

Water potential

International Baccalaureate · IB Diploma · Biology · SL

Scope and prerequisites

This handout covers selected SL topics for the course first assessed in 2025; it is not the whole syllabus.

Prerequisites: read the stated quantities and units, and use arithmetic and the model conditions below.

The examples are original and fictional: they are not real measurements or real student investigations.

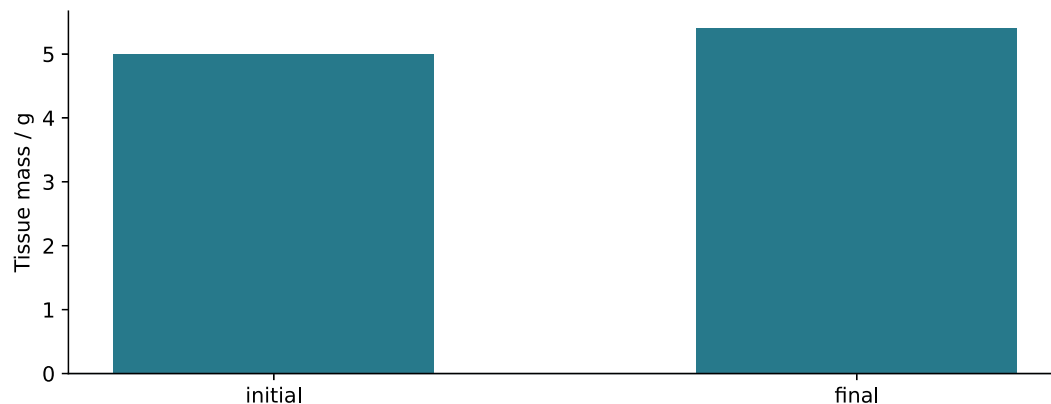
Water movement: compare potential and net change

■ What would explain this observation?

- Plant tissue can gain or lose mass in different solutions. The direction of net water movement depends on the **water-potential** difference, not on whether water molecules move at all.

■ Build the model

- Water moves through a water-permeable membrane from higher toward lower water potential.
- Dissolved solute lowers the tendency of water to leave a solution relative to the chosen reference.
- A plant cell wall allows pressure to develop as water enters; tissue behaviour cannot always be explained by solute concentration alone.
- water potential: A measure used to compare the tendency of water to move between systems.
- **turgor** : Pressure of plant-cell contents against the cell wall.



Mass rose from 5.00 g to 5.40 g, an 8% gain: net water entry

■ Choose evidence that can test it

- A zero mass change suggests no net transfer over the measured interval under the experimental conditions.
- It does not imply that every individual cell has the same potential or that molecular exchange stops.
- Compare percentage change when initial sample masses differ.

In the lab: Use repeated equal-sized plant samples in teacher-approved solutions. Keep tissue source, temperature, volume and time consistent; blot consistently before weighing. Record initial/final mass and plot percentage change against solution concentration, retaining variation and the uncertainty of any interpolated zero-change point.

■ Work from known quantities

- Known: a 5.00 g tissue sample becomes 5.40 g.
- Percentage mass change = $(5.40 - 5.00) / 5.00 \times 100 = +8\%$.
- This supports net water entry under the measured conditions.
- A separate sample with zero change is consistent with balanced net transfer, but this mass method does not independently measure cell pressure.

Your turn: A tissue sample changes from 4.00 g to 4.20 g. Calculate percentage mass change.

■ **Check the conclusion and its limits**

- This SL preparation focus uses qualitative water-potential reasoning and mass-change evidence.
- Quantitative solute/pressure equations are kept in the separate HL preparation case pending exact guide review.
- Blotting variation or tissue damage can change the observed result.

Not true: A zero net mass change proves that all movement of water molecules has stopped. Zero NET change is a balance of two continuing flows. Water molecules never stop moving; equal rates in both directions produce no net change.

Key:

- Water moves through a water-permeable membrane from higher toward lower water potential.
- A zero mass change suggests no net transfer over the measured interval under the experimental conditions.
- Watch for: this SL preparation focus uses qualitative water-potential reasoning and mass-change evidence.

■ **Write from a gain of 12 percent**

- A tissue sample changes from 3.00 g to 3.36 g.
- Find the percentage mass change. A zero net change does not mean water molecules have stopped moving.

■ **Write from the reverse change**

- The same sample then falls back from 3.36 g to 3.00 g.
- Find the percentage decrease: $0.36 \div 3.36 \approx 10.7$ percent – not 12 again, because each percentage divides by its own original.