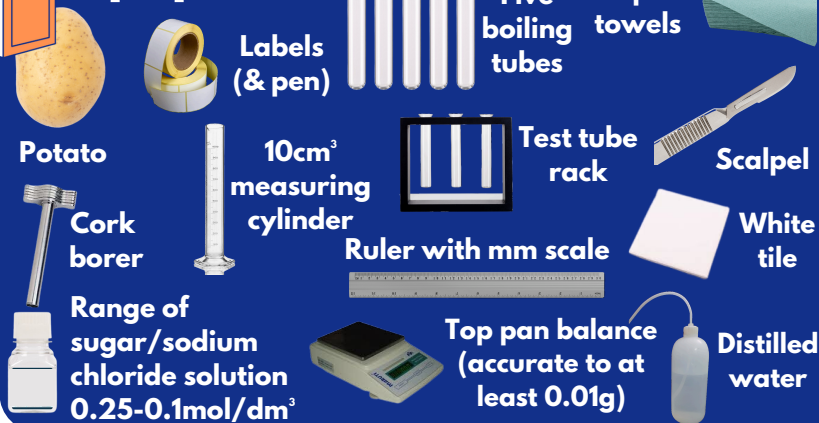


Equipment



Math Skills - % Gain/Loss of Mass

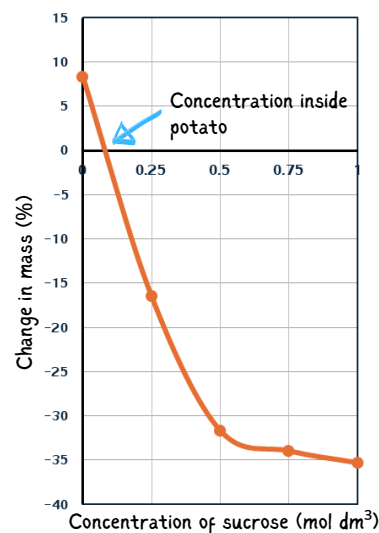
Worked example:

Initial mass of potato cylinder in 1 M solution = 13.54g.

Final mass of potato cylinder in 1 M solution = 10.30g.

$$\begin{aligned} \% \text{ change in mass} &= \frac{\text{Final mass} - \text{Initial mass}}{\text{Initial mass}} \times 100 \\ &= \frac{10.30 - 13.54}{13.54} \times 100 \\ &= -23.92\% \text{ (23.92\% lost)} \end{aligned}$$

Graphical Representation of Results



Point at which the line of best fit crosses the x axis represents the concentration inside the potato (no change in mass)

Method:

1) Use the cork borer to cut five potato cylinders of equal diameter. Trim any remaining potato skin.

2) Trim all cylinders to same length (around 3cm). Accurately measure length and mass of each cylinder. Record in your table.

3) Measure 10cm³ of each concentration of sugar or salt solution and put into boiling tubes.

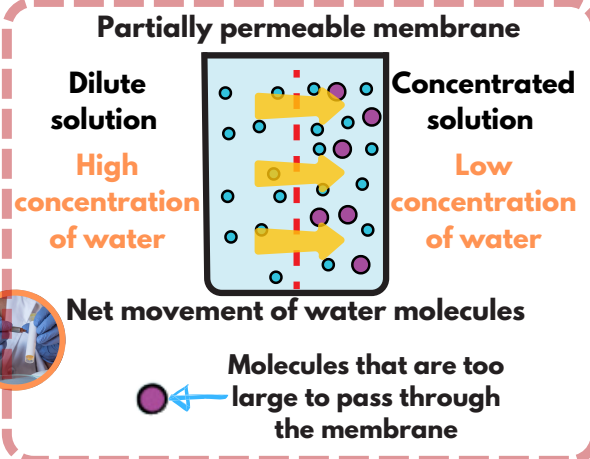
4) Measure 10cm³ of the distilled water and put into the fifth boiling tube.

5) Add one potato cylinder to each boiling tube.

6) Leave potato cylinders in the boiling tubes for a pre-determined time.

7) Remove potato cylinders and blot them dry with paper towels.

8) Measure the new mass and length of each potato cylinder again. Record in your table.



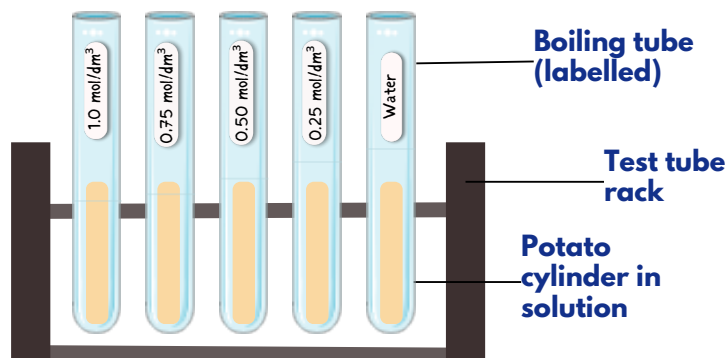
REQUIRED PRACTICAL 3 OSMOSIS



At least 30 minutes



Blotting reduces surface water, increasing accuracy and repeatability



Results Table	1.0mol/dm ³ sugar solution	0.75mol/dm ³ sugar solution	0.5mol/dm ³ sugar solution	0.25mol/dm ³ sugar solution	Distilled water
Initial length (cm)	3.10	3.20	3.15	3.00	3.30
Final length (cm)	2.43	2.61	2.64	3.12	3.80
Change in length (cm)	-0.67	-0.59	-0.51	+0.12	+0.50
% change in length (%)	-21.61	-18.44	-16.19	+4.00	+15.15
Initial mass (g)	6.12	5.98	5.97	6.11	5.95
Final mass (g)	3.96	3.95	4.08	5.10	6.44
Change in mass (g)	-2.16	-2.03	-1.89	-1.01	+0.49
% change in mass (%)	-35.29	-33.95	-31.66	-16.53	+8.24

Increasing reliability of results - collect sets of results from at least two other groups allows you to get a mean of results.

Analysis of Results

1. Calculate change in mass (initial - final length)
2. Calculate % change in mass (see Math skills)
3. Write a concluding statement about what happened. Relate this to the theory of osmosis:

"The results show that when the solution concentration is low, water enters the potato cells. This is due to osmosis as the solute concentration of the potato cells is greater than the surrounding solution. In contrast, when the solute concentration of solution is higher than the potato cells, osmosis results in water moving from the potato to the surrounding solution."

Exam Style Questions - Osmosis

1. A student investigated the effect of different salt concentrations on chicken eggs.

They followed the following protocol:

- Dissolved the shells from the chicken eggs in acid overnight.
- Blotted the eggs dry for 1 minute and weighed each egg.
- Placed each group in salt solution of different concentrations (ranging from 1-5 arbitrary units)
- Left them in the solutions for 24 hours
- Removed the eggs blotted them dry for 1 minute before re-weighing each egg.
- Calculated change in mass and percentage change in eggs.

a) Suggest why they blotted the eggs for 1 minute before weighing and how this may have caused errors in the results? (2 marks)

b) Suggest one improvement the student could make to their investigation. (1 mark)

The table below shows the students' results.

	Concentration of salt in arbitrary units				
	1.00	2.00	3.00	4.00	5.00
Initial mass of egg (g)	80.20	81.10	80.14	81.22	80.12
Final mass of egg (g)	87.74	84.33	78.32	74.33	69.23
Change in mass (g)	+7.54	+3.23	-1.82	-6.89	-10.89
% change in mass (%)	+9.40%	+3.9%	-2.27%	?	-13.59

c) The student calculated the percentage change in mass at each salt concentration.

Why is the percentage change in mass more useful than change in mass in grams? Refer to information from the table in your answer. (2 marks)

d) Calculate the percentage change in mass of the egg in the salt concentration of 4.00 arbitrary units. (2 marks)

e) The mass of the eggs decrease in salt concentrations with a concentration of 3.00+ arbitrary units. Explain what caused this. (3 marks)

Exam Style Questions - Osmosis (Answers)

1. A student investigated the effect of different salt concentrations on chicken eggs.

They followed the following protocol:

- Dissolved the shells from the chicken eggs in acid overnight.
- Blotted the eggs dry for 1 minute and weighed each egg.
- Placed each group in salt solution of different concentrations (ranging from 1-5 arbitrary units)
- Left them in the solutions for 24 hours
- Removed the eggs blotted them dry for 1 minute before re-weighing each egg.
- Calculated change in mass and percentage change in eggs.

a) Suggest why they blotted the eggs for 1 minute before weighing and how this may have caused errors in the results? (2 marks)

One mark for each of the following, up to a maximum of two marks:

- Removes the solution/liquid/water (from the outside of the egg)
- It could remove/leave variable amounts from each egg

b) Suggest one improvement the student could make to their investigation. (1 mark)

One mark for any of the following:

- Use more accurate balance
- Use smaller concentration intervals
- Use a control/distilled water group
- Equal sizes of egg
- Use more than one egg (for each solution)/repeats

The table below shows the students' results.

	Concentration of salt in arbitrary units				
	1.00	2.00	3.00	4.00	5.00
Initial mass of egg (g)	80.20	81.10	80.14	81.22	80.12
Final mass of egg (g)	87.74	84.33	78.32	74.33	69.23
Change in mass (g)	+7.54	+3.23	-1.82	-6.89	-10.89
% change in mass (%)	+9.40%	+3.9%	-2.27%	?	-13.59

c) The student calculated the percentage change in mass at each salt concentration.

Why is the percentage change in mass more useful than change in mass in grams? Refer to information from the table in your answer. (2 marks)

Mark One - Different (starting) masses/sizes/weights (at different concentration)

Mark Two - Allows comparisons/show patterns/shows trends

d) Calculate the percentage change in mass of the egg in the salt concentration of 4.00 arbitrary units. Give your answer to 2 decimal points. (2 marks)

Two marks for correct answer = (-)8.48%

One mark if answer is wrong but calculation is correct:

- $(6.89 / 81.22) * 100$

e) The mass of the eggs decrease in salt concentrations with a concentration of 3.00+ arbitrary units. Explain what caused this. (3 marks)

Mark One - Water loss

Mark Two - By osmosis/diffusion

Mark Three - From dilute region in the egg to a more concentrated solution outside

- Allow correct description in terms of high to low water concentration/water potential
- Allow salt solution is hypertonic