Rewarding Learning

Centre Number

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2016

Biology

Assessment Unit AS 1
assessing
Molecules and Cells

AB111

[AB111]

THURSDAY 16 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.
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 blue or black ink only. **Do not write with a gel pen.**
Answer **all eight** questions.
You are provided with **Photograph 1.3** for use with **Question 3** in this paper.
Do not write your answers on this photograph.

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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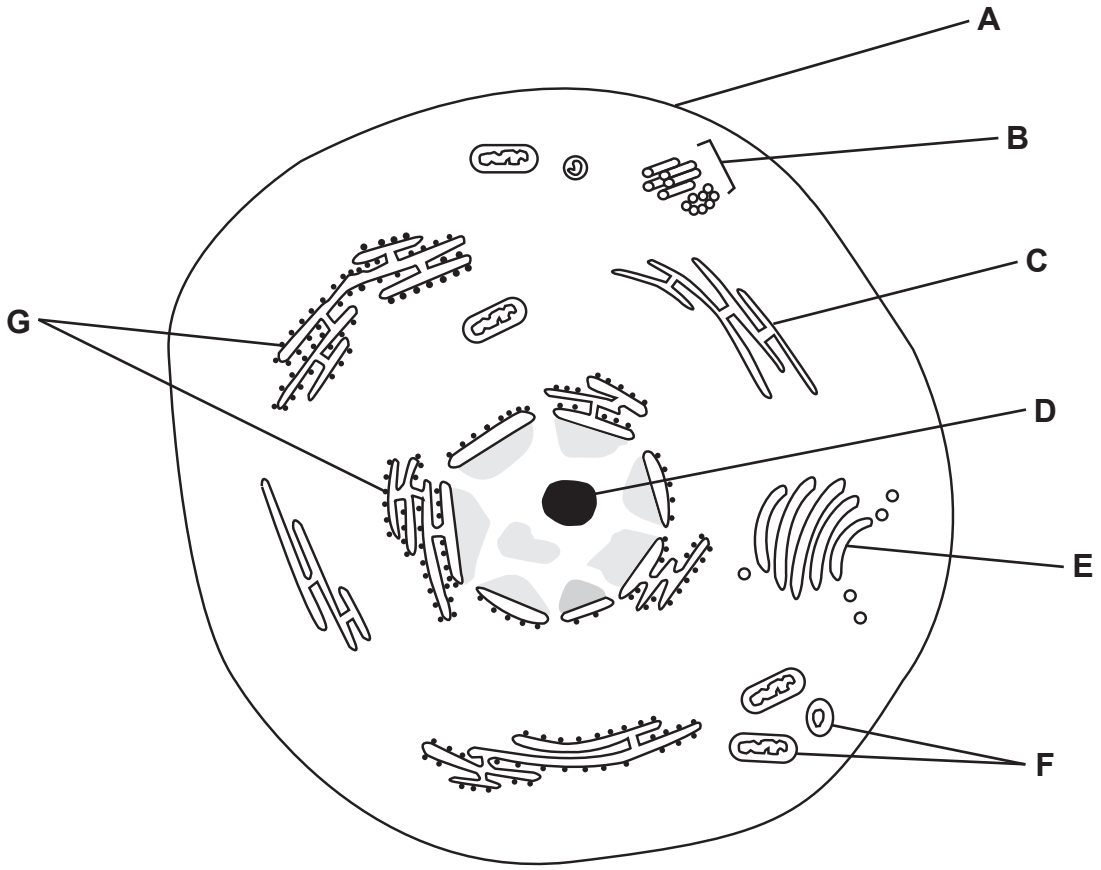
Section A

1 In the following diagram of an animal cell, cell structures are labelled **A**–**G**.



Select one structure, **A**–**G**, which is most closely associated with each of the following cell processes:

protein synthesis _____

production of spindle fibres _____

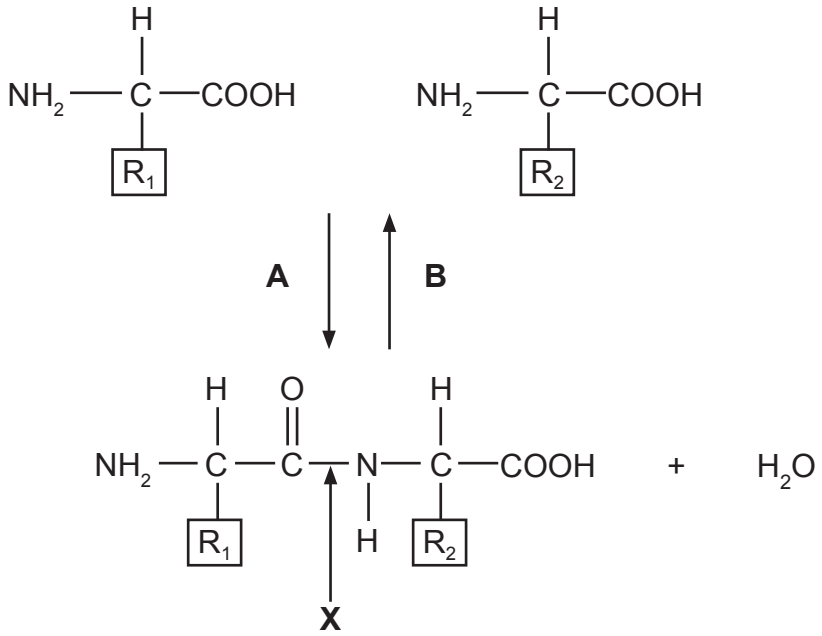
synthesis of rRNA _____

production of lysosomes or secretory vesicles _____

site of aerobic respiration _____ [5]

[Turn over

2 The diagram below illustrates a reversible reaction involving two amino acids.



(a) (i) Identify the types of reaction represented by **A** and **B**.

A _____

B _____ [2]

(ii) State the name of the bond labelled **X**.

_____ [1]

(iii) State the name of the product shown for reaction **A**.

_____ [1]

(b) Suggest a possible role of the R-groups shown on the amino acids.

_____

_____

_____ [1]

3 **Photograph 1.3** shows a transverse section through part of a privet leaf *(Ligustrum ovalifolium)*.

(a) Draw a block diagram of the leaf section in the box below. Label at least three of the main tissues visible.

[6]

(b) Calculate the magnification of **Photograph 1.3** using the scale bar.

(Show your working.)

_____ [3]

[Turn over

(c) The cells in the main photosynthesising layer of these leaves are normally very tightly packed together.

(i) Explain **one** advantage to the plant of this arrangement.

_____

_____

_____ [1]

(ii) In **Photograph 1.3** the cells of this layer do not appear to be very tightly packed. Suggest a reason for this appearance.

_____

_____

_____ [1]

4 In order to complete its life cycle, a virus must enter a host cell via the cell surface membrane. Several types of molecules are found in the cell membranes of animal cells, including cholesterol and glycoproteins.

(a) (i) Identify the group of proteins to which glycoproteins belong. Explain your answer.

_____

_____

_____ [2]

(ii) State the role of cholesterol in the cell membrane.

_____

_____ [1]

[Turn over

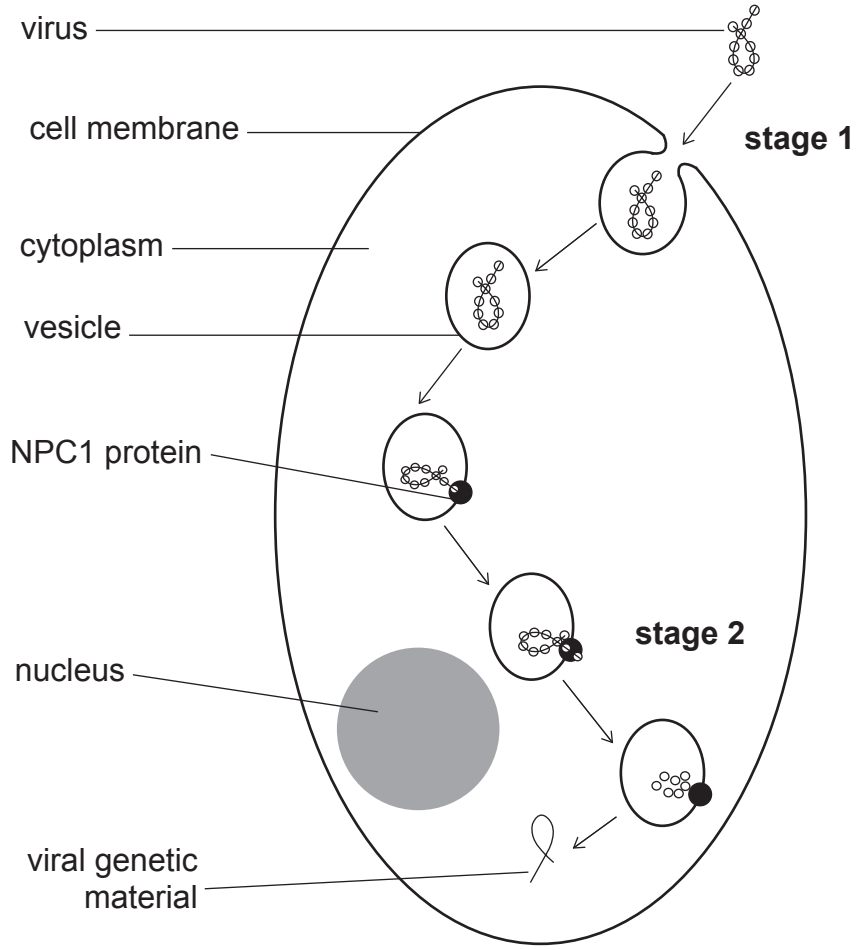
(b) In 2014, the Ebola virus was responsible for an outbreak of Ebola Virus Disease in West Africa. Like all viruses, the Ebola virus must complete its life cycle inside a host cell.

Infection of a cell by Ebola virus is a two stage process:

- **stage 1** – the virus enters the cell by forming a vesicle
- **stage 2** – the viral genetic material moves out of the vesicle into the cytoplasm of the cell.

It has been suggested that stage 2 involves a transporter protein in the vesicle membrane, called NPC1.

Infection of a cell is summarised in the diagram below.



(i) Using the diagram and your knowledge, name the transport mechanism by which the Ebola virus gains entry to the cell.

_____ [1]

Scientists investigated the importance of the NPC1 transporter protein in Ebola virus infection in mice. They used mice with different levels of the NPC1 protein. Their results are summarised in the table below:

NPC1 protein level	Percentage of mice surviving 15 days after infection/%
normal	10
reduced	80
zero	100

(ii) Describe the relationship between the level of NPC1 protein and the percentage of mice surviving 15 days after infection by Ebola. Using the information provided, suggest a possible explanation for this relationship.

_____

_____

_____

_____

_____

_____

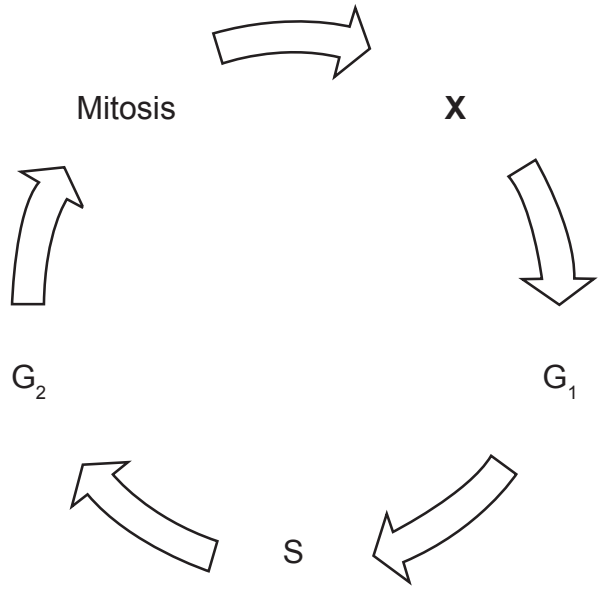
_____

_____

_____ [3]

[Turn over

5 The diagram below represents the eukaryotic cell cycle.



(a) (i) Identify process **X**.

_____ [1]

(ii) Describe **two** changes that take place in cells during the G_1 phase.

1. _____

_____

2. _____

_____ [2]

(iii) Describe **two** differences between the cell cycle in animal and plant cells.

1. _____

_____

2. _____

_____ [2]

(b) Onion root tip cells require 12 hours to complete the cell cycle. The time spent in a particular stage can be estimated using the following formula:

$$\text{time in stage} = \frac{\text{number of cells in stage}}{\text{total number of cells counted}} \times \text{time in minutes for cell cycle}$$

Actively dividing onion tissue was examined using a microscope. The table below shows the number of cells observed to be in different stages of the cell cycle. The time spent in each stage has been calculated except for metaphase.

Stage	Number of cells	Time in stage/mins
Interphase	20	389
Prophase	10	195
Metaphase	3	
Anaphase	2	39
Telophase	2	39
Total number of cells	**37**	

Using the formula and the table, calculate the time spent in metaphase by these onion cells.

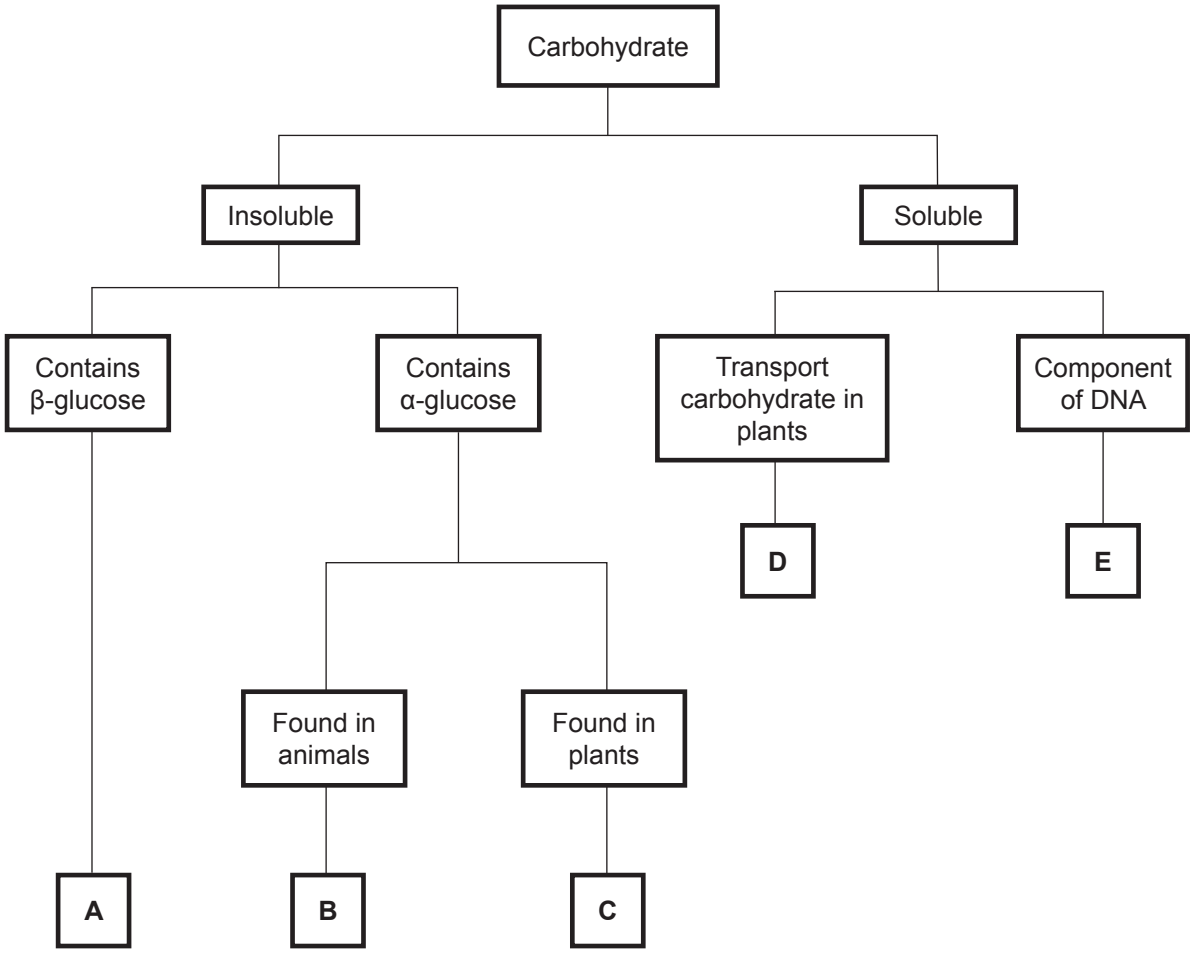
(Show your working.)

_____ [2]

[Turn over

6 **(a)** Carbohydrates are important biochemicals in living organisms.

Identify carbohydrates **A** to **E** using the key below.



A _____

B _____

C _____

D _____

E _____

[5]

(b) Both lipids and carbohydrates are used as energy storage molecules. Lipids store more energy per gram than carbohydrates but are not as easily broken down. Using this information, suggest why animals use **both** glycogen and lipids as energy stores.

_____

_____

_____

_____

_____ [2]

(c) A student tested a sample of a carbohydrate solution for the presence of reducing sugars and obtained a negative result. It was suggested that the solution contained sucrose. Describe the procedure the student would use in order to show that sucrose was present. Explain a suitable safety precaution in your procedure.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [5]

[Turn over

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7 Water relations between cells and solutions can be described using the concept of water potential.

(a) (i) For a plant cell at the point of incipient plasmolysis:

state the value of the pressure potential (Ψ_p) for the cell

_____

state the relationship between the water potential (Ψ_{cell}) and the solute potential (Ψ_s) of the cell.

_____ [2]

The water potential (Ψ_{cell}) of a different plant cell is –1900 kPa and the pressure potential (Ψ_p) is 400 kPa.

(ii) Calculate the solute potential (Ψ_s) of the cell.

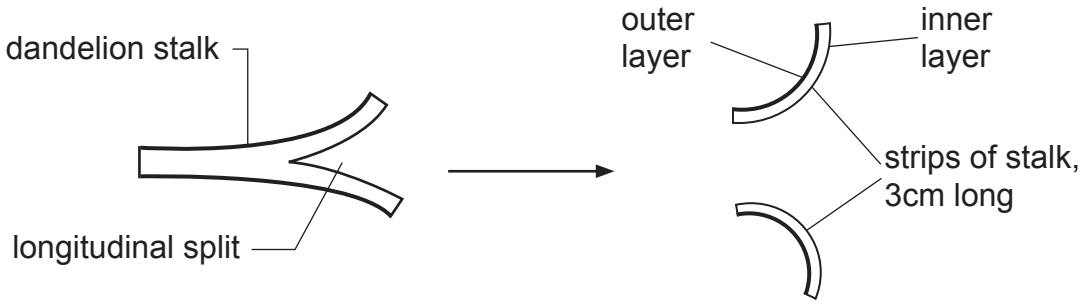
(Show your working.)

_____kPa [2]

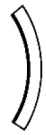
[Turn over

(b) Water relations between dandelion flower stalks and solutions were investigated. The outer layer of the stalk has adaptations to reduce water loss, much like the cuticle of a leaf.

A dandelion stalk was split longitudinally and divided into 3 cm long strips as shown.



One strip was placed in water and two in sucrose solutions of different concentrations for five minutes. The appearance of each strip before and after immersion is shown in the table below.

Concentration of sucrose solution/%	Strip appearance	
	Before immersion	After immersion
0 (pure water)		
2		
10		

(i) Complete the table by drawing the expected appearance of the dandelion strip after five minutes immersion in 10% sucrose solution. [2]

(ii) Explain the change in appearance shown by the strip in pure water.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(c) If erythrocytes (red blood cells) are placed in pure water for five minutes, the water will change from colourless to pale red. Explain this change in colour.

_____

_____

_____

_____

_____

_____ [2]

(d) *Amoeba proteus* is a single-celled organism, lacking a cell wall, that lives in damp soil or water. When viewed under the microscope, structures called contractile vacuoles can be seen within the cell. These vacuoles can be observed to enlarge in size, move towards the cell membrane and then rapidly shrink in size.

It has been found that the higher the water potential of the solution the *A. proteus* is found in, the greater the rate of enlarging and shrinking of contractile vacuoles.

Suggest the probable function for contractile vacuoles in *A. proteus*.

_____

_____

_____

_____

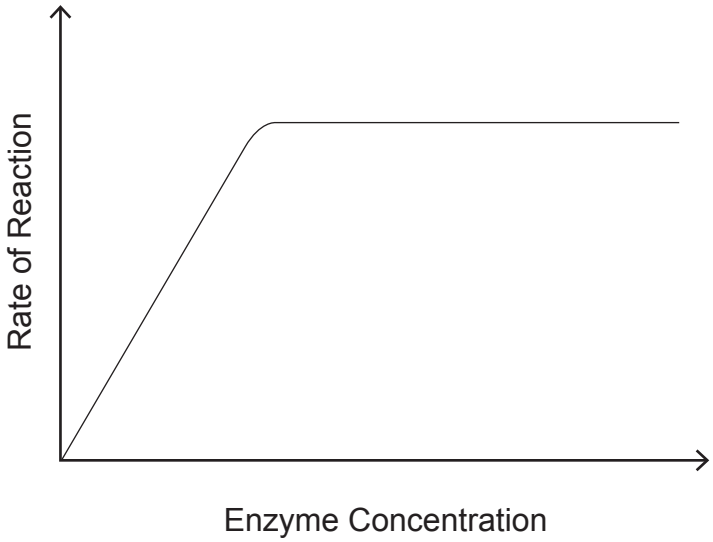
_____

_____ [2]

Section B

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

8 **(a)** The relationship between enzyme concentration and the rate of reaction is shown in the graph. Describe and explain the relationship shown. [4]



(b) Enzyme immobilisation is a technique frequently used in industry. Describe **two** methods of enzyme immobilisation and give an account of the advantages and disadvantages of enzyme immobilisation. [9]

Quality of written communication [2]

(a) The relationship between enzyme concentration and the rate of reaction is shown in the graph. Describe and explain the relationship shown.

(b) Enzyme immobilisation is a technique frequently used in industry. Describe **two** methods of enzyme immobilisation and give an account of the advantages and disadvantages of enzyme immobilisation.

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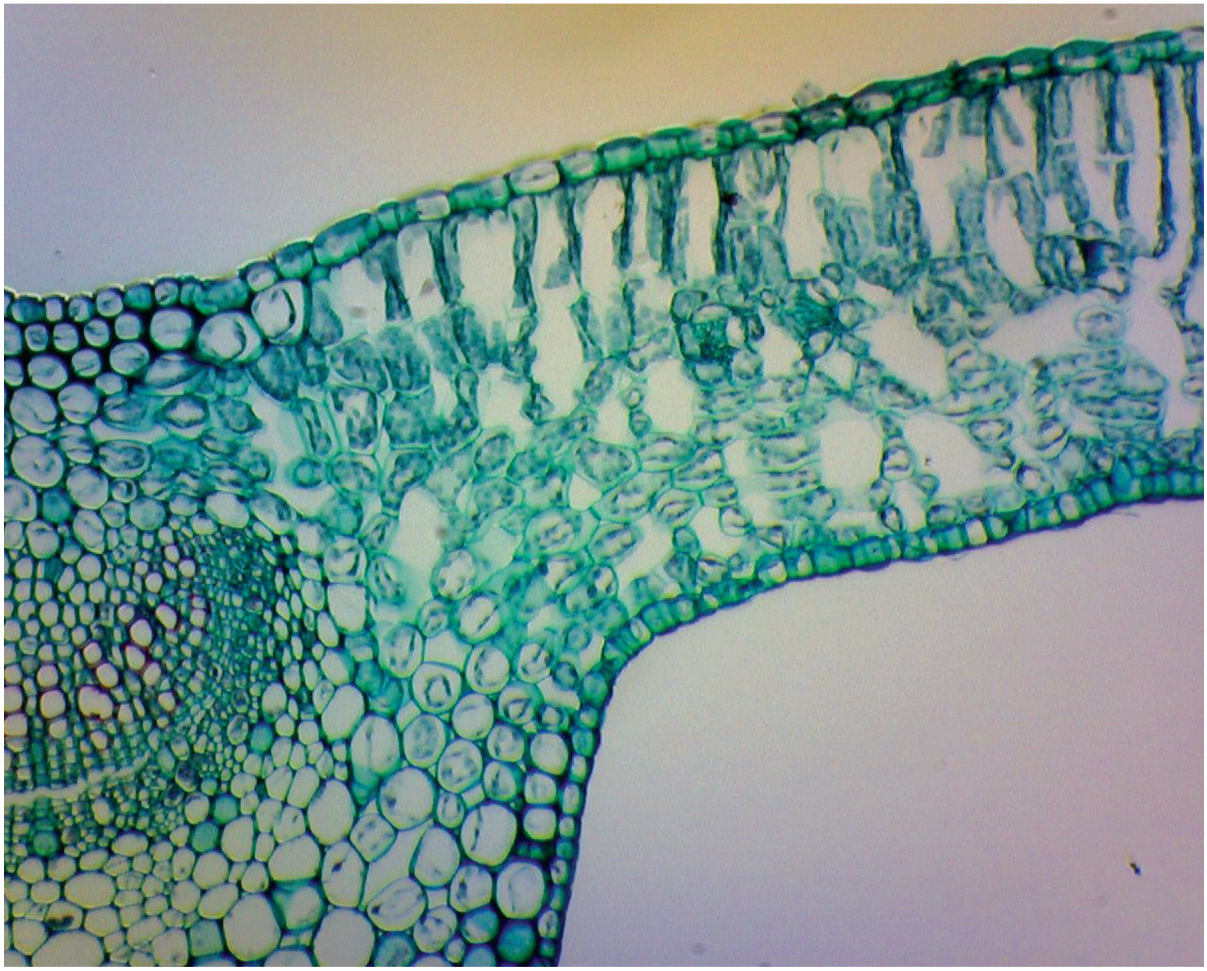
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Examiner Number

GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1
Molecules and Cells
Summer 2016

Photograph 1.3
(for use with Question 3)



Source: Principal Examiner

Scale bar
500 μm