

12.1 Osmosis and a fair potato experiment

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS osmosis • control variable

Objective

Osmosis and a fair potato experiment. Original classroom practice for IB HL; not an official IB paper.

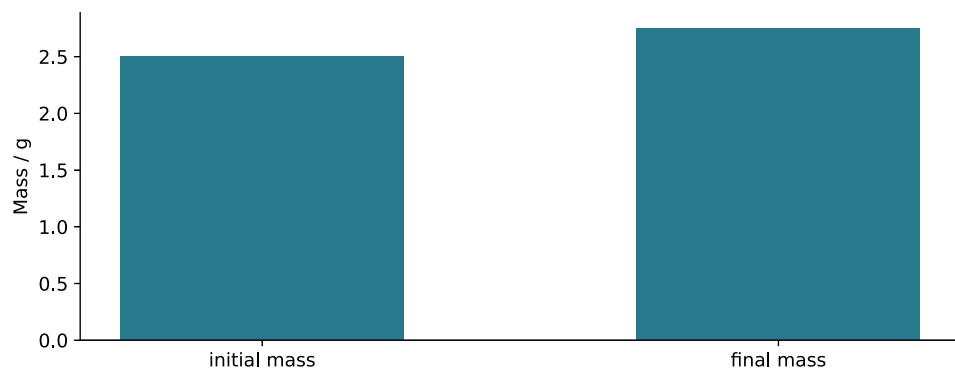
1 Key knowledge and worked examples

■ What would explain this observation?

- A potato cylinder gains mass in one solution and loses mass in another. Its mass change provides evidence about movement of water, rather than movement of potato tissue.

■ Build the model

- Osmosis** is the net movement of water through a partially permeable membrane from a more dilute solution to a more concentrated solution.
- Dissolved solutes can change the direction of net water movement.
- osmosis: Net water movement through a partially permeable membrane.
- control variable** : A factor kept constant for a fair comparison.



■ Choose evidence that can test it

- Use percentage change to compare samples with different initial masses.
- A zero percentage change estimates a solution concentration with no net water movement.
- This is an estimate from a trend, not proof that water molecules stop moving.

In the lab: Use equal-length cylinders from similar tissue, fixed solution volume, temperature and immersion time. Blot each cylinder in the same way before weighing. Repeat each concentration and plot mean percentage change against concentration.

■ Work from known quantities

- Known: initial mass 2.50 g; final mass 2.75 g.
- Use percentage change = $(\text{final} - \text{initial}) / \text{initial} \times 100$.
- Percentage change = $(2.75 - 2.50) / 2.50 \times 100 = +10\%$.
- A positive value means net water entry.
- Interpolate the concentration where the plotted trend crosses zero.

Your turn: A 4.00 g cylinder ends at 3.60 g. Find percentage mass change.

■ Check the conclusion and its limits

- Blotting removes surface solution.
- Weighing a wet cylinder without blotting adds liquid that did not enter the cells.
- Repeats reduce random variation but do not correct a miscalibrated balance.

Not true: At zero net water movement no water molecules cross the membrane. Zero NET movement means water molecules cross the membrane in both directions at equal rates. Molecules never stop moving; only the net transfer is zero.

Key:

- Osmosis is the net movement of water through a partially permeable membrane from a more dilute solution to a more concentrated solution.
- Use percentage change to compare samples with different initial masses.
- Watch for: blotting removes surface solution.

■ Write from a gain of 25 percent

- A potato cylinder starts at 6.40 g and ends at 8.00 g.
- Find the percentage change. Say what a result of 0 percent would estimate.

2 Practice

2.1 Why blot all samples before the final weighing? Choose one answer.

- **A** To make every final mass equal
- **B** To stop all molecular movement
- **C** To remove surface solution consistently

[1]

2.2 A 4.00 g cylinder ends at 3.60 g. Find percentage mass change. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: At zero net water movement no water molecules cross the membrane.

[2]

2.4 Net water movement through a partially permeable membrane: write the technical term.

[1]

3 Exam-style questions

3.1 Fictional tissue changes are +4% at 0.20 mol/L and −2% at 0.50 mol/L. Estimate the zero-change concentration by local linear interpolation and state its limitation.

[4]

Solutions

2.1 C Blotting removes solution clinging to the surface, which is not water that entered the tissue. Doing it the same way for every cylinder keeps the comparison fair; blotting cannot stop molecular movement and is not meant to equalise masses.

2.2 percentage change = $(3.60 - 4.00) / 4.00 \times 100 = -10\%$.

2.3 False. Zero NET movement means water molecules cross the membrane in both directions at equal rates. Molecules never stop moving; only the net transfer is zero.

2.4 osmosis. osmosis means Net water movement through a partially permeable membrane.

3.1 Zero is $4/6$ of the interval: $0.20 + (4/6) \times 0.30 = 0.40$ mol/L. This assumes local linearity and comparable conditions; repeat around the crossing. Zero net mass change does not mean molecules stop moving.