Surname	Centre Number	Candidate Number
Other Names		2

GCE AS

B400U20-1

S18-B400U20-1

eduqas
Part of WJEC

BIOLOGY – AS component 2
Biodiversity and Physiology of Body Systems

MONDAY, 4 JUNE 2018 – AFTERNOON

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**11**	
2.	**10**	
3.	**13**	
4.	**15**	
5.	**17**	
6.	**9**	
Total	**75**	

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ADDITIONAL MATERIALS

In addition to this paper you will require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The assessment of quality of extended response (QER) will take place in question **6**.

The quality of written communication will affect the awarding of marks.

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Answer **all** *questions.*

1. Organisms display a wide range of feeding mechanisms. For example, *Amoeba* are holozoic and feed by ingesting food particles which are digested intracellularly, whereas fungi are saprotrophic.

(a) Define the term *saprotrophic*. [1]

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(b) The parasitic tapeworm *Taenia solium* is an endoparasite that completes its life cycle in two different species of animal, humans and pigs. As an adult, *T. solium* lives in the human intestine. The tapeworm has no mouth or alimentary canal and relies on anaerobic respiration to provide energy.

(i) Describe how the tapeworm is adapted to resist peristalsis in the human intestine. [1]

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(ii) Explain why the tapeworm does not need a mouth or alimentary canal. [2]

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(iii) Suggest why the tapeworm relies on anaerobic respiration for its metabolism. [1]

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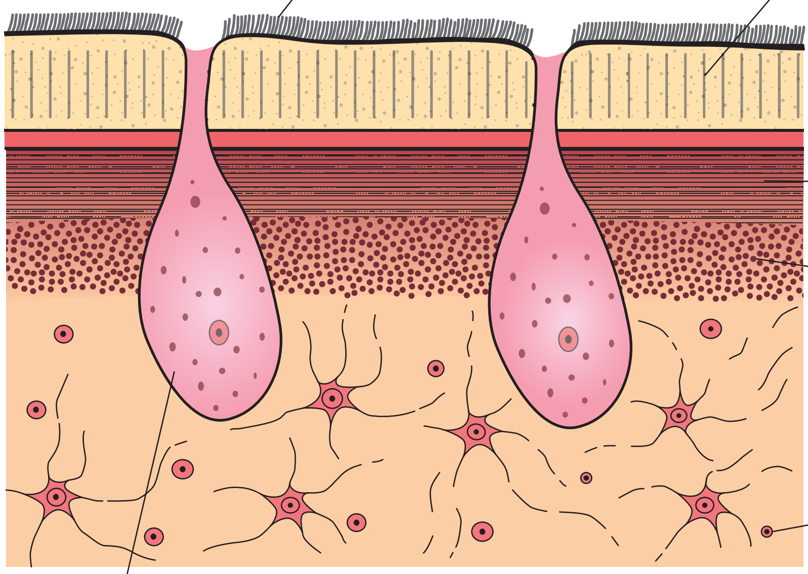
(c) The diagram below shows a section of the tapeworm's body wall.



(i) Describe and explain how the adaptations visible in the diagram enable the tapeworm to survive in the environment within the host. [4]

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(ii) Body wall cells of *T. solium* have been observed to contain transmembrane proteins involved in active transport mechanisms. Suggest how these mechanisms aid the survival of the parasite within its host. [2]

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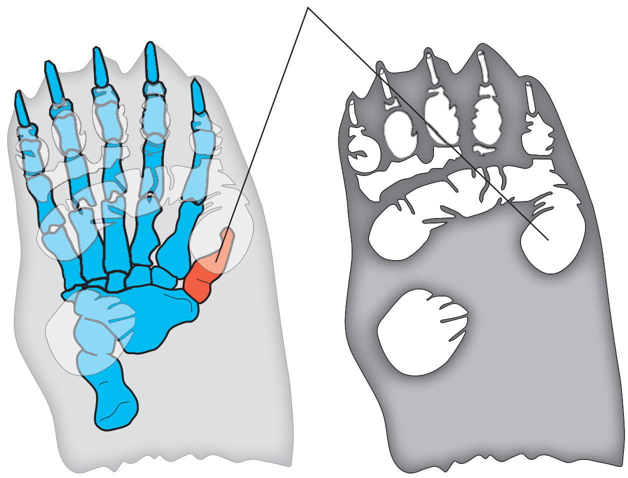
2. Giant pandas, *Ailuropoda melanoleuca* and red pandas, *Ailurus fulgens* are both mammals which are native to China. It was long believed that giant pandas and red pandas were close evolutionary relatives and there is much evidence to support this hypothesis:

- both animals live in similar habitats,
- both have digestive systems similarly adapted to their bamboo diet,
- both have a sixth digit, known as a pseudo-thumb, which they use to grip and shred bamboo shoots.



With the advent of DNA sequencing techniques, it has been possible to compare the DNA of different species to confirm how closely related they are to each other.
The table below shows mitochondrial DNA sequences from four species of mammal including giant panda and red panda.

Species	Mitochondrial DNA (mtDNA) codes
Black bear	……ATTGGAGCAGACTTA……
Giant panda	……ATTGGCACTAATCTA……
Red panda	……ATTGGAACTAATCTT……
Raccoon	……ATCGGAACTAATCTT……

(a) Use the table to identify which of the species is most closely related to the red panda. Explain your answer. [2]

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(b) In the study, mitochondrial DNA base pairs were analysed.
The following number of differences were found between giant panda DNA and that of the other species analysed:

Red panda	17
Black bear	12
Raccoon	21

One estimate of the mutation rate for the mitochondrial DNA sequence analysed is 3.95×10^{-7} mutations yr^{-1}.

Estimate how many years ago the giant panda and the red panda last shared a common ancestor. **Give your answer in standard form to two significant figures.** [3]

Answer: ....

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(c) There has been some debate as to whether the pseudo-thumb in red pandas and giant pandas are examples of analogous or homologous structures. Distinguish between analogous and homologous structures. Explain why analogous features are not considered evidence of common ancestry. [3]

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(d) In 1977, Carl Woese proposed the three domain system based on analysis of differences in the nucleotide sequences of 16S rRNA genes. Identify the domain to which the giant panda would belong. Give a reason for your answer. [2]

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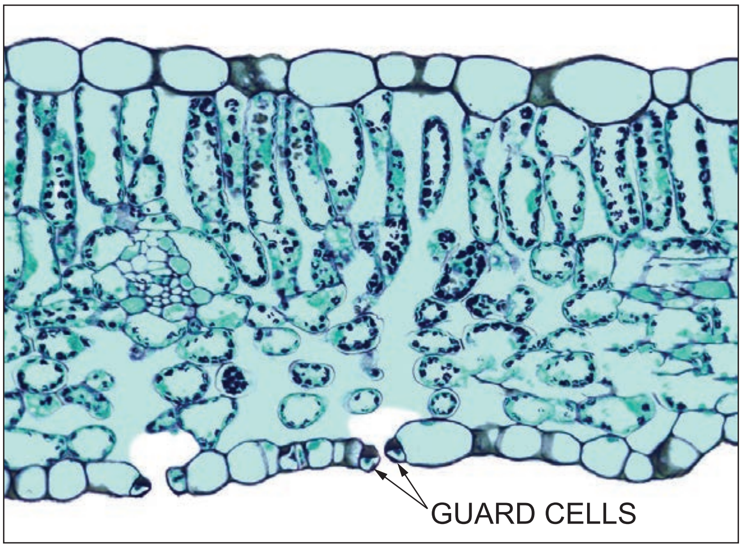
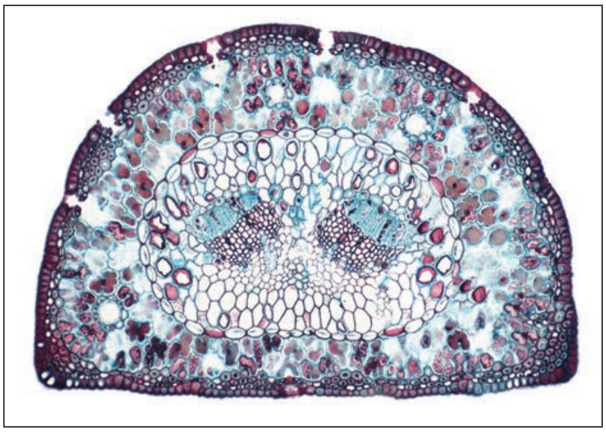
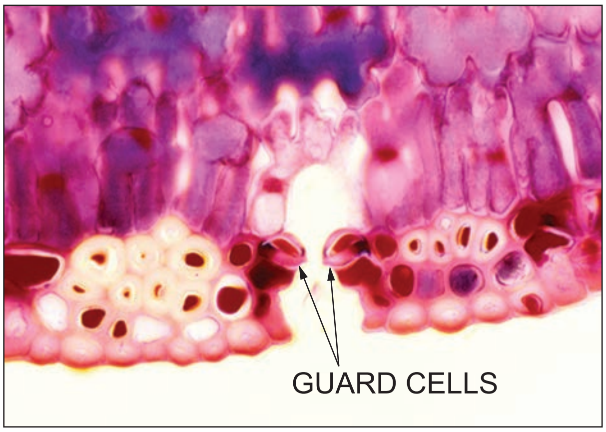
3. There is a wide variation in the rate of water loss from different plant species. Such variation is often due to structural features of the leaf. The photomicrographs below show transverse sections of a leaf of privet *(Ligustrum sp.)* and a leaf of pine *(Pinus sp.)*.



Ligustrum sp. T.S. leaf



Pinus sp. T.S. leaf



detail of stoma of *Pinus sp.*

(a) Use the photomicrographs to explain why less water vapour is lost through the stomata of *Pinus sp.* than through the stomata of *Ligustrum sp.* . [3]

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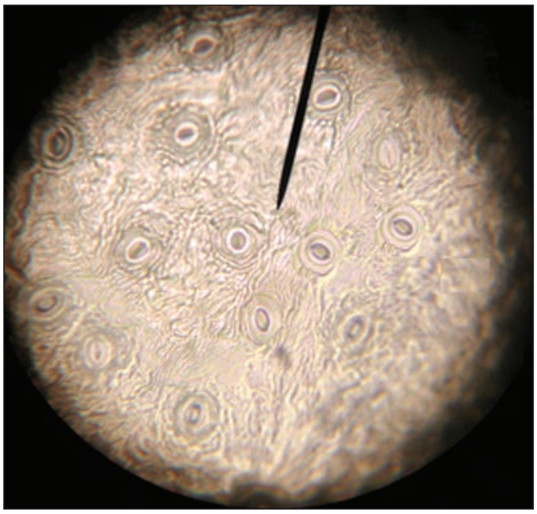
(b) An investigation was carried out into the distribution of stomata on the lower surface of leaves of *Ligustrum*. The image below shows the view through a microscope showing an impression of the lower epidermis of a *Ligustrum* leaf.



(i) Describe how the investigation would have been carried out. [4]

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(ii) Calculate the stomatal density of this part of the leaf. The diameter of the field of view of the microscope is 1mm. **Give the answer to two decimal places.** [3]

Use the formula πr^2 where $\pi = 3.142$

Stomatal density = ... mm^{-2}

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(iii) Suggest why the method used would not be suitable for calculating the stomatal density of *Pinus* leaves. [1]

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(c) The table below shows the mean number of stomata on the upper and lower surface of leaves from two species of plant.

Species	Mean number of stomata / cm^2	
	Upper surface	Lower surface
A	850	2651
B	5800	6100

Which of the two species in the table is likely to live in the driest environment? Explain your answer. [2]

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4. The photomicrograph below shows a transverse section (T.S.) of the trachea and oesophagus of a mammal.

5 mm

(a) (i) Calculate the magnification of the photograph. [2]

Magnification = ...

(ii) Explain how a feature visible in the photograph ensures that the trachea can function effectively during inspiration. [2]

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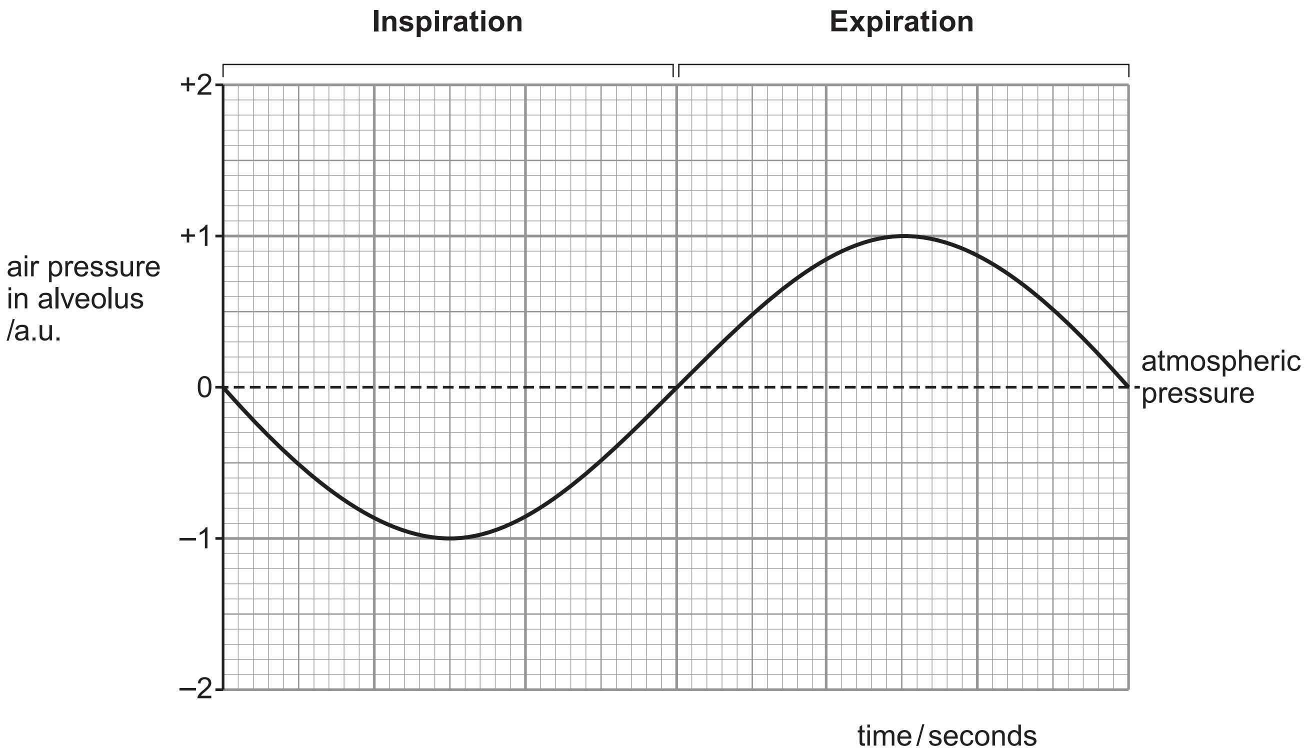
(b) The graph below shows how the air pressure changes in the alveoli during ventilation of the lungs.



With reference to the graph explain how the muscles involved in the process of inspiration bring about the changes in pressure shown. [3]

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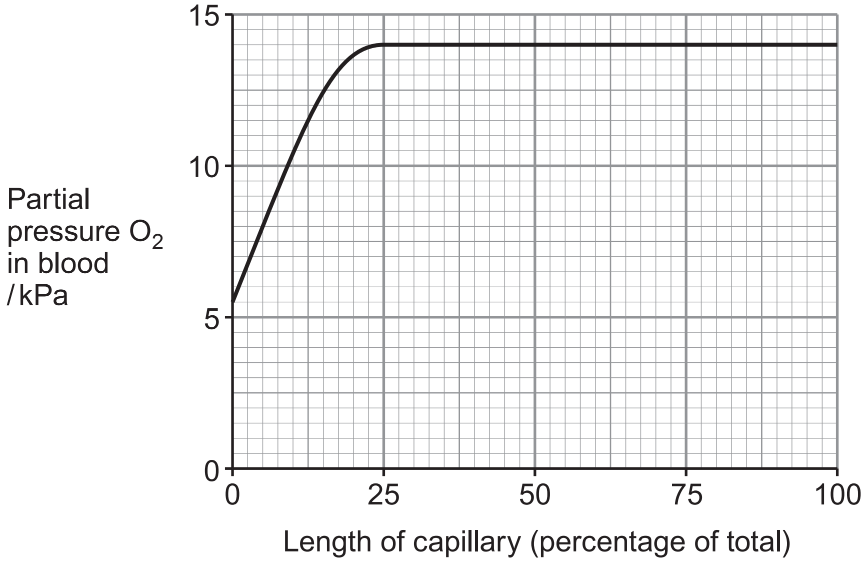
(c) The graph below shows how the partial pressure of oxygen in blood changes as blood flows through the pulmonary capillaries.



(i) I. Describe and explain the change in the partial pressure of oxygen in the blood as it passes along the pulmonary capillaries. [2]

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II. What conclusion could be reached about the minimum partial pressure of oxygen in the air in the alveoli? Explain your answer. [1]

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(ii) Describe the features of the capillaries that allow this change to take place. [2]

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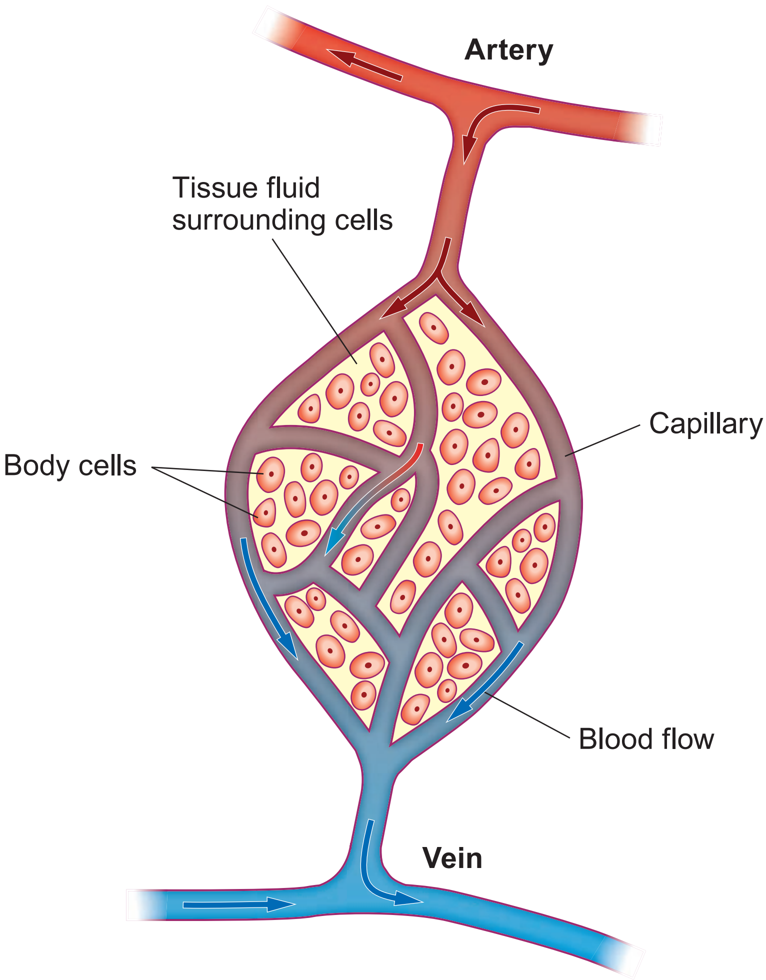
The diagram below shows the arrangement of blood vessels in a capillary bed.



(d) With reference to the diagram, describe how tissue fluid is formed. [3]

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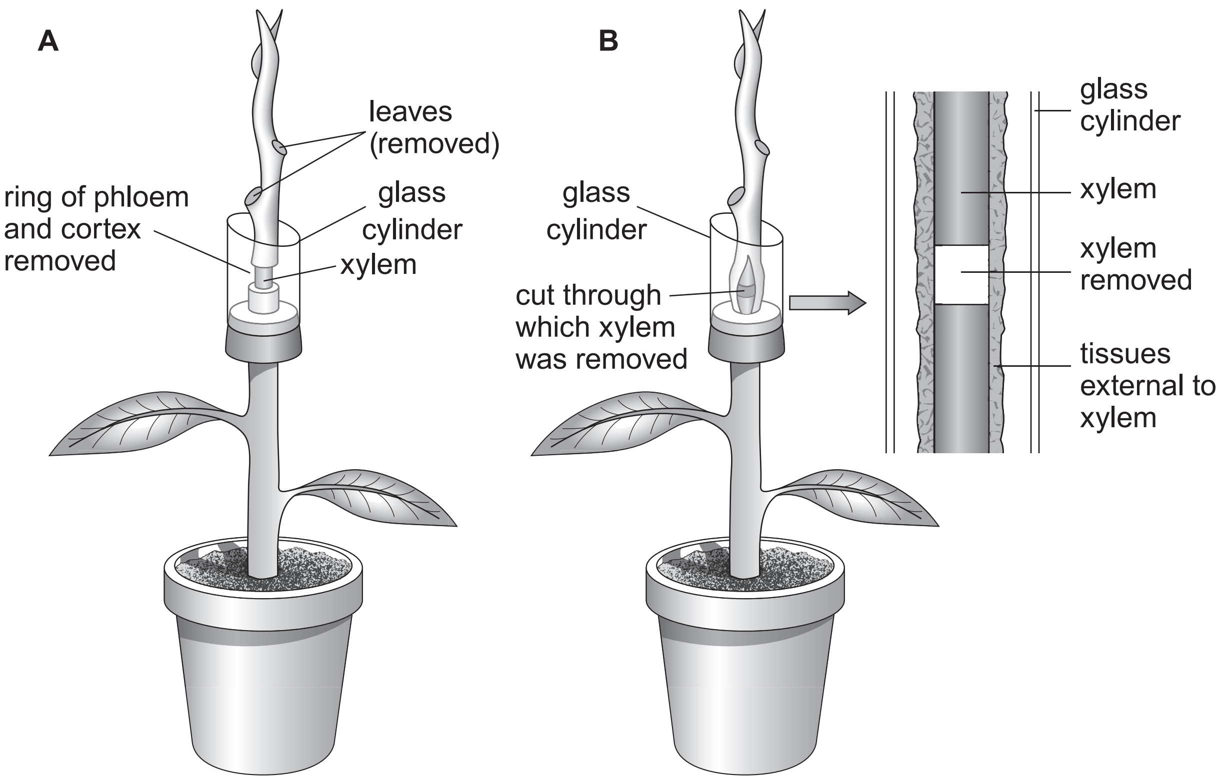
5. An investigation was carried out into the transport of sugars in the stems of actively growing woody shoots. The leaves were removed from the shoots above the region to be investigated and the shoots were divided into three experimental groups.

- **Plant A** had all the tissues (phloem and cortex) outside the xylem removed in a ring at the base of the region from which the leaves had been removed.
- In **plant B** the xylem was removed from the centre of the stem at the base of the region with the leaves removed. This left the phloem and cortex intact except for the cut through which the xylem was removed (see diagram below).
- **Plant C** – control (not shown).

Each stem was enclosed in a clear glass cylinder. The cylinders were filled with distilled water which was changed daily. No sugars were detected in the water at any point during the investigation.



(a) Suggest how Plant **C** was set up as a control for the experiment. [2]

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(b) (i) Explain why the leaves were removed above the region to be investigated. [2]

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(ii) Suggest why:

I. Each stem was enclosed in a glass cylinder containing distilled water. [1]

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II. The water was changed daily. [1]

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Question continued on next page.

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(c) The results after running the experiment for six days are shown in the table below.

Plant	Increase in length of stem / mm	Total sugar in stem above cut region / mg
A	8.3	0.08
B	48.7	5.28
C	68.2	3.21

Explain the difference in the results:

(i) between **A** and **B** [3]

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(ii) between **B** and **C** [2]

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(d) (i) With reference to the results table, suggest how the reliability of the results might have been improved. [1]

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(ii) State **two** variables which should have been controlled in this experiment. [1]

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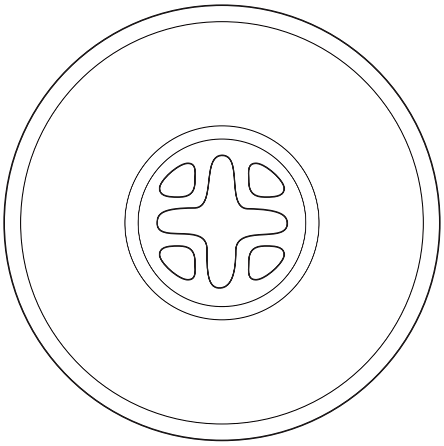
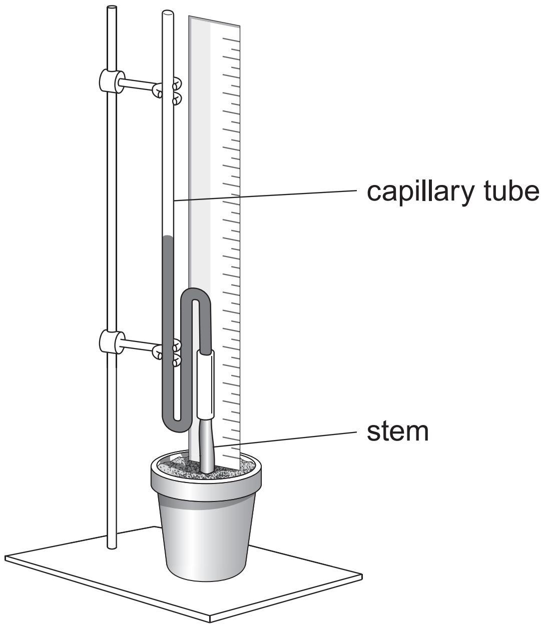
The diagram below shows a cross section of a root from one of the plants used in the experiment.



(e) **Indicate with an arrow on the diagram** where you would expect to find the Casparian strip. [1]

The apparatus below can be used to demonstrate the formation of root pressure in a plant under certain conditions.



When cyanide solution was added to the soil in the pot the root pressure was observed to fall significantly.

(f) With reference to the role of the Casparian strip, explain how cyanide would result in the reduction in root pressure observed. [3]

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6. Domestic dogs evolved from wolves between 10 000 and 30 000 years ago. Both are adapted to feed mainly on a carnivore diet. Recent studies into dogs and wolves have shown that the ancestors of domesticated dogs produced enzymes involved in starch digestion which are not produced by wolves. It has been proposed that dogs might have developed the ability to digest starch **after** they were domesticated by humans.

Explain how wolves and dogs are both adapted to feed mainly on a carnivore diet. Describe the process of starch digestion and suggest the advantage to domesticated dogs of being able to digest starch. [9 QER]

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