IB Biology SL • Trimester Assessment Worksheet 03

Cohesion and Surface Tension

Topic coverage: A1.1.3

Name: _____	Class: _____
Date: _____	Time guide: 35 minutes
Total marks: 27	Level: SL

Focus for this worksheet

• Topic focus: cohesion between water molecules, surface tension at the water surface, continuous water columns in xylem.

• 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. Cohesion in water is best described as the attraction between [1]

A. water molecules and cellulose
B. water molecules and mineral ions
C. molecules of the same substance
D. all molecules regardless of charge

2. Surface tension is strongest at the boundary between [1]

A. water and soil
B. water and air
C. xylem and phloem
D. root and leaf

3. A continuous water column in xylem is maintained mainly because water molecules [1]

A. repel one another strongly
B. are linked by hydrogen bonding
C. have no polarity
D. become gaseous in the stem

4. Pond skaters can move across water because [1]

A. their bodies are denser than water
B. surface tension can support small masses
C. water contains no dissolved substances
D. their legs dissolve into the water surface

Section B: Short answer [8 marks]

5. Define cohesion and relate it to the polarity of water. [3]

6. Explain why hydrogen bonds are more stable in ice than in liquid water. [2]

7. Explain how transpiration can pull a column of water upwards through xylem. [3]

Section C: Data response / case study [9 marks]

Stimulus 8. Investigation: surface tension on a coin

Students counted how many drops of liquid could sit on a coin before spilling over.

Liquid	Mean number of drops
Pure water	31
Water with a small amount of detergent	12

8a. Identify which liquid showed greater surface tension. [1]

8b. Calculate the difference in the mean number of drops between the two liquids. [1]

8c. Explain how detergent affects the surface tension of water. [3]

8d. Use the investigation to explain why pond skaters can stand on the surface of still water. [2]

8e. Suggest why a metal needle can sometimes float if placed very carefully on water. [2]

Section D: Extended response [6 marks]

9. Discuss the biological importance of cohesion for organisms living at the water surface and for water transport in plants. [6]

End of student response section.

Answer Key and Marking Guidance

Worksheet 03: Cohesion and Surface Tension

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	B
3	B
4	B

Section B: Short-answer markscheme

5. Define cohesion and relate it to the polarity of water. [3]

• Cohesion is attraction between water molecules.
• Water molecules are polar / have partial charges.
• Hydrogen bonds form between neighbouring molecules and create cohesion.

6. Explain why hydrogen bonds are more stable in ice than in liquid water. [2]

• Molecules move less / have lower kinetic energy in ice.
• Hydrogen bonds remain in a more organised / stable arrangement.

7. Explain how transpiration can pull a column of water upwards through xylem. [3]

• Water evaporates from leaves during transpiration.
• This creates tension / lower pressure in the leaf.
• Because water molecules are cohesive, the whole column is pulled upward together.

Section C: Data response / case-study markscheme

8a. Identify which liquid showed greater surface tension. [1]

• Pure water.

8b. Calculate the difference in the mean number of drops between the two liquids. [1]

• 19 drops.

8c. Explain how detergent affects the surface tension of water. [3]

• Detergent disrupts interactions between water molecules / reduces cohesive forces.
• This reduces the strength of the surface layer.
• So fewer drops can be supported before the surface breaks.

8d. Use the investigation to explain why pond skaters can stand on the surface of still water. [2]

• Cohesion creates a strong surface layer / surface tension.
• If their mass is spread out, the surface is not broken and they are supported.

8e. Suggest why a metal needle can sometimes float if placed very carefully on water. [2]

• The needle is supported by surface tension at the water surface.
• If the surface is not broken, the cohesive surface layer can hold it up temporarily.

Section D: Extended response

9. Discuss the biological importance of cohesion for organisms living at the water surface and for water transport in plants. [6]

Indicative scientific content:

• cohesion results from hydrogen bonding between polar water molecules
• surface tension is a consequence of cohesion at the water-air boundary
• surface tension can support small organisms such as pond skaters
• cohesion keeps water molecules connected in a continuous xylem column
• transpiration from leaves creates tension that pulls the cohesive column upward
• this transport supplies leaves with water and dissolved minerals needed for photosynthesis and growth

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.