Transport in Plants (3.1.3): OCR A Level Biology Exam Questions by Top

18 questions · 40 marks · about 48 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 1 · June 2022 · Q16(a) · 3 marks

SECTION B

Answer **all** the questions.

16 Dicotyledons are a large and diverse group of multicellular plants that includes oak trees and dandelions.

(a) Explain, using examples of transported substances, why multicellular plants need transport systems.

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..... **[3]**

Turn over

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Question 2 · A level Paper 3 · June 2018 · Q1(b) · 2 marks

(b) Fig. 1 shows a cross section of the root of an onion plant.

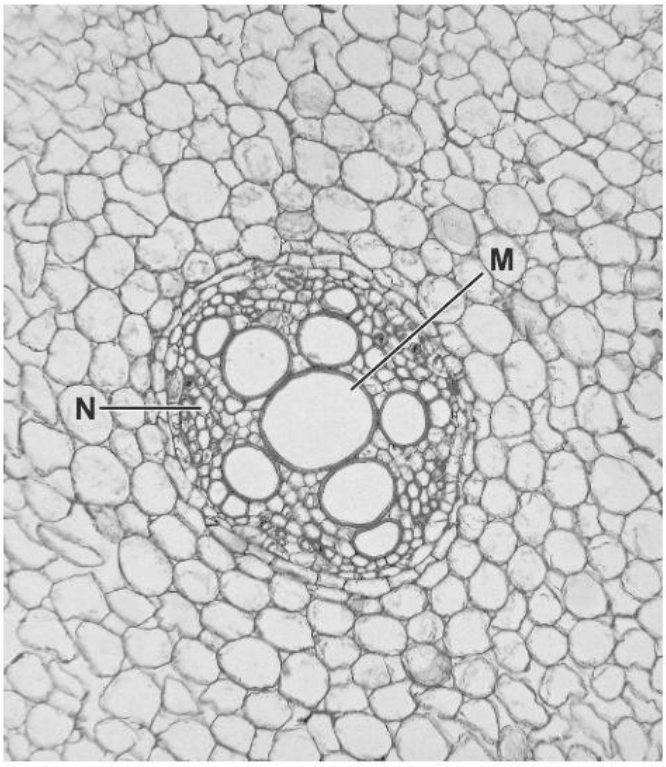


Fig. 1

Identify the **tissues** shown at **M** and **N**.

M .....

N .....

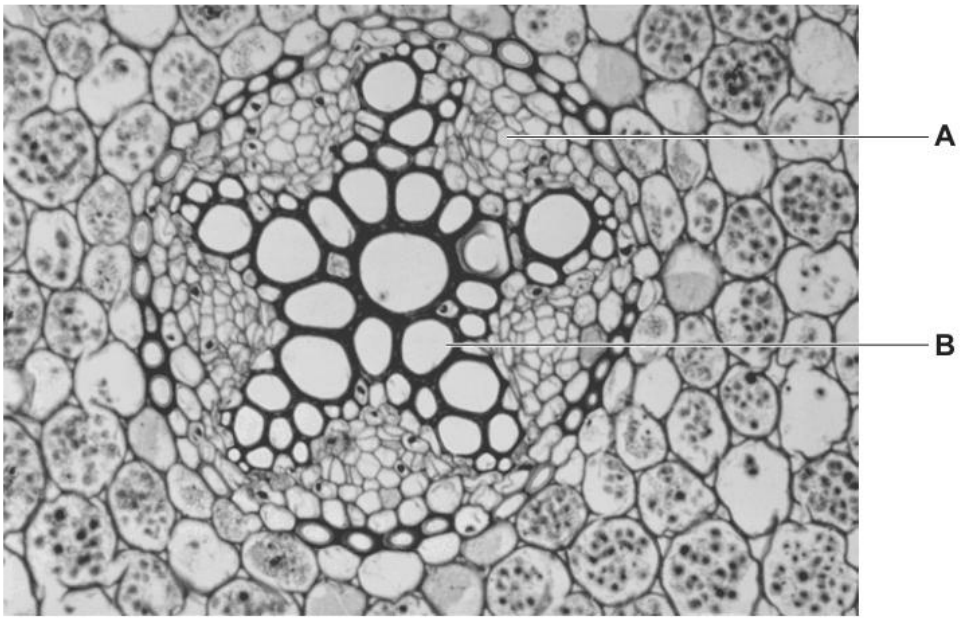
[2]

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Question 3 · A level Paper 3 · June 2025 · Q1(a) · 2 marks

1 The roots of plants contain a variety of cells and tissues.

(a) The photomicrograph shows a transverse section through the root of a herbaceous dicotyledonous plant.



Name the cells labelled **A** and **B** in the photomicrograph.

A .....

B .....

[2]

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Question 4 · information from earlier in the question

(b) **Fig. 16.1** is a light micrograph of a transverse section through the leaf of a dicotyledon.

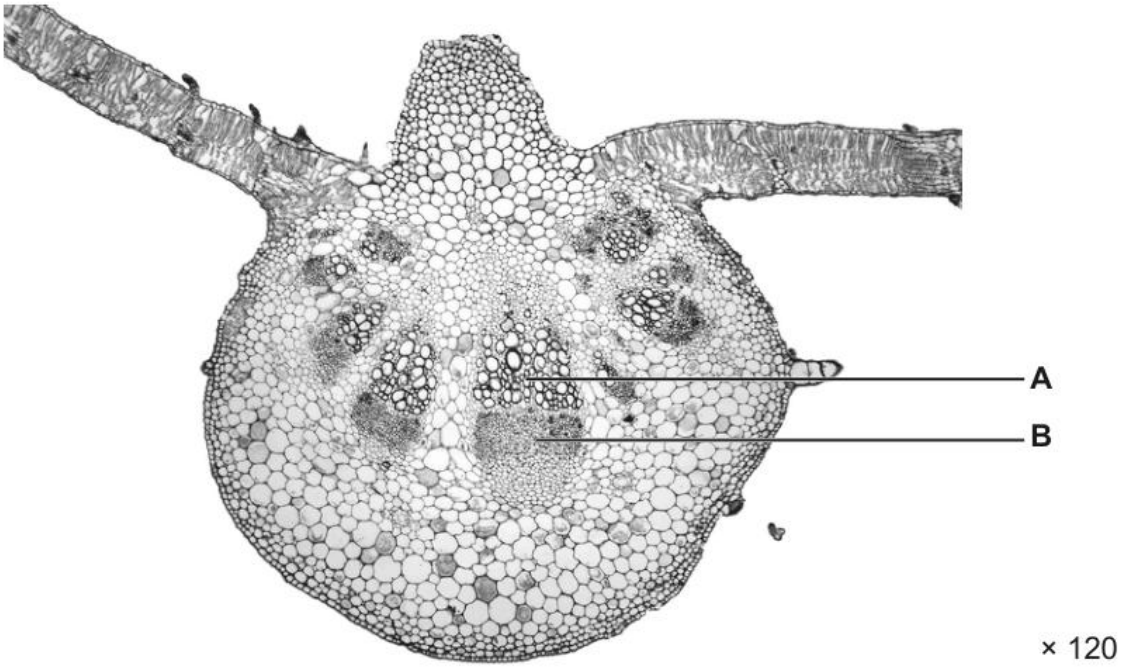


Fig. 16.1

(i) Identify the tissue labelled **B** in **Fig. 16.1**.

B ..... **[1]**

Question 4 · A level Paper 1 · June 2022 · Q16(b)(ii) · 2 marks

(ii) State **two** functions of structure **A**.

1 .....

.....

2 .....

.....

[2]

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Question 5 · AS Paper 1 · June 2019 · Q24(c)(i) · 3 marks

(c) Fig. 24 is a section through xylem tissue from a **stem** of a dicotyledonous plant.

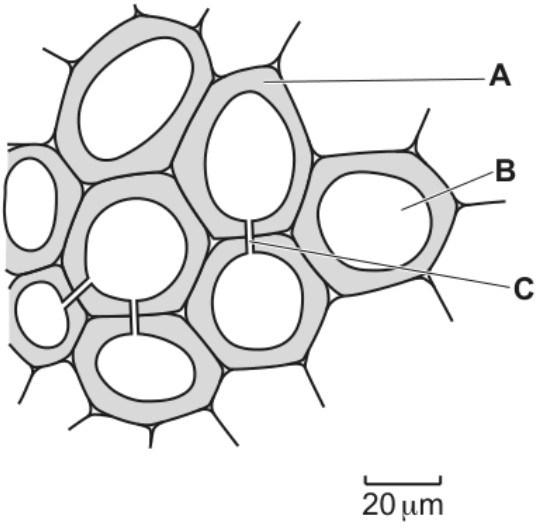


Fig. 24

(i) Identify **A**, **B** and **C** on Fig. 24.

A .....

B .....

C .....

[3]

Question 6 · AS Paper 1 · June 2019 · Q24(c)(ii) · 1 mark

(ii) Some plants, such as mosses, do not have xylem. Mosses are small plants that rarely grow more than a few cm in height.

Suggest why mosses do not need structures such as roots or xylem to survive.

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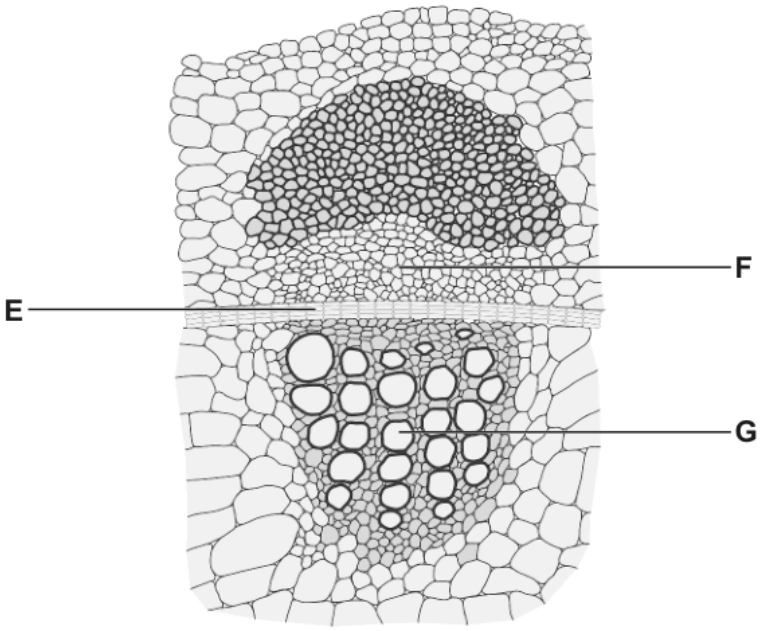
..... **[1]**

Turn over

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Question 7 · AS Paper 1 · June 2024 · Q22(b)(i) · 2 marks

(b) A light microscope image from a transverse-section through the stem of a plant was used to produce the drawing shown below.



(i) Identify tissues **E** and **F**.

Tissue **E** .....

Tissue **F** .....

[2]

Question 8 · AS Paper 1 · June 2024 · Q22(b)(ii) · 2 marks

(ii) Explain **two** ways tissue **G** is adapted for its function.

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..... **[2]**

Turn over

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Question 9 · AS Paper 1 · June 2024 · Q22(c) · 3 marks

(c) The sentences are about the transport of water through a plant.

Complete the sentences using the most appropriate terms.

In the apoplast pathway, water moves through the ..... of plant cells. When water reaches the endodermis, its movement is blocked by an impermeable barrier called the ..... .

Water is then forced into the symplast pathway. It moves between cells through channels called ..... .

[3]

Question 10 · A level Paper 1 · June 2023 · Q21(a)(i) · 2 marks

21 (a) In 1933 two scientists published a study in which they investigated the movement of coloured dyes in the transpiration stream of the stems of sycamore trees growing in a wood.

They bored holes in the stems and poured dye solution into the borehole. Then they sealed the hole with impermeable tape.

(i) Describe what is meant by the term **transpiration stream**.

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..... **[2]**

Question 11 · A level Paper 1 · June 2023 · Q21(b)(iii) · 2 marks

(iii) Explain why plants growing in high light intensity require more water than plants growing in shade, even when the temperatures are the same.

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..... **[2]**

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Question 12 · AS Paper 1 · June 2024 · Q22(d) · 2 marks

(d) Xerophytes are plants that are adapted to living in dry environments.

Explain **two** ways that xerophytes are adapted to prevent water loss in dry environments.

1 .....

.....

2 .....

.....

[2]

Question 13 · information from earlier in the question

(c) A group of students investigated the relationship between the distance of different trees from a river and the mean leaf hair density.

Table 25 shows the results of their investigation.

Distance from river (m)	Rank of distance	Mean leaf hair density (number mm^{-2})	Rank of hair density	Difference in ranks (d)	Difference squared (d^2)
9.1	4	33.1			
13.7	1	34.8			
5.5	7	11.3			
0.3	10	3.4			
5.4	8	27.3			
11.5	3	30.3			
1.7	9	6.3			
6.0	6	22.9			
11.9	2	5.7			
6.8	5	23.2			

Table 25

(i) Complete Table 25 by calculating the difference between the ranks and then squaring the difference.

[Answer on Table 25] **[2]**

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Question 13 · AS Paper 1 · June 2018 · Q25(d)(i) · 2 marks

(d) The students concluded that there is a positive correlation between distance of the tree from the river and mean leaf hair density.

(i) Suggest reasons for this positive correlation.

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..... **[2]**

Question 14 · A level Paper 3 · June 2025 · Q1(c) · 3 marks

(c) Carbohydrates produced in palisade cells are transported in phloem to sinks, such as roots.

Describe how carbohydrates move from palisade cells into companion cells in phloem.

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..... **[3]**

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Question 15 · AS Paper 1 · June 2025 · Q24(a) · 3 marks

24

(a) The cell surface membrane of companion cells has a key role in the loading of sucrose into phloem sieve tubes.

A student wrote three incorrect statements as a part of their revision notes on this topic.

For each statement, state the error **and** write a correction.

Statement 1: The cell surface membrane of the companion cell contains channel proteins for pumping protons.

Error .....

Correction .....

Statement 2: The cell surface membrane of the companion cell contains cotransporter proteins for protons and glucose.

Error .....

Correction .....

Statement 3: Cotransporter proteins in the companion cell surface membrane use ATP to change shape to transport sugar molecules against their concentration gradient.

Error .....

Correction .....

[3]

Question 16 · AS Paper 2 · June 2017 · Q2(a) · 2 marks

2 **(a)** A group of students wanted to observe the position of xylem vessels in the leaf stalks (petioles) of celery.

Describe a procedure they could use to do this.

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..... **[2]**

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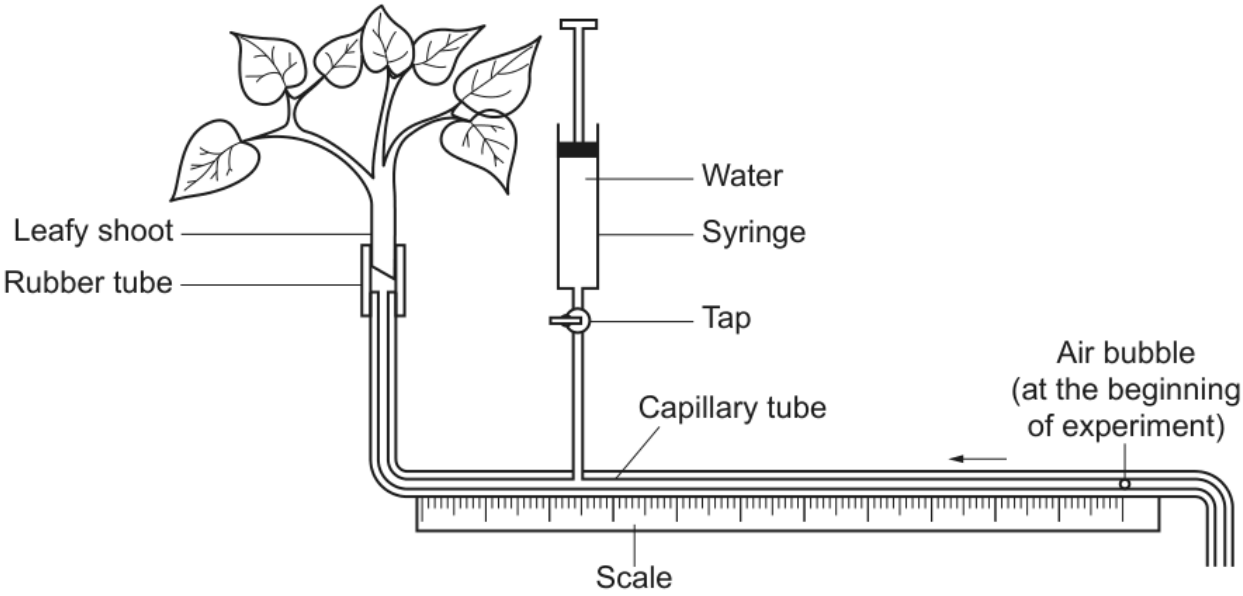
(b) A class of students investigated the effect of humidity on the rate of transpiration from a leafy shoot.

They made the assumption that the volume of water uptake by a leafy shoot is equivalent to the volume of water lost through transpiration.

This is the method the class followed:

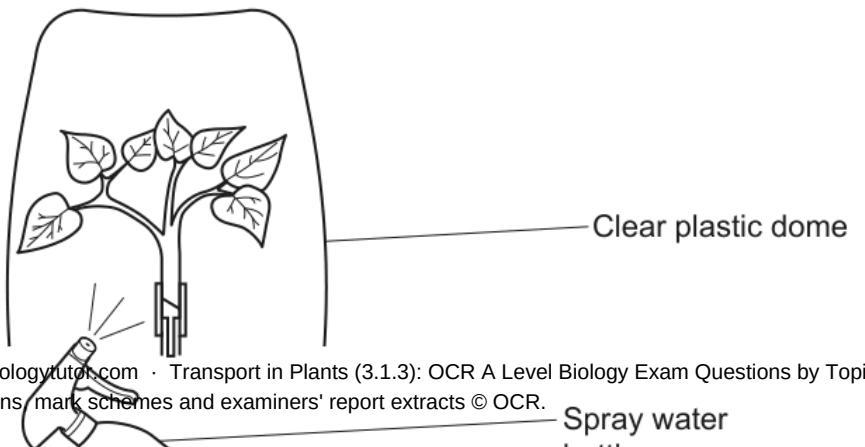
- The class was divided into three groups.
- Each group had a potometer and a leafy shoot, shown in **Fig. 2.1**.
- Each group investigated one humidity level and completed three trials.
- They measured the distance moved by the air bubble in a fixed time.
- Group A used only the apparatus shown in **Fig. 2.1**.
- Groups B and C added to the apparatus. They put a clear plastic dome over the leafy shoot and used a water spray to vary the humidity around the leafy shoot. This is shown in **Fig. 2.2**.

Fig. 2.1



7

Fig. 2.2



Question 17 · AS Paper 2 · June 2023 · Q2(c) · 2 marks

(c) The students wanted to see how air movement affects rate of transpiration.

Describe how you would **modify** the apparatus shown in **Fig. 2.1 and Fig. 2.2** to determine how air movement affects rate of transpiration.

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..... **[2]**

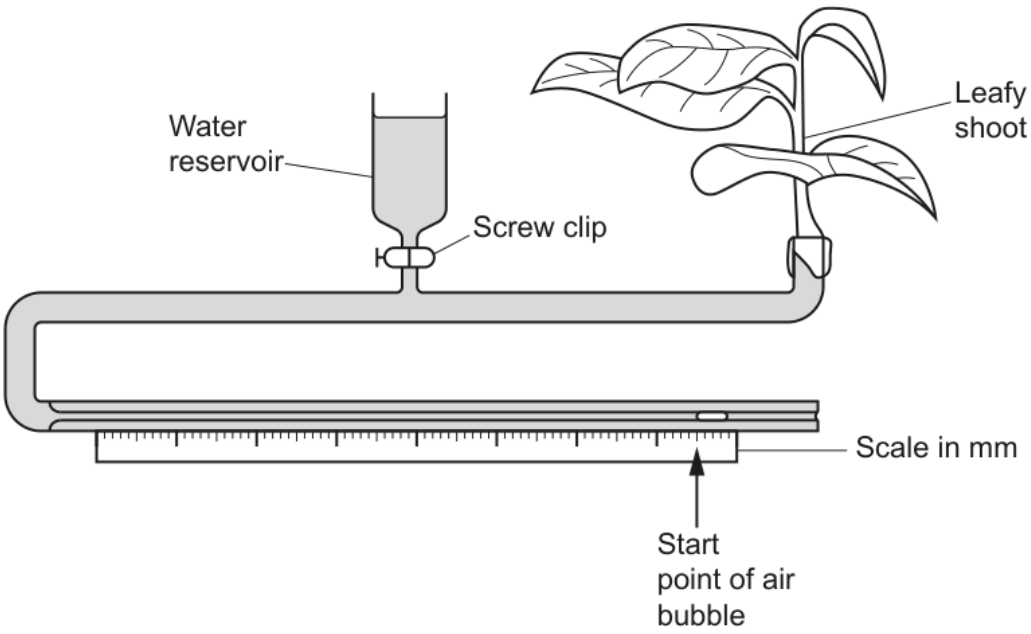
Turn over

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Question 18 · A level Paper 3 · June 2024 · Q3(c)(i) · 2 marks

(c) A scientist plans to investigate the effect of temperature on the rate of transpiration in *P. vulgaris*.

The scientist uses a potometer in their investigation, as shown in the diagram below.



(i) The scientist plans to calculate the rate of transpiration by measuring the distance moved by the air bubble.

The scientist carries out a preliminary trial by measuring the distance moved by the air bubble in 30 minutes at 20 °C.

The bubble moves 18 mm in 30 minutes. The diameter of the capillary tubing in the potometer is 1 mm.

Calculate the rate of transpiration, in $mm^3 h^{-1}$, during this preliminary trial.

Use the formula: Volume of cylinder = $\pi r^2 l$

Rate of transpiration = ... $mm^3 h^{-1}$ **[2]**

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Mark schemes

Question 1 · A level Paper 1 · June 2022 · Q16(a) · 3 marks

16	(a)		**any three from:** ***Max 2 from explanations…*** **1** (large size requires) transport over long distances / AW ✓ **2** diffusion too slow / diffusion distance too great / cannot rely on diffusion alone ✓ **3** low / small , surface area to volume ratio / SA to V ratio / SA:V ✓ ***Max 2 from examples…*** **4** (to) transport , water / ions , from roots to , cells / other parts of the plant ✓ **5** (to) transport , sucrose / products of photosynthesis / (named) assimilates , from , source to sink ✓ **6** (to) transport (named) hormones produced in one part to site of action / AW ✓

3	1.1	**MP1 ALLOW** e.g. transporting water from roots to the leaves (in a tree) is a long way =**MP1 + MP4** **MP2 ALLOW** diffusion is not sufficient to meet the needs of the plant **or** meet metabolic demand **MP 2 IGNORE** diffusion is not efficient **MP5 IGNORE** glucose **MP5 ALLOW** correct examples of source and sink **MP5 ALLOW** e.g. amino acids for assimilates

Question 2 · A level Paper 3 · June 2018 · Q1(b) · 2 marks

b	M = xylem ✓ N = phloem ✓	**2**	**DO NOT ALLOW** xylem, vessels /elements **DO NOT ALLOW** phloem, sieve tubes / companion cells **IGNORE** vascular tissue

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Question 3 · A level Paper 3 · June 2025 · Q1(a) · 2 marks

1	(a)	A = sieve tube (element) ✓ B = xylem (vessel) ✓	2	2.3	**ALLOW** xylem cell

Question 4 · A level Paper 1 · June 2022 · Q16(b)(ii) · 2 marks

16	(b)	(ii)	transport of , water / (named) ions ✓ (mechanical / structural) support ✓	2	1.2

Mark as continuous prose

ALLOW transport of (some) hormones

IGNORE strength

Question 5 · AS Paper 1 · June 2019 · Q24(c)(i) · 3 marks

(c)	(i)	A vessel wall ✓ B (vessel) lumen ✓ C (bordered) pit ✓	3	**ALLOW** 'lignified wall' **DO NOT ALLOW** 'cell'

Question 6 · AS Paper 1 · June 2019 · Q24(c)(ii) · 1 mark

		(ii)	large surface area to volume ratio ✓ idea that distance, water / mineral (ions), need(s) to travel is short ✓	
				Total

max 1	**DO NOT ALLOW** larger / higher surface area to volume ratio **IGNORE** refs to support
11	

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Question 7 · AS Paper 1 · June 2024 · Q22(b)(i) · 2 marks

(b)	**(i)**	Tissue **E** = cambium ✓ Tissue **F** = phloem ✓	**2**	**If no response check labels on picture** **ALLOW** meristematic tissue / meristem **DO NOT ALLOW** stem cells **DO NOT ALLOW** phloem sieve tubes

Question 8 · AS Paper 1 · June 2024 · Q22(b)(ii) · 2 marks

	(ii)	1. pits allow water to move into, adjacent xylem vessels / other cells / lateral parts of the plant ✓ 2. (vessel) walls contain lignin, for structural support / to prevent collapse **OR** (vessel) walls contain lignin to prevent water loss from vessel ✓ 3. no end walls (in vessel) / hollow (vessels), for continuous water transport / continuous column of water ✓ 4. vessels are narrow to contribute to capillary action (for water transport) ✓ 5. lignin allows for adhesion of water molecules to the vessel walls ✓	

2 max	**DO NOT ALLOW** if linked to incorrect tissue e.g. phloem **DO NOT ALLOW** ref to 'cell' walls **IGNORE** no cell walls at ends of cells **ALLOW** no cytoplasm / cell contents **ALLOW** does not imped flow of water for continuous water transport **ALLOW** capillary action linked to lignin in (vessel) walls

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Question 9 · AS Paper 1 · June 2024 · Q22(c) · 3 marks

(c)	**3** cell walls ✓ Casparian strip ✓ plasmodesmata ✓	**ALLOW** phonetic spelling for Casparian and plasmodesmata

Question 10 · A level Paper 1 · June 2023 · Q21(a)(i) · 2 marks

21	**(a)**	**(i)**	movement of <u>water</u> ✓ from roots to leaves ✓	**2**	1.2

Question 11 · A level Paper 1 · June 2023 · Q21(b)(iii) · 2 marks

21	**(b)**	**(iii)**	(high light intensity) increases (rate of), light-dependent reaction / LDR / photosynthesis ✓ more stomata open to allow , gas exchange / entry of carbon dioxide ✓ (high light intensity) increases transpiration so more , evaporation / water vapour is lost ✓	**max 2**	2.3

ALLOW more photolysis

ALLOW stomata widen to allow , gas exchange / entry of carbon dioxide

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	(d)	1. rolled / small leaves / leaves reduced to spines/ scales/ needles , to reduce the surface area for transpiration ✓ **OR** leaves reduced to spines/ scales/ needles, to reduce the surface area for transpiration ✓ 2. thick(er) waxy cuticle to reduce/prevent transpiration ✓ 3. sunken stomata / stomata in sunken pits to , maintain humidity / reduce water potential gradient / reduce transpiration ✓ 4. curled leaves / rolled leaves / hairs / spines / sunken stomata, to reduce, air movement / effect of wind / reduce water potential gradient **OR** curled leaves / rolled leaves / hairs / spines / sunken stomata, to, trap water vapor / increase humidity ✓ 5. reduced number of stomata/leaves , to reduce transpiration ✓ 6. hinge cells shrink when flaccid so leaf rolls , creating a humid space / to reduce transpiration ✓ 7. stomata on upper epidermis so they open into the rolled space which is more humid , to reduce transpiration ✓ 8. stomata closed during day / only open at night , to reduce transpiration ✓
		Total

2 max	**IGNORE** ref to fleshy leaves / deeper roots **IGNORE** water loss throughout **ALLOW** water **vapor** loss and/or ref to evaporation for transpiration throughout **DO NOT ALLOW** thorns **DO NOT ALLOW** thorns **IGNORE** regulate humidity
10	

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Question 13 · AS Paper 1 · June 2018 · Q25(d)(i) · 2 marks

(d)	**(i)**	further away from the river less water (available) / ORA ✓ transpiration causes water loss ✓ hairs, trap water vapour / reduce transpiration / reduce loss of water (vapour) ✓ reduced water (vapour) potential gradient from inside to outside leaf ✓	2 max

DO NOT ALLOW 'further from source' 'no source'

DO NOT ALLOW hairs prevent water (vapour) loss

Question 14 · A level Paper 3 · June 2025 · Q1(c) · 3 marks

Question			Answer	Mark	AO Element	Guidance
1	(c)		**1** (transported as) sucrose ✓ **2** (moves between cells from palisade cells) through , plasmodesmata / symplast (pathway) **OR** (or moves between cells) through , cell walls / inter-cell spaces / apoplast (pathway) ✓ **3** protons / H^+ (ions) , actively transported / pumped , out of companion cell ✓ **4** co-transport (of , sucrose / carbohydrates) with , protons / H^+ (ions) , into companion cell ✓ **5** active loading (of sucrose into companion cells) ✓	**3 max**	1.2	**IGNORE** 'palisade' throughout **NOTE:** mp2, 3, 4, and 5 can be awarded without sucrose being mentioned **ALLOW** 'facilitated diffusion of carbohydrate, together with protons, into companion cell' **ECF** from MP3 if an ion other than H^+ is used **DO NOT ALLOW** 'active transport of sucrose'

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Question 15 · AS Paper 1 · June 2025 · Q24(a) · 3 marks

24	**(a)**	*Statement 1* Error – channel (proteins) **AND** Correction – carrier (proteins) ✓ *Statement 2* Error – glucose **AND** Correction – sucrose ✓ *Statement 3* Error – use ATP (to change shape) **AND** Correction – uses the proton gradient (to cotransport the sucrose into the sieve tubes) / AW **OR** Error – cotransporter (proteins) **AND** sugar (molecules) **AND** Correction – carrier (proteins) **AND** protons ✓	**3**	1.2

IGNORE ref to protons / H^+ / hydrogen ions
DO NOT ALLOW glucose AND sucrose

ALLOW H ions / H^+ / Hydrogen ions for proton/s throughout

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Question 16 · AS Paper 2 · June 2017 · Q2(a) · 2 marks

Question			Answer	Mark
2	(a)		**D1** put , (leaf) stalk(s) / petiole(s) , in , dye / stain / food colouring ✓ **D2** (then) cut , transversely / cross section ✓ **OR** **M1** cut a (thin) , transverse / cross , section ✓ **M2** (then) add (named) stain / observe with microscope under low power ✓	2

Guidance

IGNORE any observations

D1 ACCEPT 'stick' for 'stalk'

D2 ACCEPT cut across , (leaf) stalk / petiole (with a sharp blade)
a longitudinal , cut / section
cut in half
IGNORE
IGNORE

M1 ACCEPT cut a (thin) slice of (leaf) stalk / petiole (with a sharp blade)
a longitudinal , cut / section
cut in half
IGNORE
IGNORE

Question 17 · AS Paper 2 · June 2023 · Q2(c) · 2 marks

	(c)		**1** remove , plastic dome / cover / spray bottle✓ **2** place fan at different distances (from the apparatus) / fan, set to/with, different speeds (at same distance) ✓	**2**	**3.3**	**1 ALLOW** use a fan instead of, plastic dome/water spray/spraying the plant **1 ALLOW** ref to plastic bag for 'plastic dome' **1 ALLOW** diagram showing absence of dome/spray bottle **2 ALLOW** hair dryer set on cold for 'fan'. **2 ALLOW** fan placed at a set distance compared with no fan. **IGNORE** use fan to look at different air movement unqualified.
			Total	**9**		

Question	Answer	Marks	AO element	Guidance

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3	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 28 / 28.3 award two marks** 1mm / 2 = 0.5 $0.5^2 = 0.25$ x π = 0.78539 x 18 = 14.137 ✓ x 2 = 28.274 = 28 mm^3 h^{-1} ✓	**2**

ALLOW 1 mark for correct answer not rounded to two or three significant figures (e.g. 28.27433, 28.2857, 28.26, 28.278) (depending on value of π used)

ALLOW 1 mark for correctly working out volume of water lost in 30 minutes (to any number of sig figs (e.g.14.137165, 14.142855,14.13,14.139) (depending on value of π used)

ECF if diameter rather than radius used to calculate volume (110 or 113) for 1 mark

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