

Exercise walk-through

12.1

Osmosis and a fair potato experiment

International Baccalaureate · IB Diploma · Biology · HL

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. Supported HL 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?

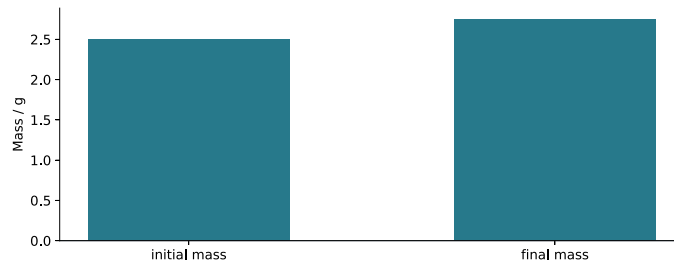
- A potato cylinder gains mass in one solution and loses mass in another. Its mass change provides evidence about movement of water, rather than movement of potato tissue.
- Start with a prediction. State the quantities or features you would compare, then

decide what evidence could distinguish two explanations.

■ 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.
- 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

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: initial mass 2.50 g; final mass 2.75 g. Use percentage change = (final - initial) / 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.

Example:

A 4.00 g cylinder ends at 3.60 g. Find 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

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

Warn:

At zero net water movement no water molecules cross the membrane. This claim is false: 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.

Key:

Osmosis and a fair potato experiment: 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.

Exercises 2.1·2.3

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

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

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

[1]

2.1 A 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.

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

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. 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.

Exercises 2.4·3.1

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]

Exercises 2.4·3.1

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

3 Exam-style questions

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

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]

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