IB Biology SL • Trimester Assessment Worksheet 04

Adhesion and Capillary Action

Topic coverage: A1.1.4

Name: _____	Class: _____
Date: _____	Time guide: 35 minutes
Total marks: 25	Level: SL

Focus for this worksheet

• Topic focus: adhesion between water and other polar substances, capillary rise in narrow spaces, water movement in xylem and soil.

• Use IB-style command terms and support explanations with biological reasoning.

• Answer directly in the spaces provided or on separate paper if more space is needed.

Section A: Multiple choice [4 marks]

1. Adhesion refers to the attraction between water molecules and [1]

A. only other water molecules
B. non-polar gases only
C. different polar or charged substances
D. only proteins in membranes

2. Capillary action is usually strongest in a tube that is [1]

A. widest
B. most horizontal
C. narrowest
D. filled with oil

3. In plants, water can adhere to the walls of xylem because the walls contain [1]

A. cellulose
B. DNA
C. starch
D. glycogen

4. Root hairs improve water uptake because they [1]

A. pump water using ATP into the xylem at all times
B. grow into tiny spaces between soil particles
C. make water non-polar
D. destroy capillary action in the soil

Section B: Short answer [7 marks]

5. Distinguish between cohesion and adhesion. [2]

6. Explain the role of adhesion in xylem vessels. [3]

7. Explain why apparently dry soil may still contain water that plants can absorb. [2]

Section C: Data response / case study [8 marks]

Stimulus 8. Data response: capillary rise in glass tubes

The height to which water rose in glass tubes of different inner diameters was measured.

Inner diameter / mm	Height of water rise / mm
0.5	48
1.0	24
2.0	12
4.0	6

8a. Describe the relationship between tube diameter and capillary rise. [2]

8b. Predict the capillary rise in a tube with an inner diameter of 3.0 mm. [1]

8c. Explain why water rises above the surrounding water level in the narrow tubes. [3]

8d. Explain how the same principle helps roots obtain water from soil micropores. [2]

Section D: Extended response [6 marks]

9. Explain how cohesion and adhesion work together to move water from soil to leaves in a plant. [6]

End of student response section.

Answer Key and Marking Guidance

Worksheet 04: Adhesion and Capillary Action

General marking notes

• Award [1] for each valid point unless otherwise indicated.

• Accept equivalent wording when the biological meaning is clear.

• For explanation questions, credit the biological link or cause–effect statement, not just a list of terms.

• Do not double-credit repeated ideas expressed in different words.

Section A: Multiple-choice answers

Question	Answer
1	C
2	C
3	A
4	B

Section B: Short-answer markscheme

5. Distinguish between cohesion and adhesion. [2]

• Cohesion is attraction between water molecules.
• Adhesion is attraction between water and different polar / charged surfaces.

6. Explain the role of adhesion in xylem vessels. [3]

• Water molecules adhere to the cellulose walls of xylem.
• This helps stabilise the water column.
• It reduces the tendency of the column to slip downward under gravity.

7. Explain why apparently dry soil may still contain water that plants can absorb. [2]

• Thin films of water remain attached to soil particles by adhesion.
• Root hairs can access these films in tiny soil spaces.

Section C: Data response / case-study markscheme

8a. Describe the relationship between tube diameter and capillary rise. [2]

• As diameter increases, the height of capillary rise decreases.
• There is an inverse / negative relationship.

8b. Predict the capillary rise in a tube with an inner diameter of 3.0 mm. [1]

• About 8 mm (accept 7–9 mm with clear reasoning).

8c. Explain why water rises above the surrounding water level in the narrow tubes. [3]

• Water adheres to the polar glass surface.
• Cohesion pulls additional water molecules upward.
• The combined effect produces capillary action / a raised water column.

8d. Explain how the same principle helps roots obtain water from soil micropores. [2]

• Water moves through very small spaces between soil particles.
• Root hairs can absorb this water from thin films / narrow channels.

Section D: Extended response

9. Explain how cohesion and adhesion work together to move water from soil to leaves in a plant. [6]

Indicative scientific content:

• adhesion attracts water to polar soil particles and xylem walls
• cohesion links water molecules into a continuous column
• capillary action helps water move through narrow spaces
• root hairs access water in small soil pores
• transpiration from leaves creates tension / lower pressure
• cohesion transmits the pull upward while adhesion helps stabilise the column against gravity

Marks	Descriptor
5–6	Accurate, relevant and well-organised response with several linked biological ideas and appropriate terminology.
3–4	Some accurate biology with partial development or limited linkage between ideas.
1–2	A small number of correct ideas, often brief, vague, or weakly linked to the question.
0	No relevant creditworthy content.