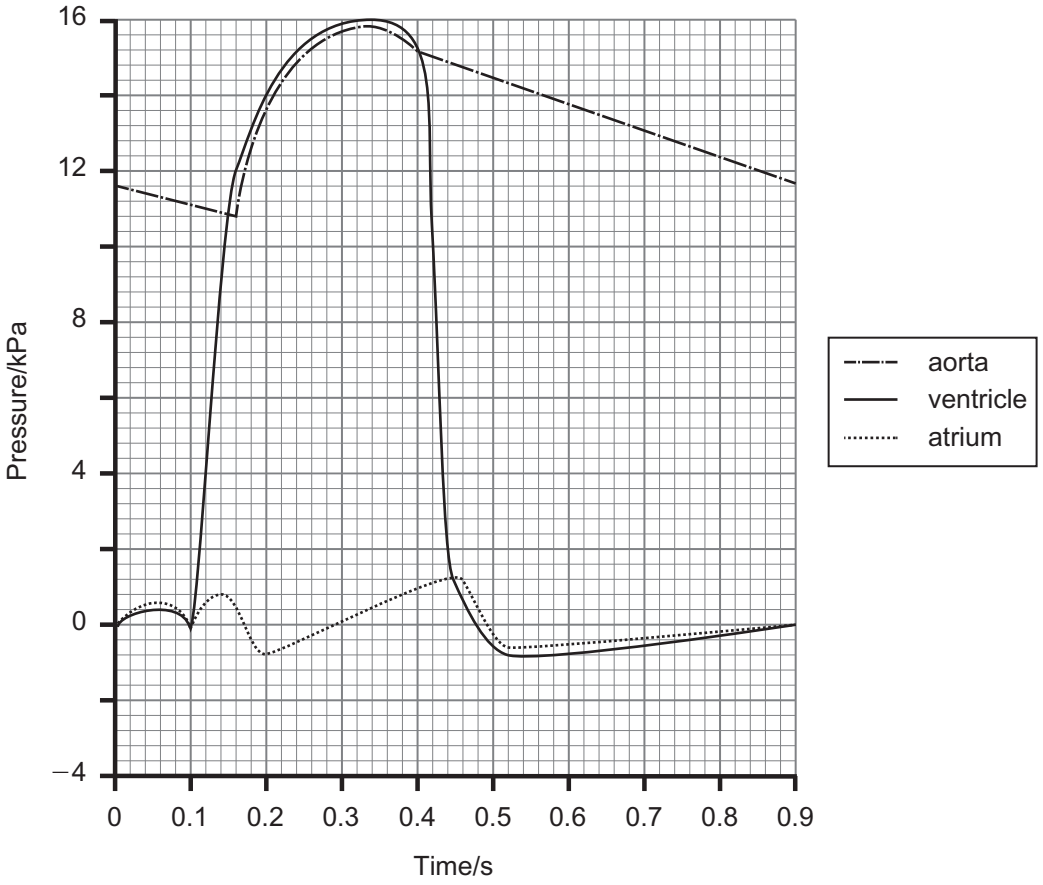
(ii) The amino acids in the sieve tubes have been synthesised by the barley, using nitrate ions which have been taken in from the soil.

Suggest why there are no nitrate ions located in the sieve tubes.

_____

_____ [1]

4 **(a)** The graph below shows pressure changes which take place in the left side of the heart during one complete cardiac cycle.



(i) State the cause of the increase in ventricular pressure which occurs at 0.1 s.

_____ [1]

(ii) State the effect of the closure of the semi-lunar valves on blood flow, and give the time at which this occurs in the graph above.

Effect of semi-lunar valves closure _____

_____

Time at which this occurs _____ [2]

(iii) The maximum pressure generated by the left ventricle, as shown in the graph, differs from that of the right ventricle.

State how the maximum pressure in the right ventricle differs and account for this difference.

_____

_____

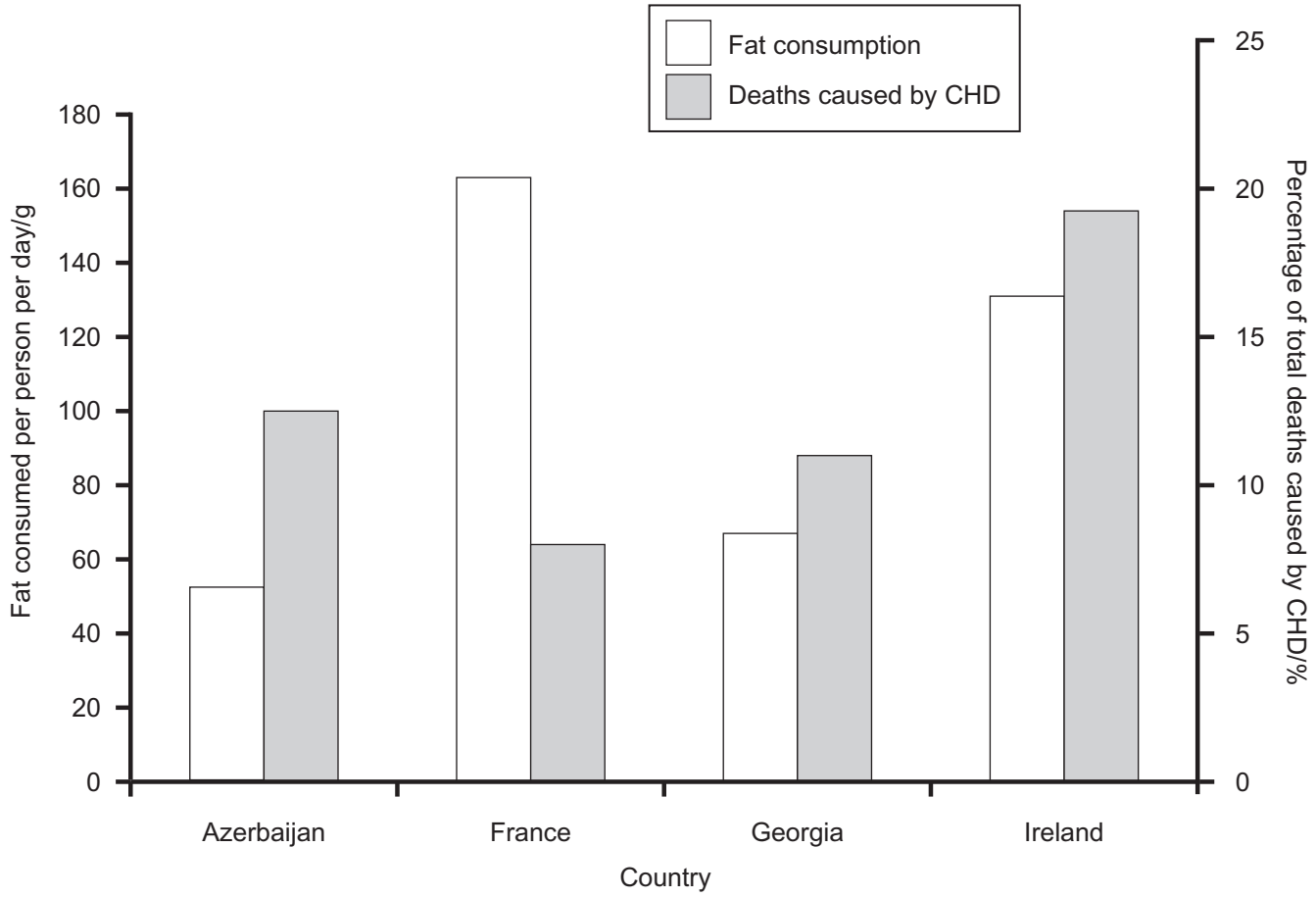
_____

_____

_____ [2]

(b) It is considered that a diet which is rich in fat can lead to the developme
cardiovascular diseases such as coronary heart disease (CHD).

The amount of all types of fat consumed per person and the percentage of tota
due to coronary heart disease (CHD) were investigated in four countries. The resu
are shown in the graph below.



(i) From the graph, identify **one** piece of evidence in favour of the proposed link between fat consumption and deaths from CHD and **one** piece of evidence against the existence of such a link.

Evidence in favour: _____

_____

_____

Evidence against: _____

_____

_____ [2]

Examiner Only	
Marks	Remark

(ii) Some scientists have suggested that analysing **total** fat intake in relation to incidence of CHD decreases the validity of the investigation. Suggest why.

_____

_____ [1]

5 A bog in Co. Down is designated as an ASSI. In this bog, the percentage cover of plant species was estimated in 10 randomly placed quadrats. The results are summarised in the table below.

Plant species	**Total % cover of each species in 10 quadrats (n_i)**	**$n_i(n_i-1)$**
Bog moss	990	979 110
Bog cotton	445	197 580
Ling heather	220	48 180
Cross-leaved heather	330	108 570
Cranberry	240	57 360
Lichen	45	1 980
Bog asphodel	235	54 990
	$N = 2505$	**$\sum n_i(n_i-1) = 1\,447\,770$**

(a) (i) State what is represented by the letters ASSI.

_____ [1]

(ii) Calculate the value for Simpson's Index (D) for this bog.

The formula for calculating D is presented as

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

where n_i = the total % cover of each individual species
N = the total % cover of organisms of all species
(Show your working.)

Answer _____ [2]

(b) (i) In another bog, located in Co. Armagh, plant species were also sampled and the Simpson's Index (D) was calculated as 0.24.

Compare the biodiversity of the two bogs and suggest an explanation for the value of the Simpson's Index obtained in the Co. Armagh bog.

_____

_____

_____

_____

_____ [2]

(ii) Simpson's Index is a measurement of species diversity.

Distinguish between the terms 'species diversity' and 'genetic diversity'.

_____

_____

_____

_____

_____ [2]

(c) Two distinct species, ling heather and cross-leaved heather, were found in both bogland locations. If these two species were closely related, state how their DNA and protein molecules would display similarities.

DNA _____

_____

Protein molecules _____

_____ [2]

(d) Bog cotton was also found in both bogland locations. Bog cotton possesses a hydrophytic adaptation in the form of aerenchyma tissue. This tissue enables the passage of oxygen to the roots from the leaves.

Explain fully why aerenchyma tissue is a useful adaptation for plants in bogland habitats.

_____

_____

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

6 An investigation was carried out to show how light intensity affects the rate of carbon dioxide uptake in two different plant species. The results are shown in the table below.

Light intensity/ $W m^{-2}$	Rate of carbon dioxide uptake/ arbitrary units	
	Species A	Species B
0	−2.0	−2.0
20	1.6	−0.3
40	3.3	1.4
120	4.8	8.2
160	5.1	9.3
240	5.1	9.3

(a) Using the most appropriate graphical technique, plot the above data. (Use the graph paper opposite.) [4]

(b) Plant species **B** is grown commercially using artificial light sources. Using the graph, determine the light intensity value at which species **B** will grow most economically. Explain your answer.

_____

_____

_____ [2]

(c) For each plant species, there is a particular light intensity value which results in no net exchange of carbon dioxide.

State the term used to describe this value and explain how it arises.

_____

_____

_____

_____ [2]

(d) (i) In its natural habitat, plant species **A** can be found growing under dense tree cover, but plant species **B** is confined to bright forest clearings.

Using all the information provided, explain how plant species **A** is adapted for growing in shady conditions.

[2]

(ii) The chloroplasts in plant species **A** are particularly large. This is an adaptation for the low levels of light intensity that occur in its natural habitat. Suggest how directional selection may have given rise to this adaptation in species **A**.

[3]

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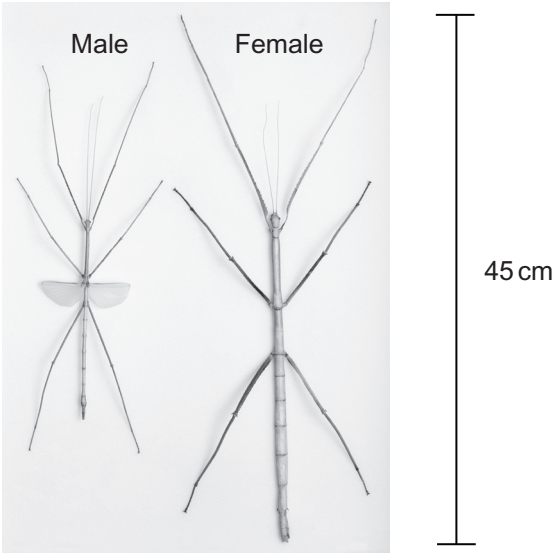
(Questions continue overleaf)

7 The photograph below shows a male and female stick insect. Adult females lack wings and are larger than the males. Adult males are winged and must release sufficient energy from respiration to facilitate flight.



© Pascal Goetgheluck / Science Photo Library

Insects do not use blood to transport oxygen and therefore oxygen needs to be carried directly from the atmosphere to the respiring tissues.

There are surface pores along the sides of the stick insect, which enable air to move in and out. These surface pores are connected internally to a series of fine tubes (resembling bronchioles) to allow the passage of oxygen to the respiring cells.

(a) Explain how the body shape of a stick insect assists the diffusion of oxygen which has entered the fine tubes from the atmosphere.

_____

_____

_____

_____

_____ [2]

(b) (i) A student hypothesises that the density of surface pores on the male would be greater than that of the female. Suggest the reasoning behind this hypothesis.

_____

_____

_____

_____

_____ [2]

(ii) Another student puts forward a different hypothesis, proposing that the density of surface pores on the male would not differ greatly from that of the female. Suggest the reasoning behind this alternative hypothesis.

_____

_____

_____

_____

_____ [2]

(c) In stick insects, the junction between the ends of the fine tubes and the respiring tissue is filled with a small amount of fluid. Explain the function of the fluid in this particular location.

_____

_____

_____

_____

_____ [2]

(d) The diagram below shows a respirometer which is being used to monitor the exchange of gases between a stick insect and its environment. **Tube A** contains the stick insect and **tube B** is acting as a thermobarometer (compensates for changes in temperature and pressure).

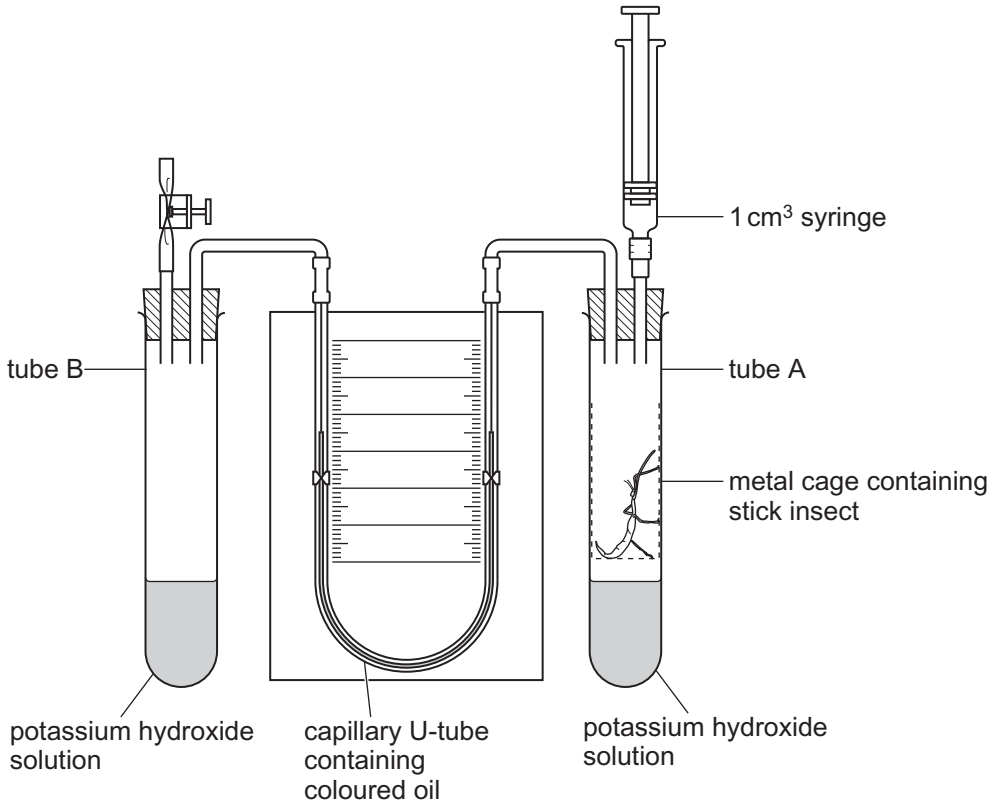


Image taken from www.practicalbiology.org and reproduced with permission from the Nuffield Foundation and the Society of Biology.

Explain how the apparatus shown would be used to determine the rate of oxygen uptake by the stick insect.

_____

_____

_____ [4]

Section B

Quality of written communication is awarded a maximum of 2 marks in this section.

8 In intensive agriculture, farmers maximise both the area and the productivity of the land which they farm. However, such practices have been associated with a reduction in biodiversity.

Describe the range of practices used in intensive agriculture, and explain how they can reduce biodiversity on farms. [13]

Quality of written communication [2]

Extra lined page