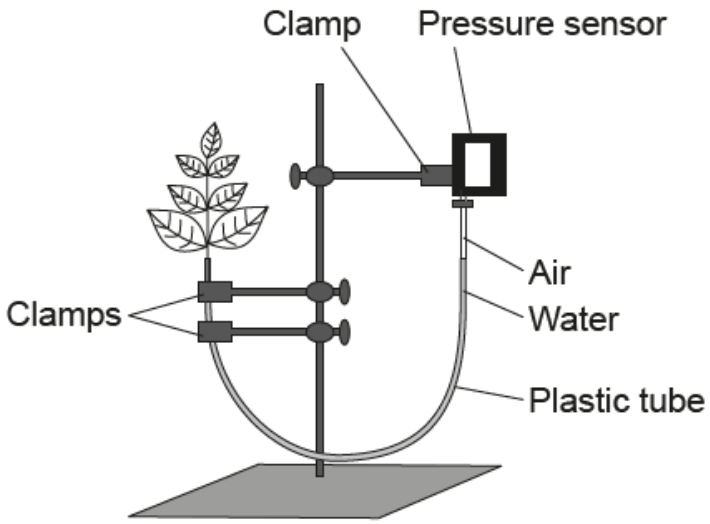
HL Paper 3

The rate of transpiration can be measured using a data-logging pressure sensor connected to a plant cutting via a plastic tube. In an experiment, a control set-up was connected to the tube and placed in a well-lit room with normal humidity levels.



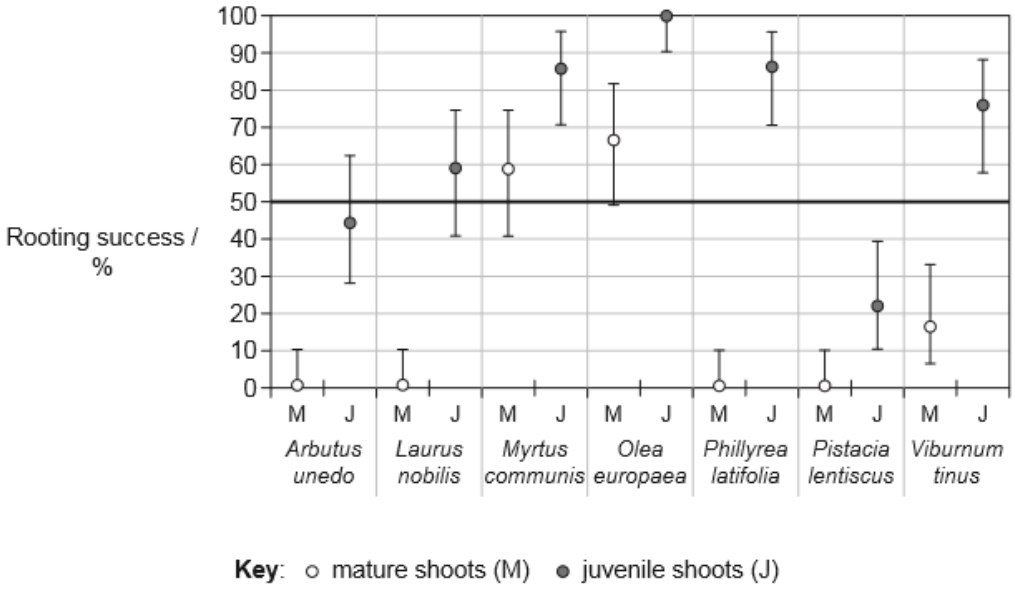
[Source: © International Baccalaureate Organization 2017]

a. State the specific type of plant tissue that the plastic tube is meant to model. [1]

b. Predict, with a reason, what will happen to the pressure in this tube as transpiration occurs. [2]

c. Outline how this control set-up could be modified to test the effect of either humidity or temperature on the rate of transpiration. [2]

Achieving successful rooting of cuttings is difficult in some shrub species. An experiment was undertaken to determine whether juvenile shoots (J) of shrubs root more successfully than mature shoots (M).



[Source: "Effects of rejuvenation on cutting propagation of Mediterranean shrub species" by G. Pignatti and S. Crobeddu, *Forest@*, vol. 2, pp. 290-295 (Sep 2005): Figure 3. Used with permission.]

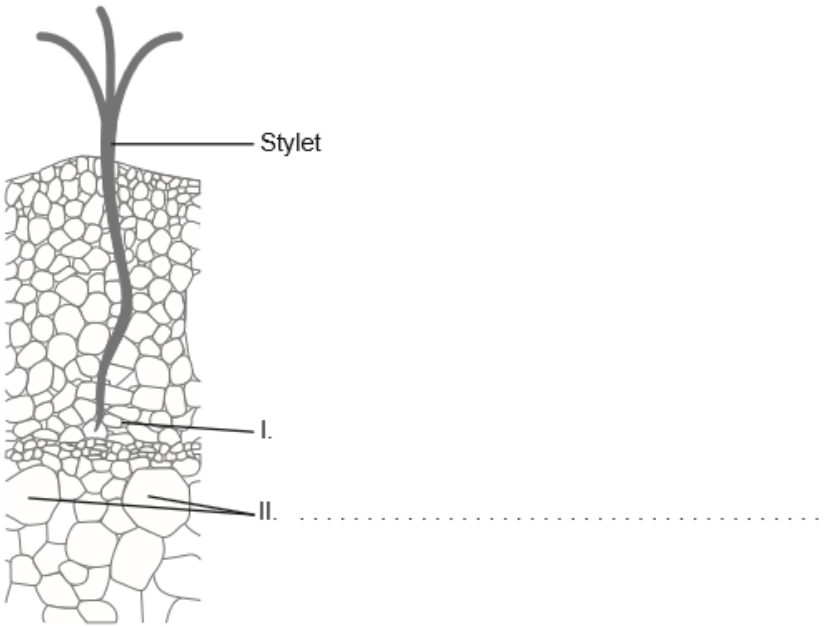
a. Distinguish between the rooting success of the juvenile shoots and the mature shoots. [1]

b. Suggest **one** reason for the difference in the rooting success in the juvenile shoots and the mature shoots. [1]

c. Outline **one** variable that would need to be controlled in this experiment. [1]

d. Auxin is a hormone that can be applied to improve the percentage success of rooting in those study plants with poor rooting success. Explain the effects of auxin on plant cells. [3]

The image shows a severed aphid stylet embedded in plant tissue.

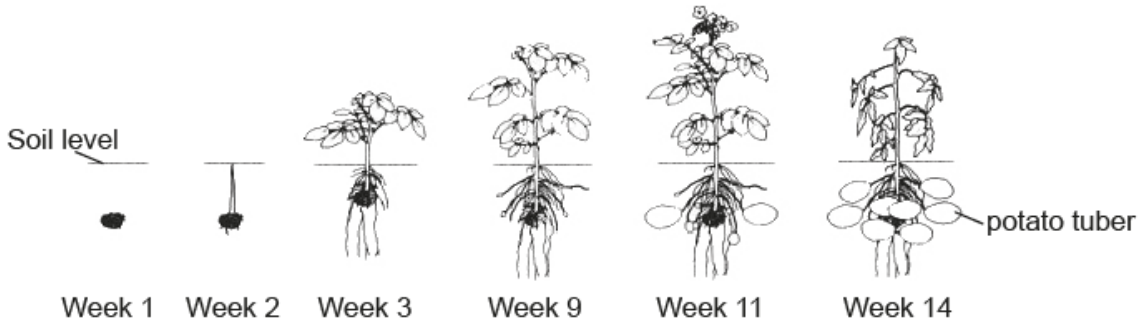


a. Identify the tissue labelled II. [1]

b. Outline **one** piece of evidence that the tissue labelled I is phloem tissue. [1]

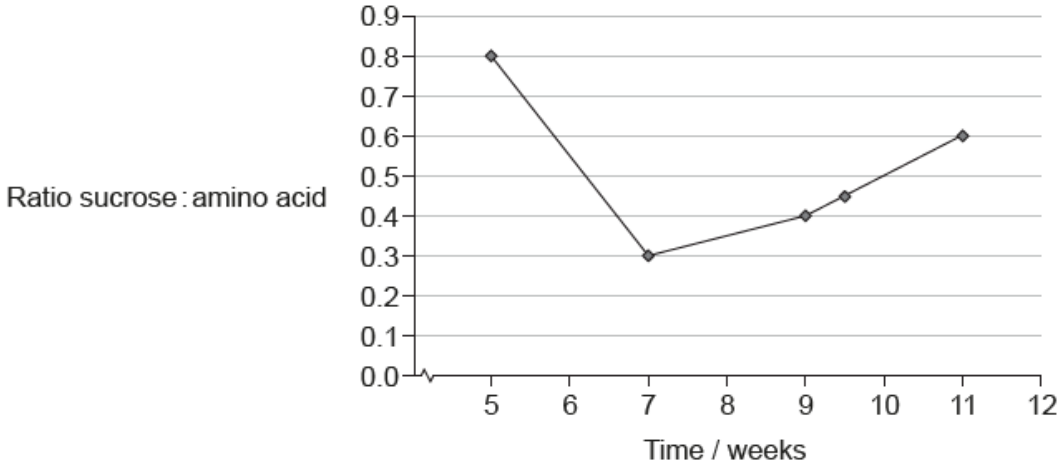
c. Explain how aphid stylets can be used to study the movement of solutes in plant tissues. [3]

The diagram shows the development of potato plants (*Solanum tuberosum*) over 14 weeks. New tubers start growing from week 9. These are modified underground stems serving as a starch reserve and bearing buds from which new plants arise.



[Source: adapted from http://humanitiespotato.weebly.com/potato-production.html]

Scientists planted several potato plants in a greenhouse. The sucrose and amino acids in potato plant phloem exudates were measured during several weeks.

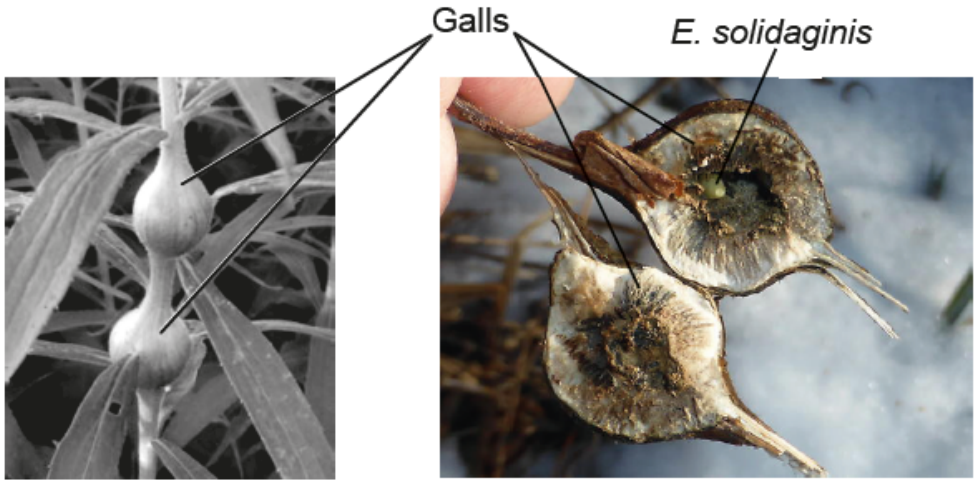


[Source: adapted from A. J. Karley, A. E. Douglas, W. E. Parker, Amino acid composition and nutritional quality of potato leaf phloem sap for aphids. *Journal of Experimental Biology* 2002 205: 3009-3018.© The Company of Biologists Limited 2002.]

a. Describe briefly how scientists obtained leaf phloem sap from the potato plants. [2]

b. Suggest reasons for different amounts of sucrose in the leaf phloem sap of the potato plants. [3]

The larval stage of the fly *Eurosta solidaginis* develops in the plant *Solidago altissima*. The larva secretes a chemical which causes plant tissue to grow around it forming a swelling called a gall. The gall provides the developing insect with protection from predators.



[Source: https://nhgardensolutions.files.wordpress.com]

[Source: Masumi Palhof]

The *E. solidaginis* fly is preyed upon by the parasitic wasp *Eurytoma gigantea*. The graph shows the relationship between gall diameter and the percentage of flies that avoid predation by *E. gigantea*.

a. In order to form galls, the insects choose a location where cell division occurs at a high rate. State the term for a region of rapid cell division within a plant. [1]

b. Describe the relationship between gall diameter and percentage survival of *E. solidaginis*. [2]

c. Explain the concept of directional selection with respect to this example. [2]