Exercise walk-through

2.4
Plant tissues and organ systems (4.2.3, RP5)

AQA · GCSE · Biology

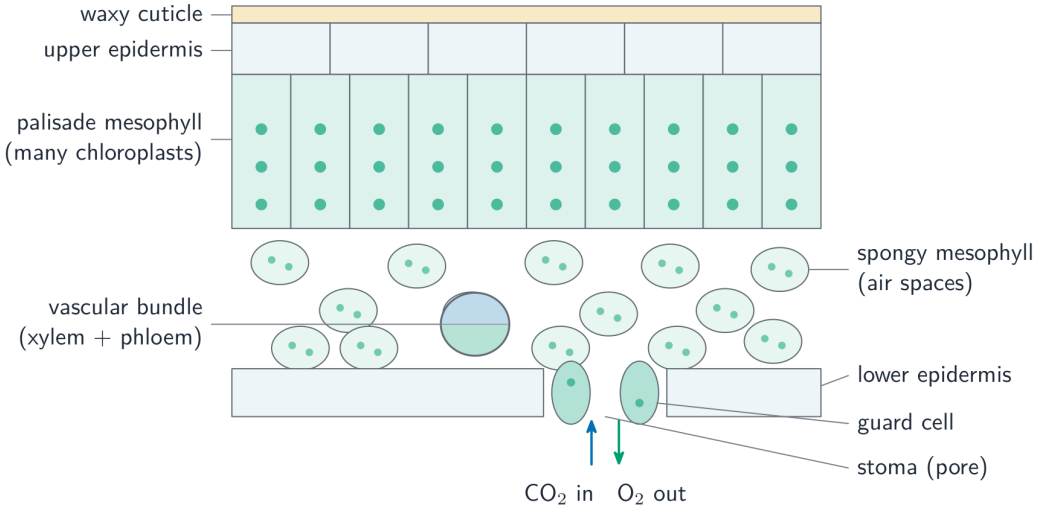
Plant tissues and organs

- The upper and lower **epidermis** cover the leaf; the upper **epidermis** has a **waxy cuticle** that reduces water loss.
- The **palisade mesophyll** has many chloroplasts, for photosynthesis.
- The **spongy mesophyll** has air spaces, so gases can diffuse through the leaf.

Plant tissues and organs (2)

- **Guard cells** open and close the **stomata**, the small pores that let carbon dioxide in and water vapour out.
- **Meristem** **tissue** at the tips of roots and shoots makes new cells for growth.

Figure: Plant tissues and organs

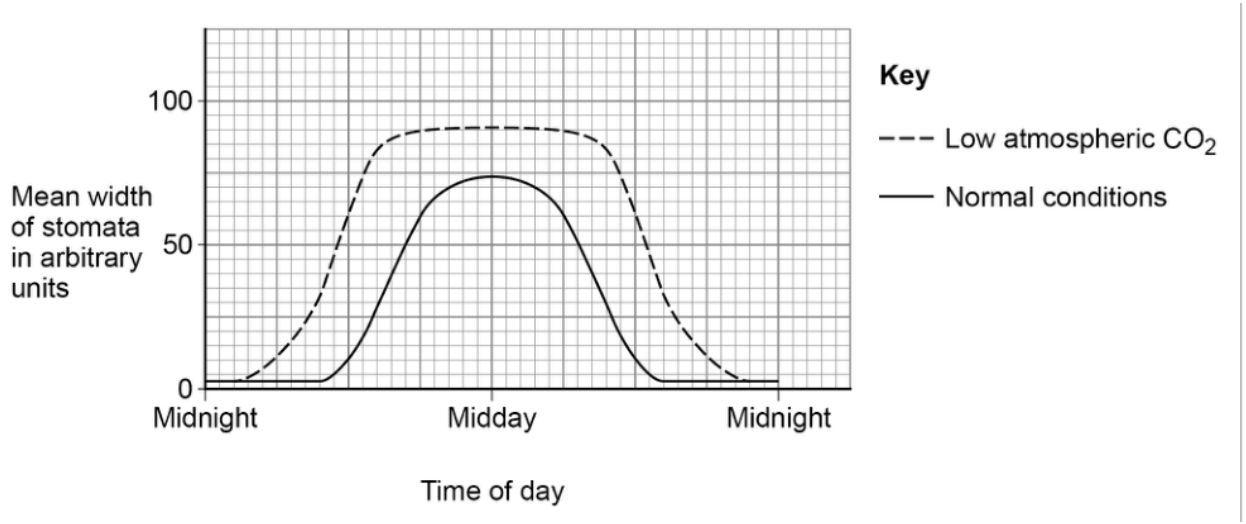


- A section through a leaf, not to scale; the dots in the palisade cells are chloroplasts
- Match each part of the diagram to the text.

Transpiration

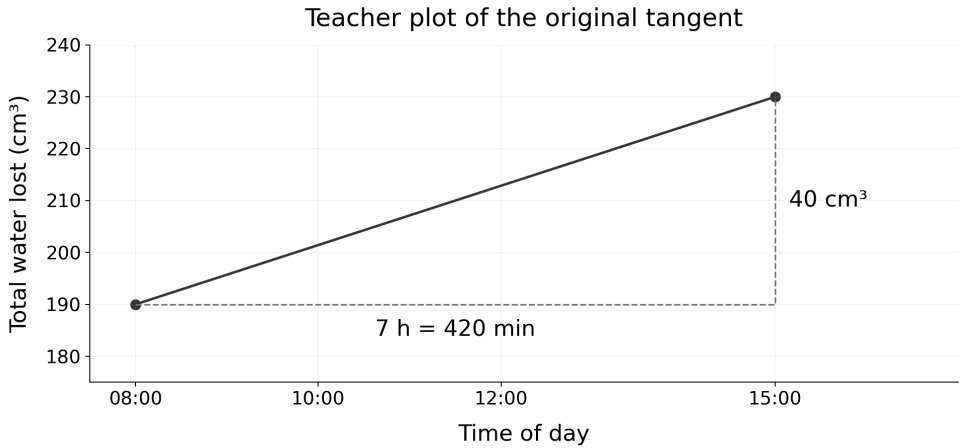
- **Transpiration** is the loss of water vapour from the leaves.
- Water evaporates from the surfaces of the mesophyll cells into the air spaces, and the vapour diffuses out through the **stomata**.
- As water is lost, more is pulled up the **xylem** from the roots: the **transpiration** stream.
- **Measuring transpiration.** A **potometer** measures how fast a leafy shoot takes up water, by timing how far an air bubble moves along a narrow tube.

Figure: Transpiration



- Mean width of **stomata** through the day (arbitrary units): solid line in normal air, dashed line in low carbon dioxide (AQA GCSE Biology Paper 1H, June 2022, Figure 7)
- Read the axes and units first.

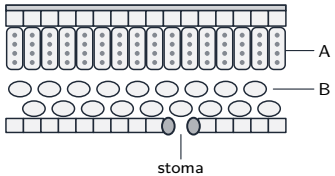
Figure: Transpiration (2)



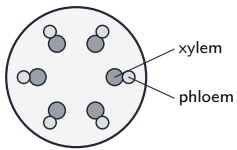
- The tangent at 12:00 passes through 190 cm^3 at 08:00 and 230 cm^3 at 15:00, so its gradient is 40 cm^3 in 7 hours
- Read the axes and units first.

Exercises 2.1·2.2

2.1 The diagram shows a section through a leaf. Name tissues A and B. [2]

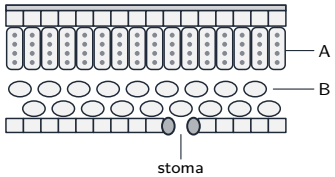


2.2 Which tissue carries sugars around a plant? In which direction can the sugars move? [2]



Exercises 2.1·2.2

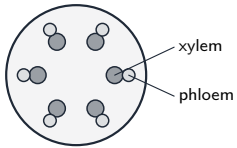
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2.1

- A: **palisade mesophyll**; B: **spongy mesophyll**

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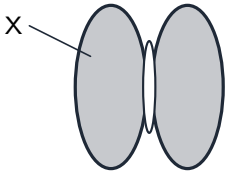


2.2

- **phloem**; up and down the plant (in both directions)

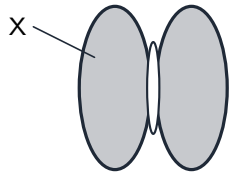
Exercise 2.3

2.3 The diagram shows a stoma. Name cell X. Give **one** reason why stomata close at night. [2]



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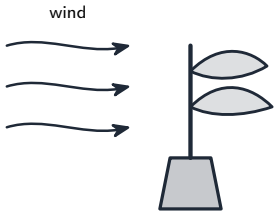


2.3

- **guard cell**; there is no light for photosynthesis, so no carbon dioxide is needed; closing stops water loss

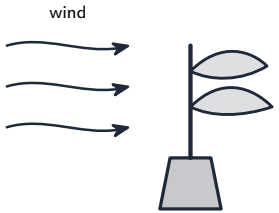
Exercise 3.1

3.1 Explain why a plant loses water faster on a windy day. [3]



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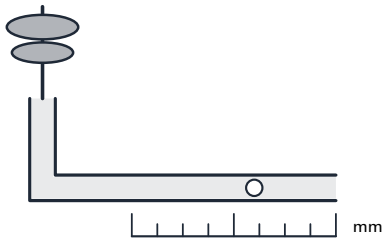
- wind moves water vapour away from the leaf surface
- so the concentration gradient between the inside of the leaf and the air is bigger
- water vapour diffuses out of the stomata faster

Exercise 3.2 (a)

3.2 A student uses a potometer to measure water uptake by a shoot in different conditions. She measures how far the air bubble moves in 5 minutes.

condition	still air	fan	dark	plastic bag over shoot
distance moved in 5 min / mm	12	30	4	5

(a) Calculate the rate of water uptake in still air in mm/min. [2]

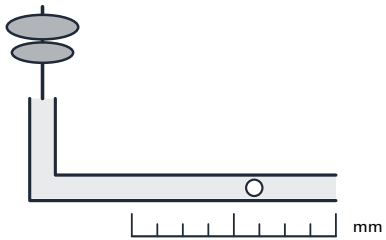


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(a) Calculate the rate of water uptake in still air in mm/min. [2]



(a) $12 \div 5 = \mathbf{2.4}$ mm/min

Exercise 3.2 (b)

3.2 A student uses a potometer to measure water uptake by a shoot in different conditions. She measures how far the air bubble moves in 5 minutes.

condition	**still air**	**fan**	**dark**	**plastic bag over shoot**
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(b) The capillary tube has a radius of 0.5 mm. Calculate the volume of water taken up in 5 minutes with the fan. Use volume $= \pi r^2 \times$ distance. [3]

Exercise 3.2 (b)

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(b) $\pi \times 0.5^2 = 0.785$ mm^2; 0.785×30; $=$ **23.6** mm^3

Exercise 3.2 (c)

3.2 A student uses a potometer to measure water uptake by a shoot in different conditions. She measures how far the air bubble moves in 5 minutes.

condition	**still air**	**fan**	**dark**	**plastic bag over shoot**
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(c) Explain the result in the dark. [2]

Exercise 3.2 (c)

3.2 A student uses a potometer to measure water uptake by a shoot in different conditions. She measures how far the air bubble moves in 5 minutes.

condition	**still air**	**fan**	**dark**	**plastic bag over shoot**
distance moved in 5 min / mm	12	30	4	5

(c) Explain the result in the dark. [2]

(c) the stomata close in the dark; so much less water vapour diffuses out and less water is taken up

Exercise 3.2 (d)

3.2 A student uses a potometer to measure water uptake by a shoot in different conditions. She measures how far the air bubble moves in 5 minutes.

condition	**still air**	**fan**	**dark**	**plastic bag over shoot**
distance moved in 5 min / mm	12	30	4	5

(d) Describe how water moves from the soil, through the plant, and out into the air. Include how the root and the leaf are adapted. [6]

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(d) points to include:

- water enters root hair cells from the soil by osmosis; root hairs give a large surface area
- water moves across the root into the xylem
- xylem vessels are hollow tubes strengthened with lignin, carrying water up the stem
- in the leaf, water evaporates from the spongy mesophyll cells into the air spaces
- water vapour diffuses out through the stomata; guard cells control the opening
- this loss pulls more water up the xylem: the transpiration stream

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.