

Exercise walk-through

6.2

Leaf structure

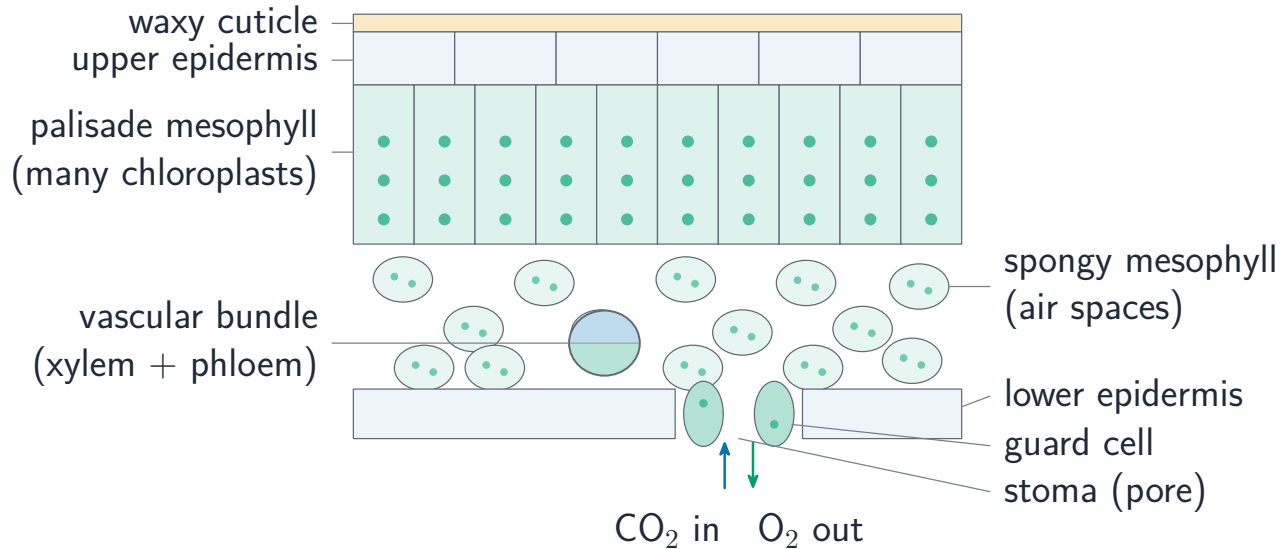
IGCSE Biology

Leaf structure

A leaf is **adapted** – broad & thin to catch light.

- **palisade** cells: packed with chloroplasts
- **spongy** layer: air spaces for gas
- **xylem** brings water; phloem takes sugar

Leaf structure, in detail



A leaf is **adapted** – broad & thin to catch light.

The leaf, layer by layer

the cuticle

a waxy waterproof layer on top – reduces water loss, and lets light through

the epidermis

a single transparent layer, with no chloroplasts, protecting the tissue beneath

palisade mesophyll

tall cells packed with chloroplasts, near the top where the light is strongest

spongy mesophyll

loosely packed with air spaces – a large **surface area** for gas exchange

vascular bundles

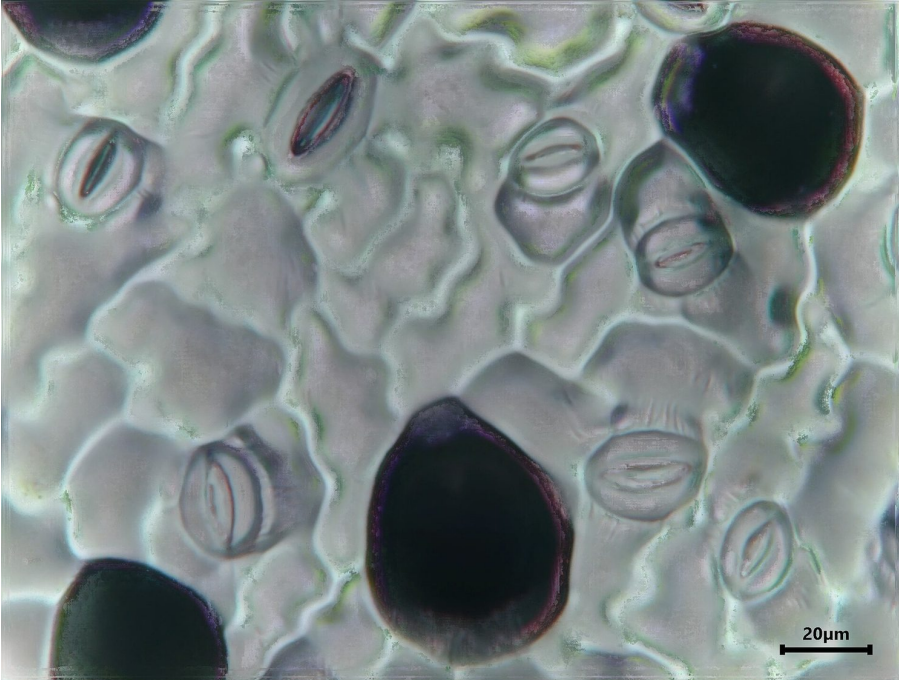
the leaf's veins: **xylem** brings water in, phloem takes sugar away

stomata

pores in the lower epidermis, opened and closed by guard cells

To test what photosynthesis needs, remove **one** of light, chlorophyll or carbon dioxide, keep every other condition the same as the **control**, and test the leaf for starch with iodine – blue-black means starch. Hydrogencarbonate **indicator** is the separate test, for carbon dioxide.

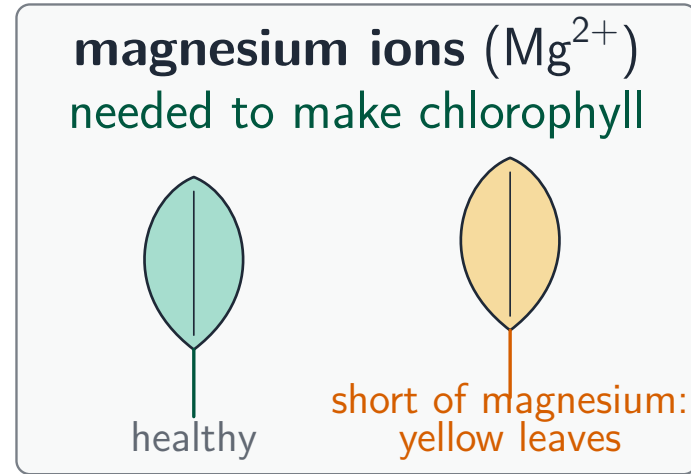
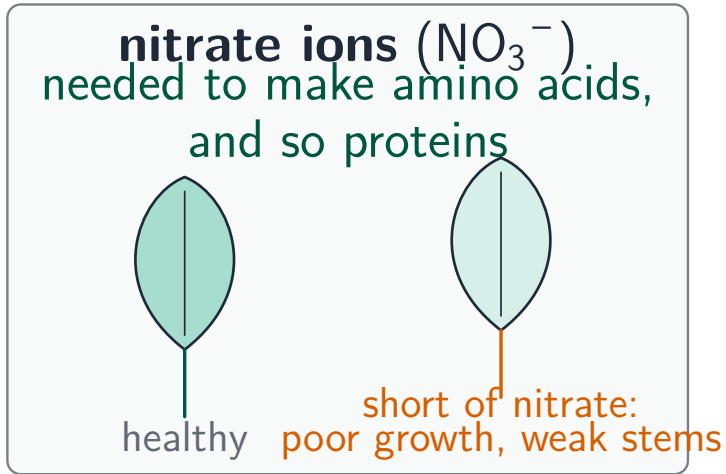
Stomata and guard cells



Stomata are tiny pores (mostly on the lower surface) that let CO_2 in & O_2 out.

A pair of **guard cells** opens & closes each stoma.

Minerals from the soil, continued



A plant short of nitrate grows poorly; a plant short of magnesium has yellow leaves

Exercises 2.1·2.2

2.1 Name the leaf tissue where most photosynthesis happens. [1]

2.2 State the function of the stomata. [1]

Exercises 2.1·2.2

2.1 Name the leaf tissue where most photosynthesis happens.

[1]

2.1

- most photosynthesis happens in the **palisade mesophyll**

2.2 State the function of the stomata.

[1]

2.2

- stomata let **carbon dioxide in and oxygen out** (gas exchange)

Exercise 3.1

3.1 Palisade mesophyll cells are well suited to photosynthesis because they: [1]

☐

A have no chloroplasts

B are packed with chloroplasts near the top of the leaf

C are deep in the leaf

D have a thick cuticle

Exercise 3.1

3.1 Palisade mesophyll cells are well suited to photosynthesis because they: [1]

☐

A have no chloroplasts

B are packed with chloroplasts near the top of the leaf

C are deep in the leaf

D have a thick cuticle

3.1 B

- palisade cells are **packed with chloroplasts near the top** of the leaf
- A, C and D would reduce photosynthesis

Exercise 3.2 (a)

3.2 A leaf is broad and thin.

(a) Explain how being broad helps the leaf.

[1]

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(a) Explain how being broad helps the leaf.

[1]

(a)

- a broad leaf has a **large surface area** to catch more light

Exercise 3.2 (b)

3.2 A leaf is broad and thin.

(b) Explain how the air spaces in the spongy mesophyll help.

[2]

Exercise 3.2 (b)

3.2 A leaf is broad and thin.

(b) Explain how the air spaces in the spongy mesophyll help.

[2]

(b)

- air spaces let CO_2 and O_2 **move easily**
- to and from the cells

Exercise 3.3

3.3 State the role of the guard cells.

[2]

Exercise 3.3

3.3 State the role of the guard cells.

[2]

3.3

- guard cells **open and close** the stomata
- to control **gas exchange** (and water loss)

Exercise 3.4 (a)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(a) For the **palisade mesophyll**, the **spongy mesophyll** and the **stomata**, state one way each is adapted and explain how that adaptation helps the leaf. [6]

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(a) For the **palisade mesophyll**, the **spongy mesophyll** and the **stomata**, state one way each is adapted and explain how that adaptation helps the leaf. [6]

(a)

- **palisade:** tall cells full of chloroplasts at the top – most light absorbed
- **spongy:** large air spaces – gases **diffuse quickly**
- **stomata:** pores that open and close – CO₂ in, O₂ out, close to cut water loss

Exercise 3.4 (b)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(b) Explain why most stomata are found on the lower surface of the leaf.

[2]

Exercise 3.4 (b)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(b) Explain why most stomata are found on the lower surface of the leaf. [2]

(b)

- the lower surface is **shaded and cooler**
- so **less water evaporates** than from the hot upper surface

Exercise 3.4 (c)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(c) Name the tissue that brings water to the leaf and the tissue that carries sugars away.[2]

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3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(c) Name the tissue that brings water to the leaf and the tissue that carries sugars away.[2]

(c)

- water arrives in the **xylem**
- sugars leave in the **phloem**

Exercise 3.4 (d)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(d) Explain why a leaf is thin and flat.

[2]

Exercise 3.4 (d)

3.4 A cross-section through a leaf shows a waxy cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, and a lower epidermis containing stomata and guard cells.

(d) Explain why a leaf is thin and flat.

[2]

(d)

- **flat**: large surface area to catch light and exchange gases
- **thin**: short distance for CO₂ to **diffuse**