

Water · supported focus

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

Water: a molecular cause for a biological property

■ What would explain this observation?

- A water droplet holds together on a leaf. Its behaviour comes from interactions between molecules, not a skin made of solid water.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- Water molecules are polar. Attraction between the partially positive hydrogen of one molecule and a partially negative oxygen of another gives hydrogen bonding. **Cohesion** is attraction between water molecules; **adhesion** is attraction to another surface.
- cohesion: Attraction between molecules of the same substance; adhesion: Attraction between different substances.



■ Choose evidence that can test it

- The same intermolecular interactions help explain surface tension and the energy needed to change temperature. Heating changes molecular motion and interactions; it does not normally break the covalent O–H bonds.
- Compare equal drops on clean surfaces under fixed temperature. Measure contact angle or spreading consistently. A detergent changes the system, so record concentration rather than treating all liquids as equivalent.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: 0.100 kg of water warms by 5.0 K; specific heat capacity is 4,180 J/(kg K). $Q = mc\Delta T = 0.100 \times 4,180 \times 5.0 = 2,090$ J. This calculation excludes energy absorbed by the container and lost to the surroundings.

Example:

Use $c = 4,180$ J/(kg K). Calculate Q for 0.200 kg water heated through 5.0 K. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- Hydrogen bonds between molecules differ from covalent bonds within a water molecule. Polarity alone does not make every substance dissolve well in water.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Boiling water normally breaks its O–H covalent bonds. This claim is false: Hydrogen bonds between molecules differ from covalent bonds within a water molecule. Polarity alone does not make every substance dissolve well in water.

Key:

Water: a molecular cause for a biological property: The same intermolecular interactions help explain surface tension and the energy needed to change temperature. Heating changes molecular motion and interactions; it does not normally break the covalent O–H bonds.