

# 9.2 Transport in the Phloem of Plants

## Question Paper

Course	DP IB Biology
Section	9. Plant Biology (HL Only)
Topic	9.2 Transport in the Phloem of Plants
Difficulty	Hard

**Time allowed:** 10  
**Score:** /5  
**Percentage:** /100

## Question 1

The following statements describe steps in the movement of sucrose along the apoplast pathway.

- I. Hydrogen ions are actively pumped out of the cytoplasm of companion cells.
- II. Sucrose molecules move into the sieve tubes.
- III. Sucrose is carried into the companion cell via a co-transporter protein.
- IV. Hydrogen ions move into the cytoplasm of companion cells.
- V. A hydrogen ion concentration gradient is created.

Which of the following represents the correct order of the steps?

- A. IV → I → V → II → III
- B. I → IV → V → III → II
- C. IV → I → V → III → II
- D. I → V → IV → III → II

[1 mark]

## Question 2

Which of the following best describes the factor that determines the direction of mass flow of phloem sap between leaves and fruit?

- A. The active loading of sucrose into phloem sieve tubes near the fruit will create a hydrostatic pressure gradient that will facilitate mass flow between the leaves and fruit.
- B. The movement of water molecules in the phloem sieve tubes from the leaves to the fruit will contribute to the hydrostatic pressure gradient between them.
- C. The movement of organic compounds into the phloem sieve tubes near leaves will increase the hydrostatic pressure in the sieve tubes and create a pressure gradient between leaves and fruit.
- D. The unloading of organic compounds from the phloem sieve tubes at the fruit will increase the osmolarity of the sieve tubes and create a hydrostatic pressure gradient between the leaves and fruit.

[1 mark]

**Question 3**

An aphid is located 6 cm from a source of  $^{14}\text{C}$  on a plant. It takes 15 minutes for the  $^{14}\text{C}$  to reach the aphid.

Which of the following gives the correct phloem flow rate in  $\text{cm hr}^{-1}$ ?

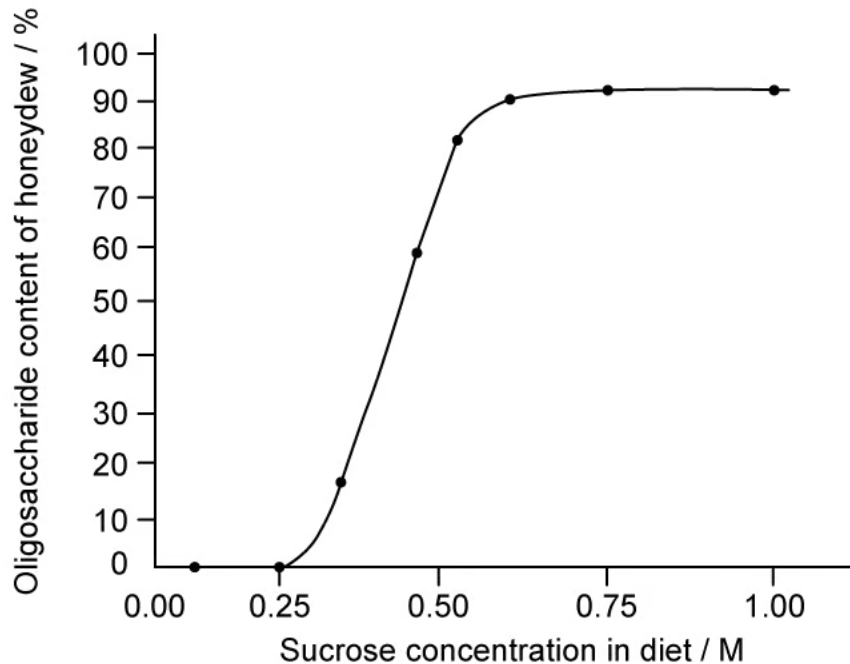
- A. 0.4
- B. 1.5
- C. 24
- D. 90

[1 mark]

### Question 4

Aphids secrete a sugary liquid called honeydew when they feed on phloem sap. Honeydew is produced in the guts of aphids and contains molecules known as oligosaccharides. Oligosaccharides consist of a small number of monosaccharides linked together and those produced by aphids are less soluble than sucrose.

Scientists investigated the effect of phloem sap sucrose concentration on the production of oligosaccharides in the guts of aphids.



Which of the following is the most likely explanation for the data?

- A. Aphids produce more oligosaccharides when consuming high sucrose phloem sap in order to increase honeydew production in their guts.
- B. Aphids produce more oligosaccharides when consuming high sucrose phloem sap in order to decrease the osmolarity of the gut contents.
- C. Aphids produce more oligosaccharides when consuming high sucrose phloem sap in order to increase the osmolarity of the gut contents.
- D. Aphids produce more oligosaccharides when consuming high sucrose phloem sap in order to prevent an excess of water from moving into the cells.

[1 mark]

### Question 5

Certain heavy metals, e.g. zinc and chromium, are considered toxic to plants. Research suggests that some of these metals can alter the outcome of the events that occur within the electron transport chain inside plant cells.

Fruit trees grown in soils containing high levels of heavy metals have been found to produce fruits that are much smaller than those produced by trees grown in soil with low concentrations of the metal.

Which of the following statements provides the most important and reasonable explanation for this observation?

- A. Loading of organic compounds in the apoplast pathway cannot occur due to a lack of proton pump activity.
- B. Loading of organic compounds in the apoplast pathway cannot occur due to non-functional membrane transport proteins.
- C. Loading of organic compounds through the symplast pathway cannot occur due to a lack of proton pump activity.
- D. Unloading of organic compounds cannot occur at the source due to a lack of membrane transport proteins.

[1 mark]