
A-level Biology example for required practical 3

Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue:

Determining the water potential of potato tuber cells

Student sheet

You are provided with the following:

- large potato tuber
- potato chip cutter
- 1 mol dm⁻³ sucrose solution
- distilled water
- boiling tube rack
- six boiling tubes,
- marker pen
- thermometer
- 10cm³ graduated pipette and pipette filler
- White tile
- scalpel or small kitchen knife
- ruler
- paper towels
- timer
- digital balance
- forceps.

You should read these instructions carefully before you start work.

Preparing the dilution series

1. Label six boiling tubes 0.0, 0.2, 0.4, 0.6, 0.8 and 1.0 mol dm⁻³ sucrose.
2. Use the 1.0 mol dm⁻³ sucrose solution and water to make up 20cm³ of sucrose solution of each of the following concentrations:
 - 0.2 mol dm⁻³
 - 0.4 mol dm⁻³
 - 0.6 mol dm⁻³
 - 0.8 mol dm⁻³
 - 1.0 mol dm⁻³

Complete **Table 1** to show the volumes of 1.0 mol dm⁻³ sucrose solution and water that you used to make up each concentration.

3. Stand the boiling tubes containing the sucrose solutions in a water bath set at 30°C. Use a thermometer to check the temperatures in all tubes reaches 30°C.
4. Using the potato chip cutter, cut six chips from your potato tuber. Make sure you remove any peel on the potatoes. Use a ruler, scalpel and tile to cut all of the chips to the same length. Blot the potato chips dry with a paper towel, ie roll each chip until it no longer wets the paper towel and dab each end until dry. **Do not squeeze the chips.** Put each potato chip onto a clean square of paper towel which you have numbered in the same way as the boiling tubes.
5. Weigh each potato chip. Record these initial masses in a suitable table.
6. At the water bath, set the stop clock to zero. Quickly transfer each potato chip from its square of paper towel to its own boiling tube with the same number.

7. After 20 minutes, remove the chips from the boiling tubes. Blot the chips dry, as before. Then reweigh them. Record these final masses in your table.
8. Calculate the change in mass and then calculate the percentage change in mass.
9. Plot a graph of your processed data and use this to determine the concentration of sucrose which has the same water potential as the potato tuber cells.

Table 1

Concentration of sucrose solution/mol dm ⁻³	0	0.2	0.4	0.6	0.8	1.0
Volume of 1.0 mol dm ⁻³ sucrose solution/cm ³	0					20
Volume of water/cm ³	20					0

Further work to include serial dilution.

Although the determination of water potential tends to be associated with dilution series work, serial dilution opportunities do exist.

The serial dilution with stock solution 1.5M sucrose gives a four stage serial dilution and control opportunity, concentrations generated being with equivalent [sucrose] of potato, swede, parsnip and carrot.

