

Section 1 — Multiple Choice Answers

Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	6	B	11	A	16	B
2	B	7	B	12	C	17	B
3	B	8	C	13	B	18	B
4	C	9	C	14	A	19	B
5	C	10	B	15	B	20	C

Section 2 — Short Response

Question 21 — Sample response (4 marks)

See comparison table below.

Feature	Xylem	Phloem
Cell type	Dead, lignified vessels	Living sieve tube elements and companion cells
Direction	Mainly upward (roots to leaves)	Both directions (source to sink)
Substance transported	Water and dissolved minerals	Organic substances, mainly sucrose
Mechanism	Transpiration pull / cohesion-tension	Pressure flow (mass flow); active loading at the source

Marking criteria:

- Correctly compares cell type/structure (dead, lignified vessels vs living sieve tube elements with companion cells). [1 mark]
- Correctly compares direction of transport (mainly upward, roots to leaves vs both directions, source to sink). [1 mark]
- Correctly compares substances transported (water and minerals vs organic substances, mainly sucrose). [1 mark]
- Correctly compares transport mechanism (transpiration pull/cohesion-tension vs pressure flow/mass flow with active loading). [1 mark]

Question 22 — Sample response (3 marks)

As light intensity increases from 0 to 100 units, transpiration rate increases steadily at first, then begins to plateau at higher light intensities (levelling off between 80 and 100 units).

This occurs because higher light intensity increases the rate of photosynthesis, causing stomata to open wider (or remain open longer) to allow more CO₂ to enter, which also allows more water vapour to escape by transpiration. At very high light intensities, the plateau occurs because stomata are already fully open and another factor (such as humidity or water availability) becomes limiting.

Marking criteria:

- Describes the trend: transpiration rate increases with light intensity, then plateaus at higher light intensities. [1 mark]
- Explains that increased light increases photosynthesis, causing stomata to open wider/for longer. [1 mark]
- Links stomatal opening to increased water vapour loss, and/or explains the plateau in terms of a new limiting factor. [1 mark]

Question 23 — Sample response (4 marks)

A competitive inhibitor has a similar shape to the substrate and binds directly to the enzyme's active site, physically blocking the substrate from binding. Because it competes directly with the substrate for the same site, increasing substrate concentration can outcompete the inhibitor, restoring the reaction rate toward normal.

A non-competitive inhibitor binds to a different site on the enzyme (not the active site), changing the overall shape of the enzyme and therefore the shape of the active site, so the substrate can no longer bind effectively. Because it does not compete for the same site as the substrate, increasing substrate concentration does not overcome its inhibitory effect.

Marking criteria:

- Describes a competitive inhibitor binding to the active site, blocking the substrate. [1 mark]
- Explains that increasing substrate concentration can outcompete/reduce the effect of a competitive inhibitor. [1 mark]
- Describes a non-competitive inhibitor binding elsewhere, changing the enzyme's/active site's shape. [1 mark]
- Explains that increasing substrate concentration does not overcome non-competitive inhibition. [1 mark]

Question 24 — Sample response (3 marks)

1. Physical barriers: the waxy cuticle covering leaf surfaces and the tough cell walls of plant cells prevent many pathogens from directly penetrating plant tissue.
2. Chemical defences: plants produce antimicrobial compounds, such as plant defensins (small proteins) and toxins, that can directly inhibit or kill invading pathogens.

Marking criteria:

- Identifies a correct physical defence mechanism (e.g. cuticle, cell wall). [1 mark]
- Identifies a correct chemical defence mechanism (e.g. plant defensins, toxins). [1 mark]
- Explains how at least one identified mechanism prevents pathogen entry or establishment. [1 mark]

Question 25 — Sample response (4 marks)

The data suggest the outbreak was most likely transmitted through contaminated water from Well A, rather than through food shared at the BBQ.

Persons 1, 3 and 4 all used Well A and became ill with a similar, earlier onset (days 2-3), regardless of whether they attended the BBQ. Person 3, who did not attend the BBQ at all, still became ill after using Well A, ruling out the BBQ as the sole source.

Person 2 attended the BBQ but used the town supply, and had a much later onset with milder symptoms (day 5), while Person 5 used the town supply, did not attend the BBQ, and did not become ill at all — further supporting Well A as the common source rather than the BBQ.

Marking criteria:

- Identifies Well A as the likely common source/mode of transmission. [1 mark]
- Uses data showing persons 1, 3 and 4 (all Well A users) had similar early onset regardless of BBQ attendance. [1 mark]
- Uses Person 3 (no BBQ, but used Well A, still became ill) to rule out the BBQ as the sole cause. [1 mark]
- Uses Persons 2 and/or 5 (town supply) to further support water, not food, as the source. [1 mark]

Question 26 — Sample response (2 marks)

A zone of inhibition is the clear area surrounding an antimicrobial disc where microbial growth has been prevented, because the antimicrobial agent has diffused into the surrounding agar.

A larger zone of inhibition generally indicates that the antimicrobial agent is more effective at inhibiting the growth of that microorganism, allowing different agents to be compared by measuring the diameter of their zones under the same experimental conditions.

Marking criteria:

- Describes a zone of inhibition as the clear area where microbial growth has been prevented. [1 mark]
- Explains that the size of the zone indicates relative effectiveness (larger zone = more effective), allowing comparison between agents. [1 mark]