

Name	Date started	Target end date
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## GCE AS / A LEVEL – BIOLOGY UNIT 2 QUESTION PACK

1072-01 (Legacy BY2) · New spec Unit 2 Topic 11 · AS unit, first sat 2016, 80 marks, 1h 30min paper

# REVISE

.wales

## BIOLOGY – UNIT 2 · TRANSPORT IN PLANTS &Mdash; PHLOEM & TRANSLOCATION

### *BY2.2.6 Adaptations for transport in plants – phloem, sieve tubes and translocation*

*Phloem tissue (sieve tube elements and companion cells), the mass-flow hypothesis of translocation, and evidence for active loading at sources and unloading at sinks.*

#### LEGACY 2008 SPECIFICATION

#### Estimated time for entire question pack: ~43 min

*Derived from the legacy BY2 paper's pace of ~1.1 min/mark, padded for long-prose answers (27 marks over 3 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

#### ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY2 papers (2008 modular spec, 2011–2017) that maps onto new-spec AS Unit 2 Topic 11 (2.6).

Questions are ordered by source paper date.

*For Examiner's use only*

Q	Source	Max	Mark
1	Jun 13 Q6	9	
2	Jun 14 Q5	9	
<b>Total</b>		<b>27</b>	

#### INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

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# Transport in Plants – Phloem & Translocation – what the new spec asks

WJEC GCE AS / A Level Biology (from 2015) · Unit 2: Biodiversity & Physiology of Body Systems · Topic 2.6.

## Phloem tissue

- Sieve tube elements: living, no nucleus, sieve plates between cells.
- Companion cells: many mitochondria, control sieve cells.
- Transports sucrose, amino acids, hormones from source to sink.

## Mass-flow hypothesis

- Sucrose actively loaded at source  $\Rightarrow$  water enters by osmosis.
- High hydrostatic pressure pushes sap to sink.
- Sucrose unloaded at sink; water leaves; low pressure.

## Evidence for translocation

- Radioactive  $\text{CO}_2$  labelling experiments (autoradiography).
- Aphid stylet experiments – sample sap directly.
- Ringing experiments – sugars accumulate above the ring.

## Source & sink

- Source: net producer of sucrose (mature leaf).
- Sink: net importer (roots, fruits, growing buds, tubers).
- Direction of transport in any sieve tube can reverse with season.

# Transport in Plants – Phloem & Translocation in one page

Quick-reference notes – revisit before each question.

## Phloem cells

Sieve tube element: living, no nucleus, sieve plates.

Companion cell: dense cytoplasm, many mitochondria, full organelles.

Together regulate transport via plasmodesmata.

## Translocation

Movement of organic solutes (sucrose, amino acids) from source to sink.

Source: net producer (mature leaf).

Sink: net consumer/storer (root, fruit, growing tip).

## Mass-flow hypothesis

Sucrose actively loaded at source  $\Rightarrow$  water enters by osmosis.

Hydrostatic pressure pushes sap down phloem.

Unloaded at sink; water leaves; pressure falls.

## Source loading

H<sup>+</sup> pumped out of companion cell using ATP.

H<sup>+</sup> / sucrose co-transport into companion cell.

Sucrose diffuses into sieve tube through plasmodesmata.

## Evidence

Radioactive CO<sub>2</sub> tracer: ratio appears first in phloem, then sinks.

Aphid stylet experiments – sample sieve tube contents directly.

Ringing (girdling) – sugars build up above ring; tissues below die.

## Direction reversal

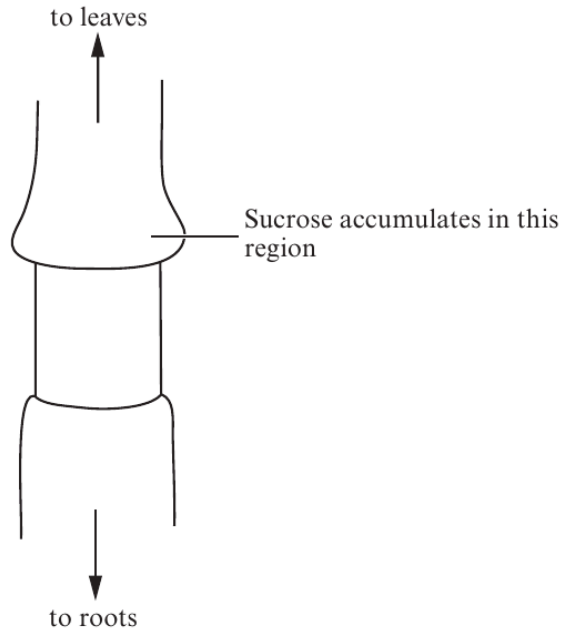
A leaf can be source in summer, sink in spring.

Storage roots / tubers reverse roles seasonally.

Phloem can transport in either direction (xylem only upwards).

6. (a) The diagram below shows part of a plant stem with the tissue external to the xylem removed, a technique known as ringing.

An accumulation of sucrose was found in the region shown.



(i) Explain why this accumulation of sucrose occurred. [3]

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(ii) Name **one** other type of organic molecule that is likely to accumulate with the sucrose. [1]

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(b) If the growing points of the shoot of the plant are removed there is a greater accumulation of sucrose.

Explain why there is a greater accumulation of sucrose. [2]

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(c) Explain fully the likely effect of the removal of the ring of tissue on the concentration of sucrose **below** the ring. [3]

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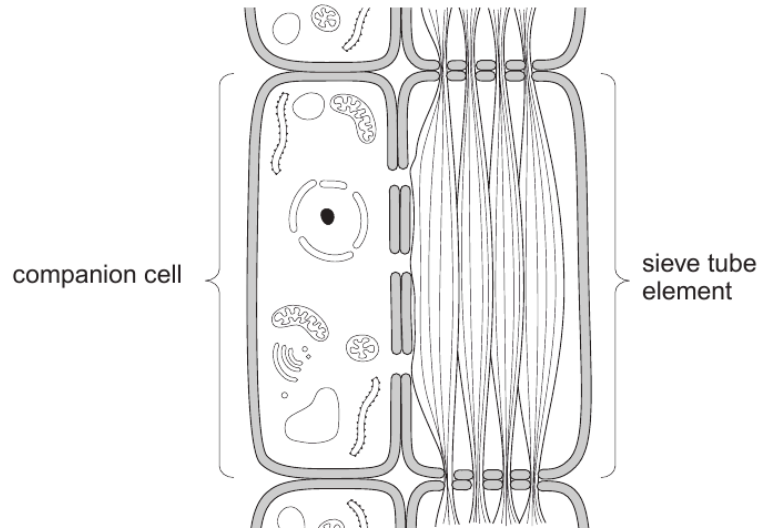
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Examiner only

5. The diagram below shows two types of cell that are found in phloem tissue.



(a) Name **two** other types of cell that are found in phloem. [2]

1 .....

2 .....

(b) The function of phloem is to transport organic molecules, such as sucrose, in a plant.

Using the diagram only, explain how **two** features of the sieve tube element enable the phloem to carry out its function. [4]

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(c) The mass flow theory is one explanation to account for the movement of solutes in the phloem.  
Suggest why the presence of large numbers of mitochondria in the companion cells does **not** support this theory. [3]

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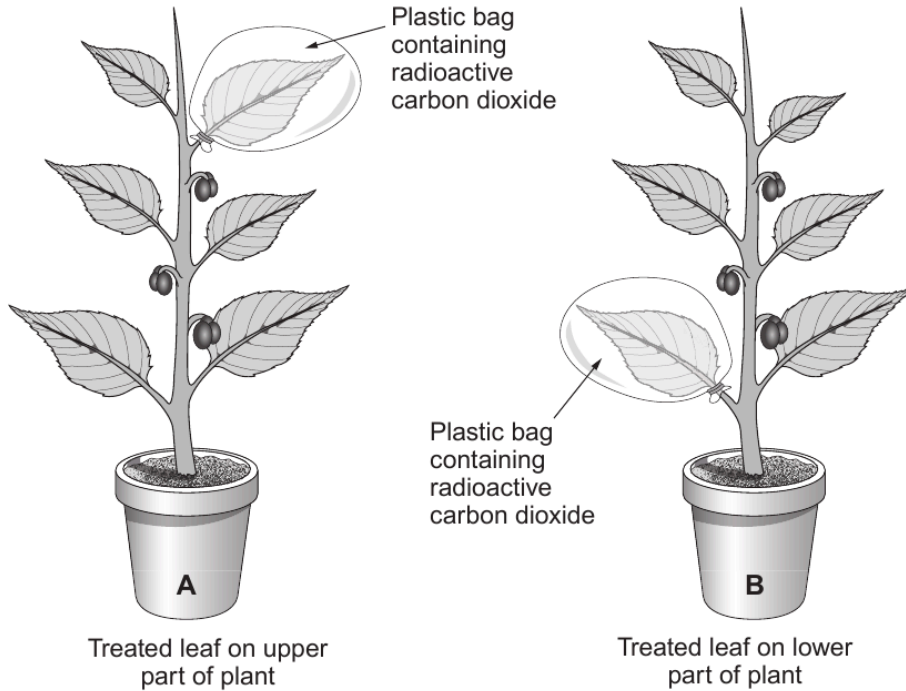
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6. An experiment was carried out to investigate the translocation of carbohydrate in a plant species. Selected leaves were allowed to photosynthesise in the presence of radioactive carbon dioxide for 30 minutes by securing plastic bags over the leaves. The treatment was applied to two plants of the same species that were both producing fruit. The plastic bags were then removed and the plants were allowed to photosynthesise normally. The radioactivity of different parts of the plants was then measured.

Examiner only



- (a) Suggest why the plants were left for 24 hours before the parts of the plants were analysed. [1]

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- (b) The quantities of radioactivity found in various parts of the plants are shown in the table.

Parts of plants	Radioactivity / counts min <sup>-1</sup>	
	<b>Plant A</b> <i>(leaf on upper part of stem treated)</i>	<b>Plant B</b> <i>(leaf on lower part of stem treated)</i>
Untreated leaf	230	170
Radioactive CO <sub>2</sub> treated leaf	11 200	11 300
Shoot tip	1 125	760
Stem	810	1 160
Fruit	9 050	4 520
Roots	850	2 700

15

Examiner  
only

- (i) Given that the total radioactivity recorded in plant **A** was 23265 counts min<sup>-1</sup>, calculate the percentage radioactivity found in the fruit. [2]

Percentage radioactivity = ..... %

- (ii) The percentage radioactivity found in the shoot tip was 4.8%. Suggest an explanation for the difference in these results. [3]

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- (c) (i) Name **one source** and **one sink** in this experiment. [1]

Source .....

Sink .....

- (ii) Using your knowledge of translocation, explain the distribution of radioactivity in plant **B**. [2]

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**END OF QUESTION PACK**

3 questions · 27 marks · ~43 min

Source: WJEC BY2 (2008 modular spec, 2011–2017)

Curated for WJEC Biology 2015 spec AS Unit 2 – Topic 11 (2.6)

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