AQA Biology A-Level

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.

Calibration curves are **graphs** used to **determine an unknown concentration** of a sample by comparing the unknown to a set of standard samples with known concentrations - they are also known as **standard curves.** A **dilution series** can be used to create a set of samples with known concentrations.

A calibration curve can be used to determine an unknown water potential in a potato sample. **Water potential** is the tendency of water to **diffuse** from one area to another. Water molecules move from areas of **high water potential** to areas of **low water potential** by **osmosis**. The water potential is determined by the **concentration of solutes**. The movement of water in and out of cells is related to the **relative concentration** of solutes either side of the cell membrane.

Equipment list

- Potato tuber
- Cork borer
- Scalpel
- Ruler
- Distilled water
- Sucrose solution (1M)
- Boiling tubes
- Boiling tube rack
- Timer
- Digital balance
- Paper towels

Method

1. Make a **series of dilutions** of 1M sucrose solution. These should be at **0.0, 0.2, 0.4, 0.6, 0.8 and 1.0M sucrose**. Dilute using **distilled water.**
2. Measure 5cm^3 of each dilution into separate test tubes.
3. Use a cork borer to cut out six potato chips and cut down the sections into **identically sized chips**. Dry each chip using a paper towel to remove excess water but do not squeeze.
4. **Weigh each** before the start of the experiment.
5. Place a potato chip in each test tube (one per sucrose concentration) and leave for **20 minutes.**

6. Remove each potato chip, dry gently using paper towel, and weigh them in turn.
7. Calculate the **percentage change in mass** for each sucrose solution.

Risk Assessment

Hazard	Risk	Safety Precaution	In emergency	Risk Level
Scalpel	Cuts from sharp object	Cut away from fingers;use forceps to hold sample whilst cutting, keep away from the edge of the desk	Elevate cuts; apply pressure; seek medical assistance	Low
Broken glass	Cuts from sharp object	Take care when handling glass objects; keep glassware away from edge of desk	Elevate cuts; apply pressure; do not remove glass from wound; seek medical assistance	Low

Graph

- Plot a graph of **change in mass** against **concentration of sucrose solution**.
- The point at which the line of best fit **crosses the x axis** (zero change in mass) indicates the point at which the solution is **isotonic**. This is when the water potential of sucrose solution is the same as the water potential of the potato tissue, so there is **no net movement of water in or out** of the potato.

Conclusion

- Potato chips in **lower concentrations** of glucose solution will **increase in mass**, whilst those in the **higher concentrations** of glucose solution will **decrease in mass**.

- In the **dilute glucose solutions**, the solution has a higher water potential than the potato, so water **passively** moves via **osmosis** to the area of lower water potential (the potato). This causes the potato to **increase** in mass.
- In **concentrated glucose solutions**, water will move **out** of the potato, thus the potato will **decrease** in mass.