Exercise walk-through

9.1 Osmosis and a fair potato experiment

International Baccalaureate · IB Diploma · Biology · SL

INTERNATIONAL BACCALAUREATE · IB DIPLOMA · BIOLOGY · SL • EXERCISE SHEET

9.1 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 SL; not an official IB paper.

1 Key knowledge and worked examples

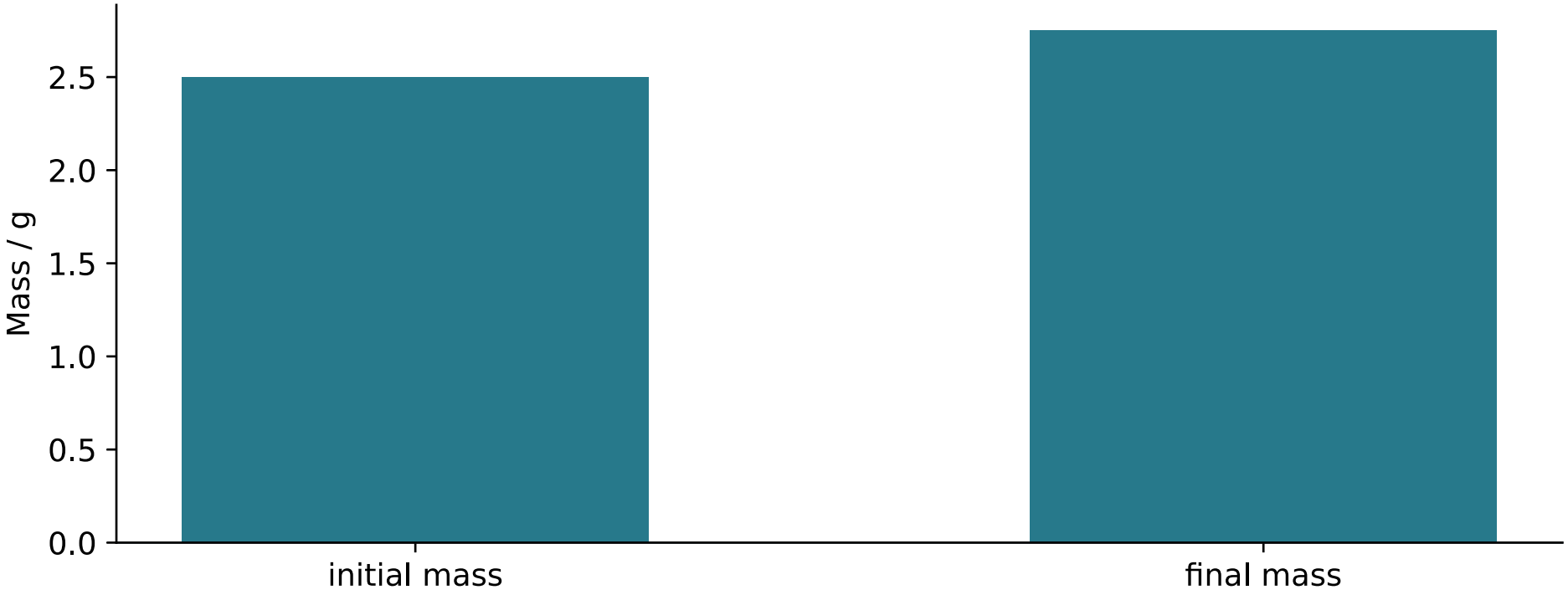
What would explain this observation?

- 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 = (final - initial) / initial × 100.
- Percentage change = (2.75 - 2.50) / 2.50 × 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 loss of 5 percent

- A 5.00 g cylinder ends at 4.75 g.

- Find the percentage mass change. Zero net water movement is not zero movement.

Exercises 2.1·2.3

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]

Exercises 2.1·2.3

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]

2.1 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 A 4.00 g cylinder ends at 3.60 g. Find percentage mass change. Show the relation, substitution and units. [2]

2.2 percentage change$=(3.60-4.00)/4.00\times100=-10\%$.

2.3 Decide whether this claim is true and justify: At zero net water movement no water molecules cross the membrane. [2]

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.

Exercises 2.4·3.1

2.4 Net water movement through a partially permeable membrane: write the technical term. [1]

3.1 Fictional tissue changes are$+4\%$ at0.20 mol/L and-2% at0.50 mol/L. Estimate the zero-change concentration by local linear interpolation and state its limitation. [4]

Exercises 2.4·3.1

2.4 Net water movement through a partially permeable membrane: write the technical term. [1]

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

3.1 Fictional tissue changes are$+4\%$ at0.20 mol/L and-2% at0.50 mol/L. Estimate the zero-change concentration by local linear interpolation and state its limitation. [4]

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.