

Leaf Structure & Plant Function

Key ideas

Photosynthesis: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (light energy, in chloroplasts).

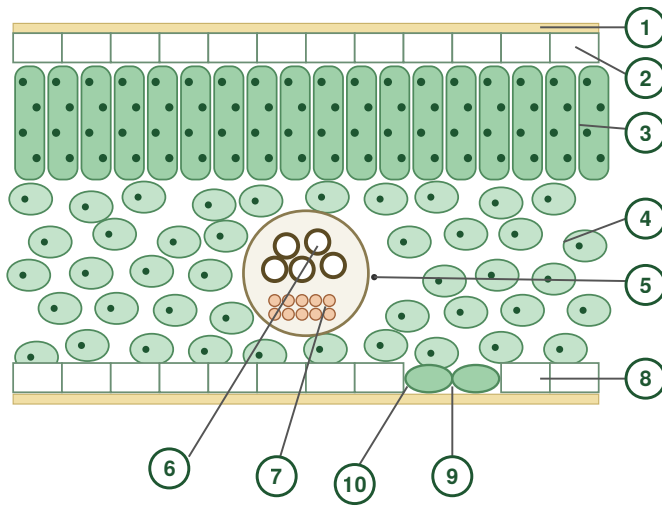
Leaf layers (top to bottom): cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, lower epidermis with stomata.

Transport: xylem carries water and minerals up; phloem carries sugars to where they are needed. **Transpiration** is the loss of water vapour through stomata.

A Label the leaf cross-section

5 marks

Word bank: Air space · Cuticle · Guard cell · Lower epidermis · Palisade mesophyll · Phloem · Spongy mesophyll · Stoma · Upper epidermis · Xylem



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

B Structure and function

3 marks

Write the letter of the matching function (½ mark each).

- | | |
|------------------------------|--|
| 11. _____ Palisade mesophyll | a. Carries sugars from the leaves to the rest of the plant |
| 12. _____ Spongy mesophyll | b. Openings that let CO_2 in and O_2 and water vapour out |
| 13. _____ Stomata | c. Tightly packed cells with many chloroplasts where most photosynthesis happens |
| 14. _____ Guard cells | d. Carries water and minerals up from the roots |
| 15. _____ Xylem | e. Swell or shrink to open and close each stoma |
| 16. _____ Phloem | f. Loosely packed cells with air spaces that let gases diffuse through the leaf |

C Photosynthesis and the leaf

3 marks

17. Write the word equation for photosynthesis.

18. Why is the palisade layer found near the top of the leaf?

19. Most stomata are on the lower surface of a leaf. Suggest why.

D Transpiration

6 marks

A student used a potometer to measure how much water a leafy shoot took up in 30 minutes.

20. Complete the rate column (mL per hour). (2 marks)

Condition	Water taken up in 30 min (mL)	Rate (mL/h)
Normal room conditions	1.2	
Fan blowing on the plant	2.1	
In the dark	0.4	
Clear plastic bag over the plant	0.5	

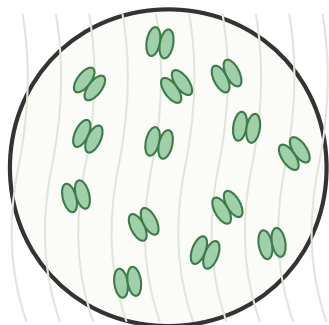
21. Explain how water moves from the roots to the leaves. Use the terms *transpiration*, *cohesion* and *xylem*. (2 marks)

22. Explain why the fan increased the rate of transpiration.

23. Explain why transpiration was so slow in the dark.

E Counting stomata

2 marks



Lower leaf surface, field of view
0.40 mm

24. Count the stomata in the field of view.

25. The field of view is 0.40 mm across. Calculate the stomatal density (stomata per mm²). Use area = πr^2 .

F Plant hormones

2 marks

Write the letter of the matching effect (½ mark each).

26. _____ Auxin

a. A gas that ripens fruit

27. _____ Gibberellin

b. Closes stomata during drought

28. _____ Ethylene

c. Makes shoots bend toward light (phototropism)

29. _____ Absciscic acid

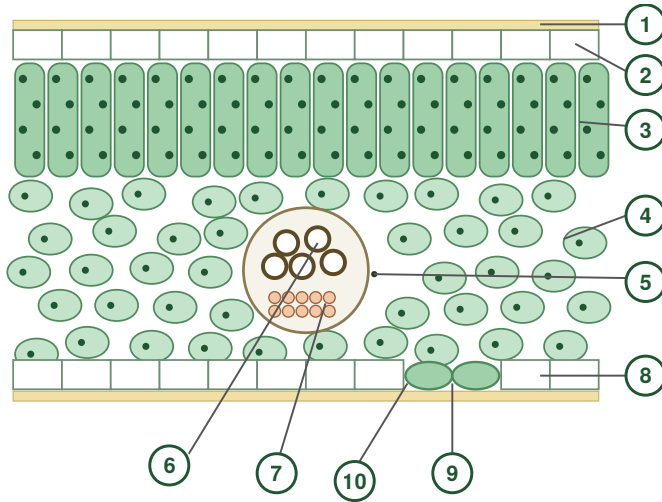
d. Causes stem elongation and seed germination

G Spot the mistake

2 marks

30. A student writes: "Plants get their food from the soil." Explain the error and correct it.

31. A student writes: "Xylem carries sugar down from the leaves." Explain the error and correct it.

Leaf Structure & Plant Function**ANSWER KEY****Key ideas****Photosynthesis:** $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (light energy, in chloroplasts).**Leaf layers (top to bottom):** cuticle, upper epidermis, palisade mesophyll, spongy mesophyll, lower epidermis with stomata.**Transport:** xylem carries water and minerals up; phloem carries sugars to where they are needed. **Transpiration** is the loss of water vapour through stomata.**A Label the leaf cross-section****5 marks****Word bank:** Air space · Cuticle · Guard cell · Lower epidermis · Palisade mesophyll · Phloem · Spongy mesophyll · Stoma · Upper epidermis · Xylem

1. Cuticle
2. Upper epidermis
3. Palisade mesophyll
4. Spongy mesophyll
5. Air space
6. Xylem
7. Phloem
8. Lower epidermis
9. Stoma
10. Guard cell

B Structure and function**3 marks**

Write the letter of the matching function (½ mark each).

- | | |
|---------------------------------|--|
| 11. <u>c</u> Palisade mesophyll | a. Carries sugars from the leaves to the rest of the plant |
| 12. <u>f</u> Spongy mesophyll | b. Openings that let CO ₂ in and O ₂ and water vapour out |
| 13. <u>b</u> Stomata | c. Tightly packed cells with many chloroplasts where most photosynthesis happens |
| 14. <u>e</u> Guard cells | d. Carries water and minerals up from the roots |
| 15. <u>d</u> Xylem | e. Swell or shrink to open and close each stoma |
| 16. <u>a</u> Phloem | f. Loosely packed cells with air spaces that let gases diffuse through the leaf |

C Photosynthesis and the leaf**3 marks****17.** Write the word equation for photosynthesis.**carbon dioxide + water → glucose + oxygen (using light energy, in chloroplasts)****18.** Why is the palisade layer found near the top of the leaf?**It gets the most light, so photosynthesis is fastest there.****19.** Most stomata are on the lower surface of a leaf. Suggest why.**The lower surface is cooler and shaded, so less water is lost by evaporation.**

D Transpiration

6 marks

A student used a potometer to measure how much water a leafy shoot took up in 30 minutes.

20. Complete the rate column (mL per hour). (2 marks)

Condition	Water taken up in 30 min (mL)	Rate (mL/h)
Normal room conditions	1.2	2.4
Fan blowing on the plant	2.1	4.2
In the dark	0.4	0.8
Clear plastic bag over the plant	0.5	1.0

21. Explain how water moves from the roots to the leaves. Use the terms *transpiration*, *cohesion* and *xylem*. (2 marks)

Water evaporates from leaves through stomata (transpiration), which pulls water up the xylem. Water molecules stick together (cohesion), so the whole column is pulled up from the roots.

22. Explain why the fan increased the rate of transpiration.

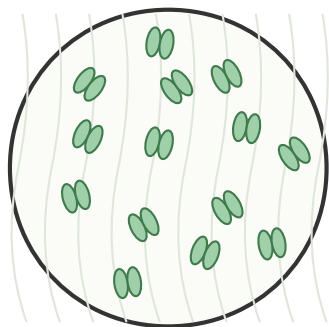
Moving air carries away water vapour near the stomata, keeping the outside air dry so water diffuses out faster.

23. Explain why transpiration was so slow in the dark.

Stomata close in the dark (no photosynthesis), so little water vapour can escape.

E Counting stomata

2 marks



Lower leaf surface, field of view
0.40 mm

24. Count the stomata in the field of view.

14 stomata

25. The field of view is 0.40 mm across. Calculate the stomatal density (stomata per mm²). Use area = πr^2 .

$r = 0.20 \text{ mm}$, area = $\pi \times 0.20^2 = 0.126 \text{ mm}^2$; density = $14 \div 0.126 = \text{about } 111 \text{ per mm}^2$

F Plant hormones

2 marks

Write the letter of the matching effect (½ mark each).

26. c Auxin

a. A gas that ripens fruit

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d. Causes stem elongation and seed germination

G Spot the mistake

2 marks

30. A student writes: "Plants get their food from the soil." Explain the error and correct it.

Plants make their own food (glucose) by photosynthesis. Soil only supplies water and minerals.

31. A student writes: "Xylem carries sugar down from the leaves." Explain the error and correct it.

Phloem carries sugar. Xylem carries water and minerals up from the roots.