Aim: To investigate the effect of different concentrations of sucrose solution on the mass of potato tissue.

Background Theory

- Osmosis: net movement of water from high water potential to low water potential through a partially permeable membrane.
- Dilute solutions have higher water potential. Concentrated solutions have lower water potential.
- If external solution is more dilute than potato cells: water enters → mass increases → turgid cells.
- If external solution is more concentrated: water leaves → mass decreases → plasmolysis.
- At the isotonic point (same water potential inside and outside), there is no net water movement.

★ Water potential of pure water = 0 kPa. Adding solutes lowers water potential (makes it more negative).

Equipment

- Potato
- Cork borer (to cut equal-diameter cylinders)
- Scalpel and ruler
- Balance (accurate to 0.01 g)
- Sucrose solutions: 0.0, 0.2, 0.4, 0.6, 0.8 mol/dm^3
- Petri dishes or boiling tubes
- Paper towels
- Stopwatch

Method

1. Use a cork borer to cut 5 cylinders of potato, all from the same potato if possible.
2. Trim each cylinder to exactly 3 cm using a scalpel and ruler.
3. Pat each cylinder dry with paper towel. Weigh each one and record the initial mass.
4. Place each cylinder into a separate petri dish containing 20 cm^3 of a different sucrose concentration.
5. Cover the petri dishes and leave for 30 minutes.
6. Remove the potato cylinders, pat dry carefully with paper towel, and reweigh each one. Record final mass.
7. Calculate percentage change in mass for each cylinder.
8. Repeat the whole experiment twice more and calculate mean % change.

Variables

Independent variable	Concentration of sucrose solution (0.0, 0.2, 0.4, 0.6, 0.8 mol/dm^3)
Dependent variable	Percentage change in mass of potato cylinder
Controlled variables	Length of potato cylinder (3 cm), time in solution (30 min), volume of solution (20 cm^3), temperature, same potato variety

Results Table

Sucrose (mol/dm³)	Initial mass (g)	Final mass (g)	Change in mass (g)	% change in mass

Calculation

% change in mass = (final mass – initial mass) ÷ initial mass × 100

Positive value = gained mass (water entered by osmosis). Negative value = lost mass (water left by osmosis).

Analysis

- Plot % change in mass (y-axis) vs sucrose concentration (x-axis). Draw a line of best fit.
- The point where the line crosses 0% change = the isotonic point (same water potential as potato).
- Above this concentration: potato loses mass. Below: gains mass.

★ Read off the isotonic sucrose concentration from the graph — this equals the water potential of the potato cells.

★ Explain in terms of water potential why the potato loses or gains mass at each concentration.

Exam Tip: Always calculate PERCENTAGE change in mass, not just change in mass. This accounts for any differences in initial mass between cylinders.

Common Mistake: Do not say "water moves from concentrated to dilute". Osmosis is from HIGH water potential to LOW water potential. Concentrated = lower water potential.