1 Read through the following passage about plant cell walls and transport. Write on the dotted lines the most appropriate word or words to complete the passage.

(5)

Many β (beta) ..... molecules join together to

form ..... , the polysaccharide found in plant cell walls.

When these polysaccharides are next to each other, ... bonds

form and a microfibril is made.

To aid transport of materials from one plant cell to the next cell, there are areas

with reduced cell walls called ..... and areas with no cell

walls called ..... .

(Total for Question 1 = 5 marks)

2 Plants are complex organisms that contain different tissues and organs.

(a) Explain what is meant by the term **tissue**.

(2)

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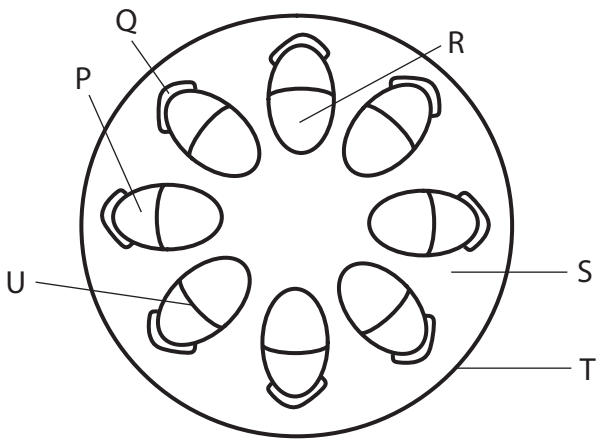
(b) The diagram below shows a section through one organ of a plant and some of its tissues labelled P to U.



For each of the following statements place a cross (☒) in the box next to the correct answer.

(2)

(i) The organ shown in the diagram is a

☒ **A** leaf

☒ **B** root

☒ **C** stem

☒ **D** vascular bundle

(ii) **Two** tissues that contain lignin are labelled

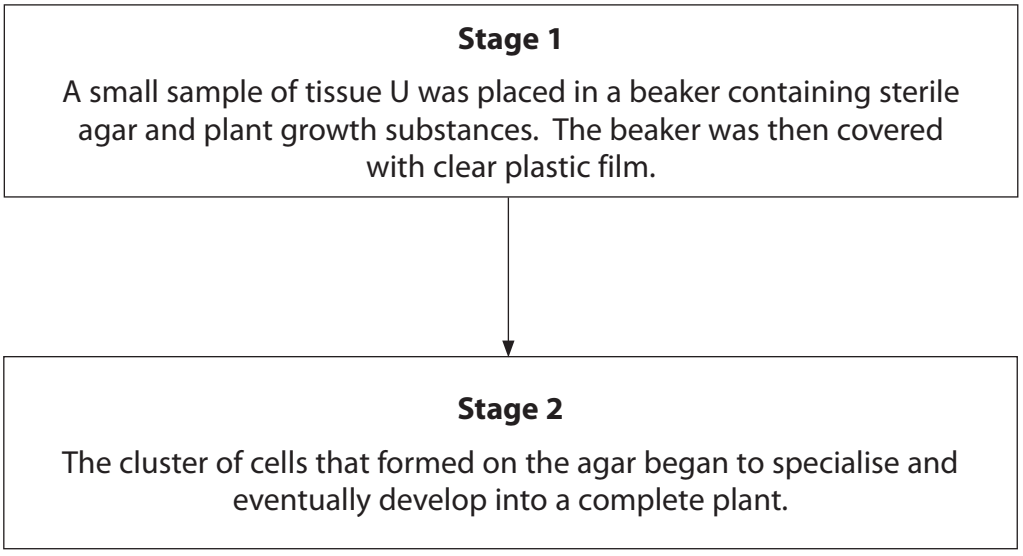
☒ **A** P and Q

☒ **B** Q and R

☒ **C** R and S

☒ **D** S and T

(c) The diagram below shows two of the stages in a plant tissue culture technique, used to demonstrate totipotency in the plant tissue labelled U on the diagram on page 19.



(i) Suggest **one** safety reason for covering the beaker with clear plastic film in stage 1.

(2)

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(ii) Suggest **one** reason, other than for safety, for covering the beaker with clear plastic film.

(1)

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(iii) No plant would develop if the plant tissue labelled R, on page 19, was used instead of plant tissue U.

Suggest reasons why no plant would develop if tissue R was used.

(3)

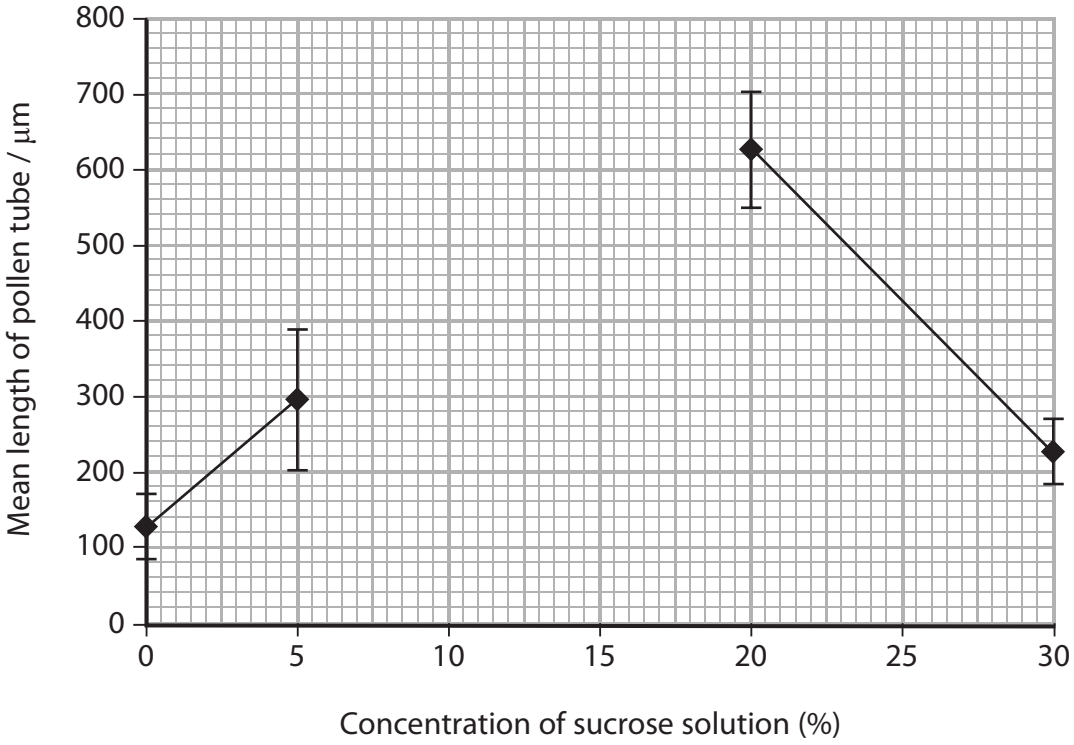
(Total for Question 2 = 10 marks)

3 A student investigated the effect of sucrose concentration on the growth of pollen tubes.

Four pollen grains were placed in a small dish containing water. The pollen grains were left for two hours and the lengths of the pollen tubes produced were measured. The mean length was then calculated.

This procedure was repeated using dishes containing sucrose solutions at concentrations of 5%, 10%, 20% and 30%.

The graph below shows the mean lengths of the pollen tubes from four of the five sets of results. Error bars showing the range are also shown.



(a) The table below shows the results for the pollen grains placed in the 10% sucrose solution.

Grain number	Length of pollen tube / µm
1	690
2	680
3	720
4	710
Mean	700

(i) Using the information in the table, plot the mean length of pollen tubes and the error bar showing the range of data for the 10% sucrose solution and complete the graph.

(3)

(ii) Using the completed graph, describe the effect of increasing sucrose concentration on the mean length of pollen tubes over the two-hour period.

(3)

(b) Explain the function of the pollen tube in fertilisation in flowering plants.

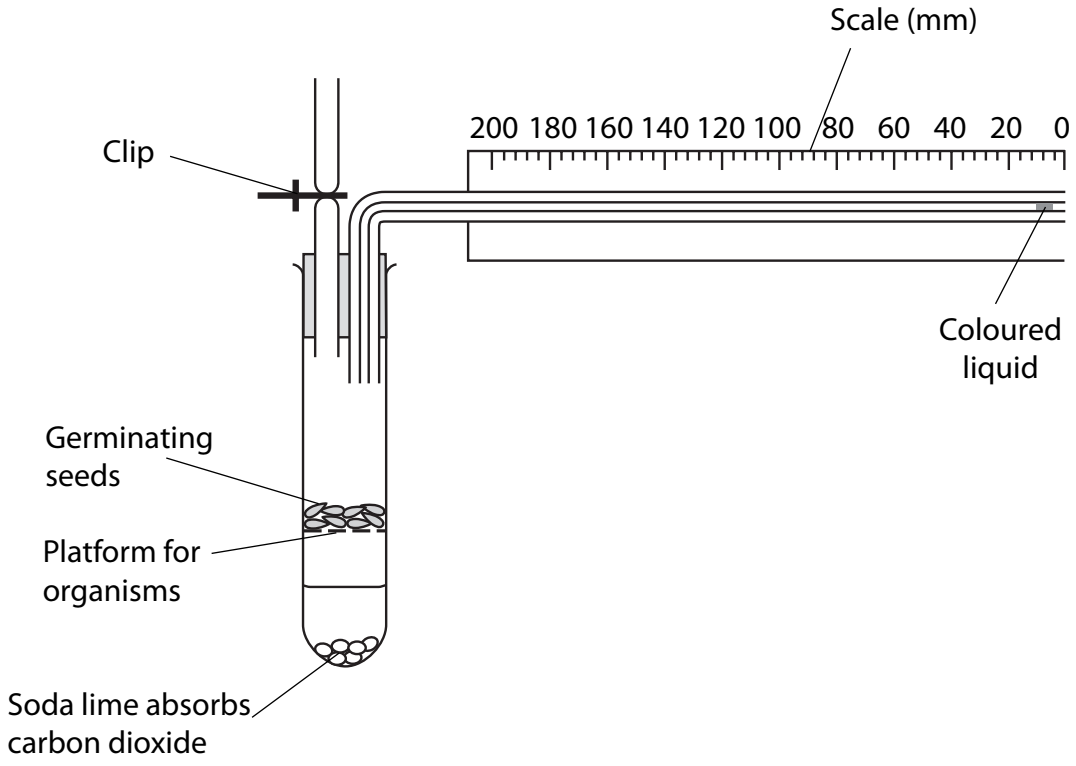
(3)

(Total for Question 3 = 9 marks)

4 The apparatus shown in the diagram below was used to measure the rate of respiration of germinating seeds in air. The distance moved by the coloured liquid was measured at 15-minute intervals for one hour.

This was repeated with the air replaced by nitrogen gas.

The rate of respiration of small insects in air was measured using the same apparatus.



(a) Suggest reasons for absorbing carbon dioxide in this apparatus.

(2)

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(b) The table below shows results recorded by a student using this apparatus.

Organism	Distance moved by liquid in 15-minute intervals / mm				Mean rate of respiration / mm min^{-1}
Germinating seeds	7	6	5	6	0.4
Germinating seeds in nitrogen gas	0	0	0	0	0
Insects	12	11	13	12	

(i) In the space below, calculate the mean rate of respiration for the insects, expressed as movement of liquid in millimetres per minute.
Show your working.

(2)

Answer ..... mm min^{-1}

(ii) The seeds in the experiment with nitrogen gas continued to germinate.
Suggest an explanation for the lack of movement of the liquid.

(2)

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(iii) Suggest **two** reasons why a valid comparison cannot be made between the mean rates of respiration of the germinating seeds in air and the insects. For each reason, suggest a modification that would allow a valid comparison.

(4)

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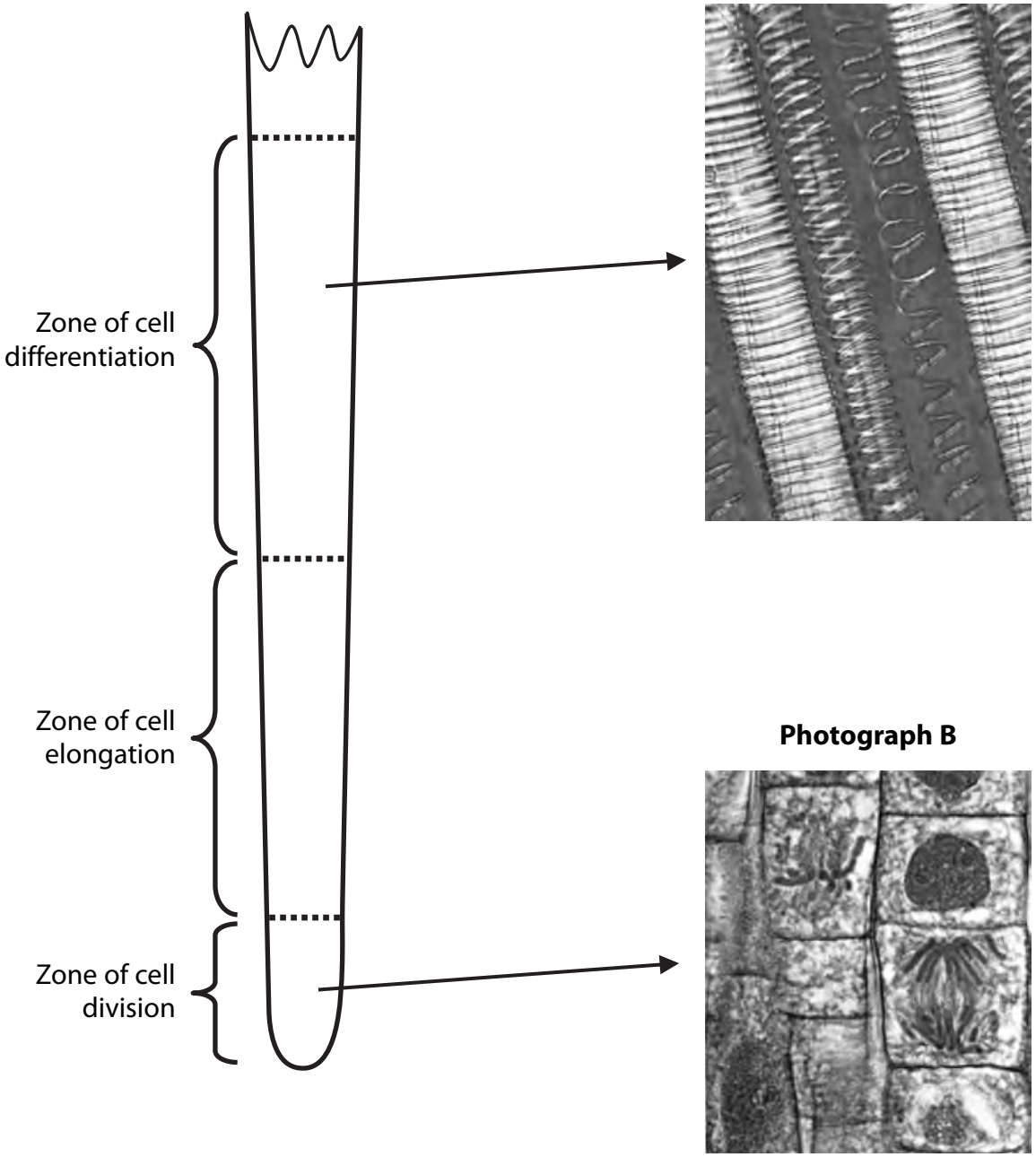
(Total for Question 4 = 10 marks)

5 In the roots of plants, cell division, cell elongation (growth) and cell differentiation occur in different zones near the root tip.

The diagram below show the three different zones in a root. Photographs **A** and **B** show some of the tissues present in two of these zones.



(a) (i) Name the specialised tissue shown in photograph **A**.

(1)

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*(ii) Describe and explain how this tissue is adapted for the transport of water and support in a plant.

(4)

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(b) Explain how differential gene expression could result in the specialisation of cells.

(3)

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(c) Only one of the two tissues shown in the photographs **A** and **B** is totipotent. Describe how you could use a plant tissue culture technique to show which of the two tissues is totipotent.

(4)

(Total for Question 5 = 12 marks)