

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	Easy

Time allowed: 60
Score: /45
Percentage: /100

Question 1a

a)
Glucose is the main product of photosynthesis in plant sources, whereas sucrose is the main sugar that is translocated around the plant.

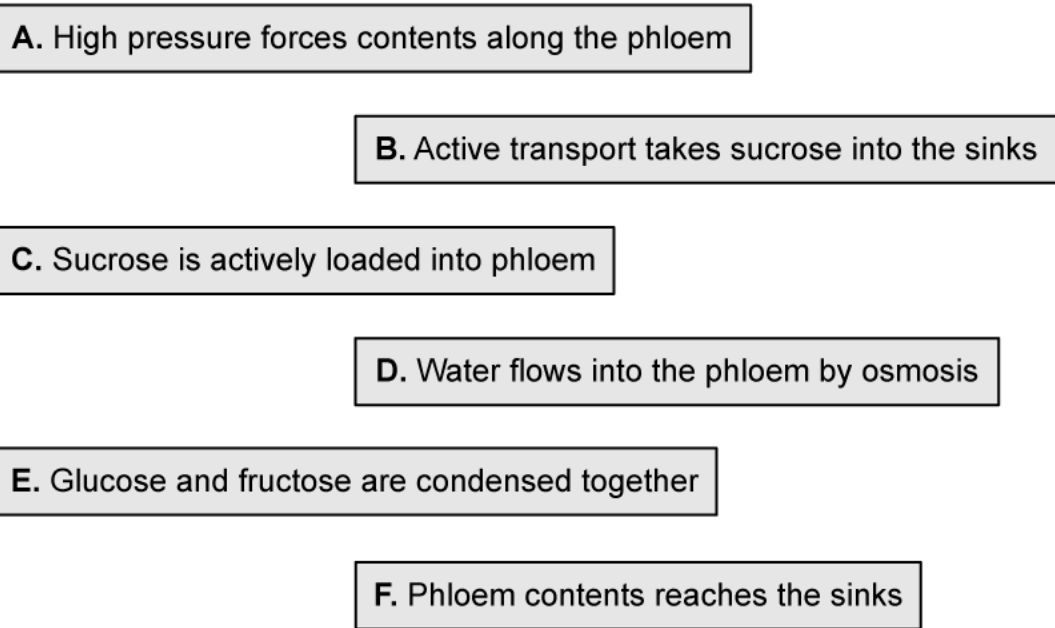
Suggest why.

[2 marks]

[2 marks]

Question 1b

b)
The statements **A – F** below are incorrectly ordered.



Identify the correct chronological order of statements **A – F**.

[3 marks]

[3 marks]

Question 1c

c)

When sucrose reaches its sink, it is converted to an oligosaccharide.

Describe the possible structure of an oligosaccharide.

[2 marks]

[2 marks]

Question 1d

d)

Once water in the translocation stream reaches a sink, such as a root tuber, changes in osmolarity cause the water to take a different path.

State what that path is and the eventual destination of the water molecules.

[3 marks]

[3 marks]

Question 2a

a)

Name the two main assimilates (products of plants' metabolism) that are carried in the phloem.

[2 marks]

[2 marks]

Question 2b

b)

Define the term 'source' when used in the context of plant biology.

[2 marks]

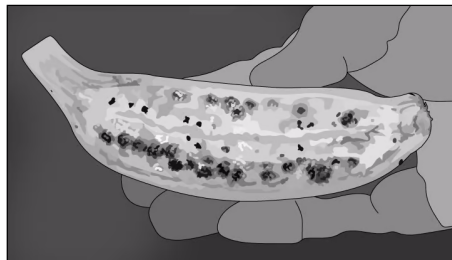
[2 marks]

Question 2c

c)

The image shows a wild banana, cut lengthways. Inside the banana, its seeds are clearly visible. Seeds are usually regarded as sinks.

Give an example of when seeds such as these act as a source.



[1 mark]

[1 mark]

Question 2d

d)

Name the features of the symplast pathway of sucrose translocation that are not present in the apoplast pathway.

[2 marks]

[2 marks]

Question 3a

a)
Plasmodesmata found in phloem cells tend to have a wider diameter than those found in cells of the xylem.
Suggest a reason for this.

[1 mark]

[1 mark]

Question 3b

b)
Phloem sieve tubes are adapted to minimise the frictional resistance to the flow of fluid within them.
List **two** ways by which friction is minimised within a phloem sieve tube.

[2 marks]

[2 marks]

Question 3c

c)

A traditional practice used in forestry to manage tree growth is called girdling. This involves removing a complete ring of bark, as shown in the image below. The tree dies over a period of time, allowing forests to be thinned out as required.



State how girdling may kill a tree over time.

[2 marks]

[2 marks]

Question 3d

d)

State the role of the parenchyma in phloem tissue.

[2 marks]

[2 marks]

Question 4a

a)

Sucrose enters the phloem companion cells via a co-transporter protein.

Explain how this co-transporter protein works.

[2 marks]

[2 marks]

Question 4b

b)

The processes referred to in part a) take place in a specialised type of companion cell called a transfer cell.

State **two** adaptations of a transfer cell that allow it to carry out sucrose co-transport effectively.

[2 marks]

[2 marks]

Question 4c

c)

The same hydrostatic pressure gradient exists within two different phloem tubes (1. and 2.) in a terrestrial plant.

These phloem tubes are located in the following parts of the plant:

1. Root tuber to growing shoot tip
2. Mature leaf on lower branch to the root tip

Suggest with a reason, whether 1. or 2. will result in a higher rate of translocation.

[2 marks]

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Phloem sieve tubes, similar to many other specialised cells, have features that allow them to carry out their function. Some of these are listed in the table below:

Feature	How the feature assists the function of phloem
Elements lined up end-to-end	
	Aids loading/unloading of assimilates and contains nucleus
	Possess functional membranes for active transport, osmosis etc
	To allow room for flow / symplast pathway without obstruction/resistance etc
Rigid cellulose cell walls	
	To release energy for active transport into / out of the phloem sieve tube

Outline these features and how they assist the function of phloem by completing the missing information in the table above.

[6 marks]

[6 marks]

Question 5b

b)

List **five** contrasts between xylem and phloem vessels.

[5 marks]

[5 marks]

Question 5c

c)

A plant was given radio-labelled CO_2 containing the ^{14}C isotope of carbon.

(i) Explain how this radio-labelled CO_2 is administered to the plant.

[2 marks]

(ii) An aphid stylet placed 18.9cm underneath the leaf first leaked radioactive assimilates after a period of 159 minutes. Calculate the rate of flow of assimilates in the phloem.

State your answer in mm hr^{-1} .

[2 marks]

[4 marks]

