

Exercise walk-through

28.1

Water movement: compare potential and net change

International Baccalaureate · IB Diploma · Biology · SL

28.1 Water movement: compare potential and net change

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS water potential • turgor

Objective

Water movement: compare potential and net change. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

■ What would explain this observation?

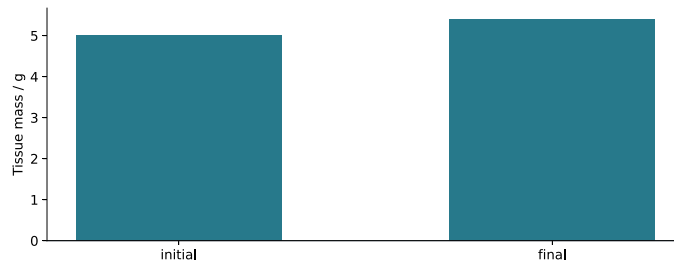
- Plant tissue can gain or lose mass in different solutions. The direction of net water movement depends on the **water-potential** difference, not on whether water molecules move at all.
- Start with a prediction. State the quantities or features you would compare, then

decide what evidence could distinguish two explanations.

■ 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.
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■ **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.
- 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**

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- 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.

Example:

A tissue sample changes from 4.00 g to 4.20 g. Calculate percentage mass change. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ **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.
 - Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.
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Warn:

A zero net mass change proves that all movement of water molecules has stopped. This claim is false: 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.

Key:

Water movement: compare potential and net change: 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.

Exercises 2.1·2.2

2.1 What does a zero percentage mass change support in this experiment? Choose one answer.

- **A** No net mass transfer over the measured interval
- **B** No water molecules cross a membrane
- **C** Every cell has identical contents

[1]

2.2 A tissue sample changes from 4.00 g to 4.20 g. Calculate percentage mass change. Show the relation, substitution and units.

[2]

Exercises 2.1·2.2

2.1 What does a zero percentage mass change support in this experiment? Choose one answer.

- **A** No net mass transfer over the measured interval
- **B** No water molecules cross a membrane
- **C** Every cell has identical contents

[1]

2.1 A 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.

2.2 A tissue sample changes from 4.00 g to 4.20 g. Calculate percentage mass change. Show the relation, substitution and units.

[2]

2.2 percentage change = $(4.20 - 4.00) / 4.00 \times 100 = +5\%$.

Exercises 2.3-2.4

2.3 Decide whether this claim is true and justify: A zero net mass change proves that all movement of water molecules has stopped. [2]

2.4 A measure used to compare the tendency of water to move between systems: write the technical term. [1]

3 Exam-style questions

Exercises 2.3-2.4

2.3 Decide whether this claim is true and justify: A zero net mass change proves that all movement of water molecules has stopped. [2]

2.3 False. 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.

2.4 A measure used to compare the tendency of water to move between systems: write the technical term. [1]

3 Exam-style questions

2.4 water potential. water potential means A measure used to compare the tendency of water to move between systems.

Exercise 3.1

3.1 Fictional tissue gains 6% in solution A and loses 3% in B. What does each result support, and why is neither an independent measurement of cell pressure? [4]

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3.1 Fictional tissue gains 6% in solution A and loses 3% in B. What does each result support, and why is neither an independent measurement of cell pressure? [4]

3.1 A supports net water entry and B net loss under comparable conditions. Mass change combines tissue responses; it does not separately determine pressure. Use repeats and a zero-change series without importing HL pressure calculations.