Osmosis in potato tissue

Student activity • practical and reasoning

YEAR 10 / LESSON 18 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

How does sucrose concentration affect the percentage change in potato mass?

Measure three independent potato cylinders at one assigned concentration and pool the class results across a concentration series.

Equipment

- Three labelled tubes, 15 cm³ measure, forceps, timer and paper towel
- Three staff-cut potato cylinders, approximately 6 mm diameter and 20 mm long
- Assigned sucrose solution and a balance readable to 0.01 g or better

Staff use the cork borer and cutting blade on a stable board; learners receive pre-cut tissue. Handle glass carefully, wipe spills promptly and do not eat any material. Wash hands after handling potato.

Course coverage: Shared Biology / Double Award: 2.17. Core practical: osmosis in living tissue.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Label three separate tubes with your assigned sucrose concentration: 0.0, 0.2, 0.4, 0.6 or 0.8 mol dm^{-3}. Add 15 cm^3 of the same solution to each tube.

2. Use three staff-cut potato cylinders of matching diameter and length. Blot each in the same gentle way and measure its initial mass; record balance resolution and identify each cylinder.

3. Put one cylinder in each tube, fully submerged, and leave all for 30 minutes at the same temperature. Record start and finish times; keep the tubes covered as directed.

4. Remove each cylinder with forceps. Blot consistently without squeezing, then record final mass using the same balance. Do not taste potato or solution.

5. For each cylinder calculate (final mass − initial mass)/initial mass ×100. Keep positive and negative signs. Pool repeats for each concentration and show their spread.

6. Plot mean percentage mass change against concentration. Estimate the zero-change concentration only if the observations bracket zero; explain osmosis and limitations rather than forcing an intercept.

Cleanup

- Place potato in solid waste, not the sink. Return solutions as directed.
- Rinse tubes, wipe balances and benches, and wash hands.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Use your actual masses. Example only: a cylinder changes from 0.80 g to 0.88 g, giving +10%. Mass gain suggests net water entry; loss suggests net water exit through partially permeable cell membranes. A zero-change estimate refers to these conditions and this tissue; it is not an exact measurement of total cell-sap solute concentration.

Cylinder	Initial / g	Final / g	Change / %
1			
2			
3			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Identify the independent and dependent variables.

2. Calculate percentage change from 0.75 g to 0.69 g.

3. Why use percentage rather than absolute mass change?

4. Why must blotting be consistent?

5. Explain mass gain in a dilute external solution.

6. What if all measured changes have the same sign?