GCSE

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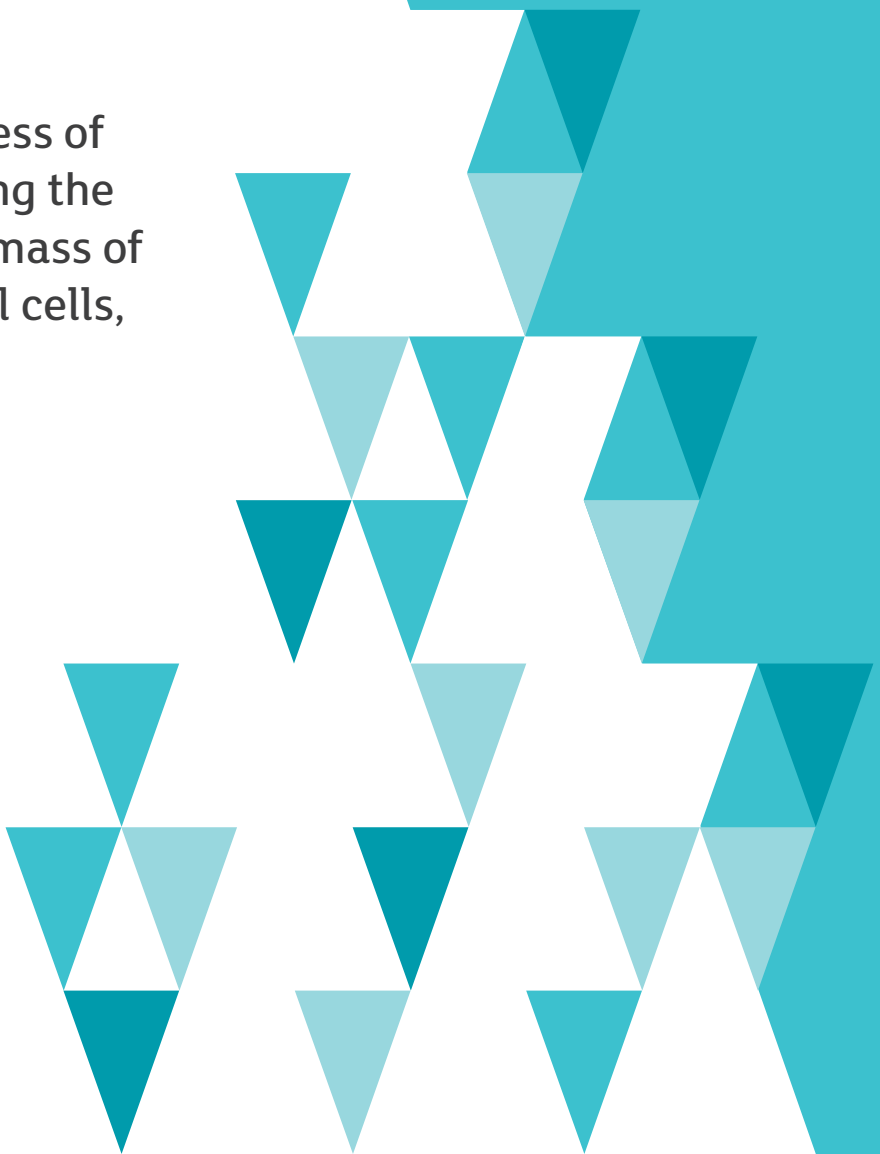
Double Award Science Practical Manual

Unit 7: Practical Skills

B5: Investigate the process of osmosis by measuring the change in length or mass of plant tissue or model cells, using Visking tubing



For first teaching from September 2017

Investigate the process of osmosis by measuring the change in length or mass of plant tissue or model cells, using Visking tubing

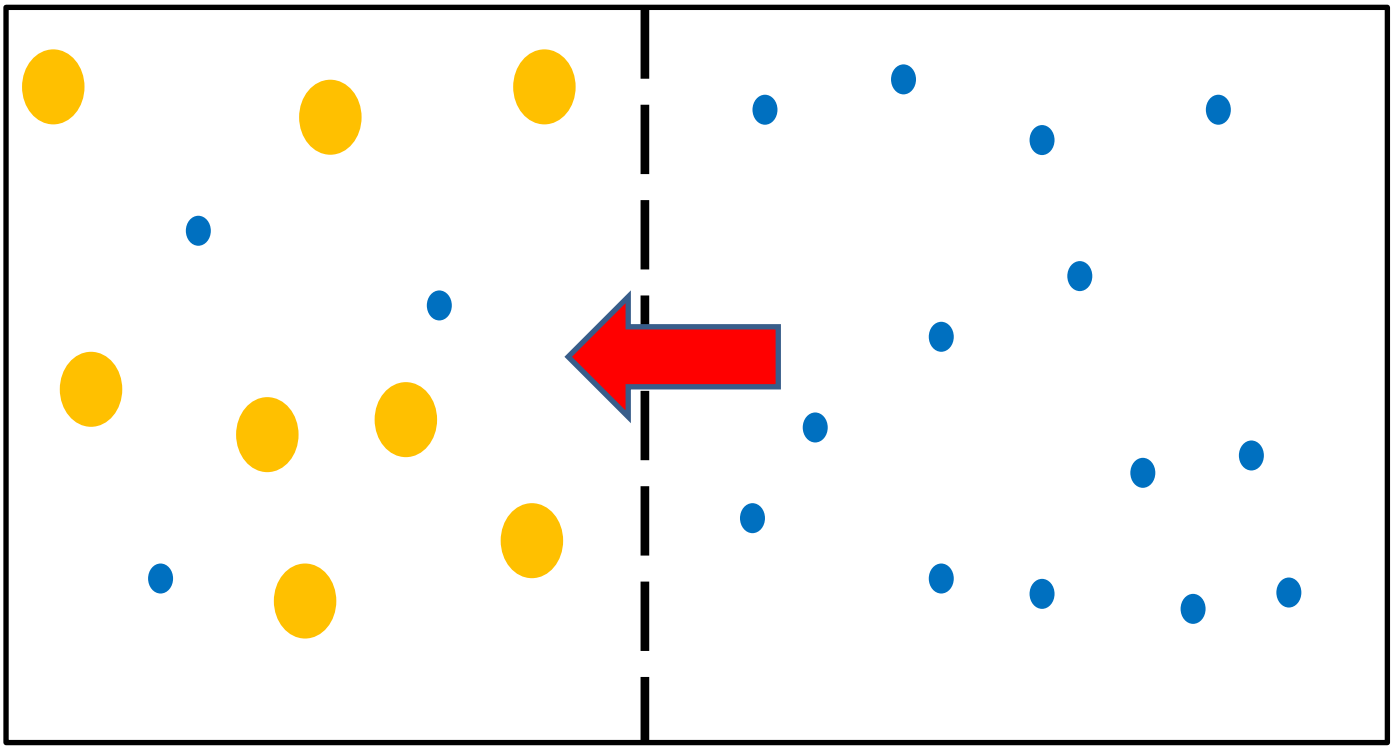
Osmosis is the movement of water molecules from a region of high concentration to a region of low concentration across a semi or partially permeable membrane. It will continue until the concentrations on both sides of the membrane are equal. A membrane has small holes in it and only lets small water molecules move through it.

A semi-permeable membrane doesn't let large solute molecules through. In a cell the semi permeable membrane is the cell membrane.

Osmosis is concerned with the movement of water molecules ONLY.

The water molecules will move down the concentration gradient, from where there is a high concentration of water (a dilute solution) to where there is a lower concentration of water (a less dilute solution).

The diagram below shows that there is a higher concentration of water molecules (small blue circles) on the right hand side than on the left hand side. Therefore the water will move from right to left until the amount of water molecules is the same on both sides.



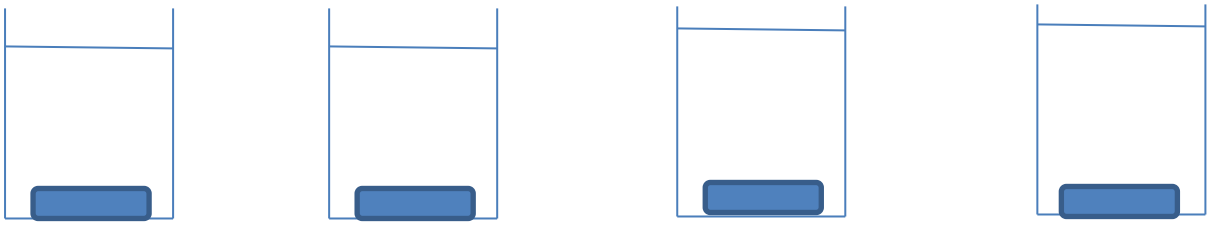
To investigate osmosis in plant tissue

Apparatus

- Potato
- Borer
- 3 Different concentrations of Sucrose solution
- 4 x 100 ml beakers
- Measuring cylinder
- Ruler

Method

1. Make up 3 concentrations of sucrose solution; for example 5%, 10%, 15% sugar solutions.
2. Pour 50 cm^3 of pure water into beaker 1.
3. Pour 50 cm^3 of 5% sucrose solution into beaker 2.
4. Pour 50 cm^3 of 10% sucrose solution into beaker 3.
5. Pour 50 cm^3 of 15% sucrose solution into beaker 4.
6. Use the borer to remove cylinders of potato from the whole potato.
7. Cut the potato cylinder into 3 cm pieces.
8. Measure the mass and diameter of each piece.
9. Record the results.
10. Place one potato cylinder into each beaker.
11. Leave for 24 hours.
12. Record the new length, mass and diameter of each potato cylinder.



Results

Record the results in a suitable table.

A sample table is shown.

BEAKER	Solution	Length (mm)			Mass (g)			Diameter (mm)		
		Start	After 24 hrs	Change	Start	After 24 hrs	Change	Start	After 24 hrs	Change
1	water									
2	5% sucrose									
3	10% sucrose									
4	15% sucrose									

The results from this investigation can be further processed by calculating the percentage change in mass, length or diameter of the plant tissue.

A line graph can also be drawn to present the results.

Conclusion

The potato cell membrane acts as the semi-permeable membrane. This is a comparison of the concentration of water in the cell and the concentration of water in the solution.

In beaker 1 the highest concentration of water is outside the cell, in the beaker. So water will move into the cell. The cell will expand. Therefore we should notice an increase in the length, mass and diameter of the potato cylinder.

In the next 3 beakers the water will either move into the potato, thereby increasing the measurements, or out of the potato, thereby decreasing the measurements.

If there is no change in the measurements then water has not moved because the concentrations on either side of the semi-permeable membrane are already equal.

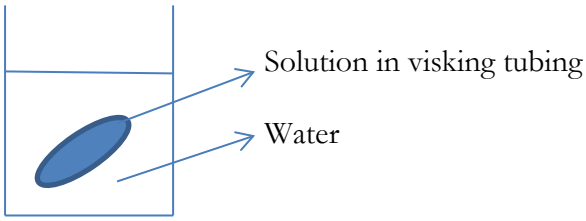
To investigate osmosis in a model cell, Visking tubing

Apparatus

- 4 x 100 ml beakers
- 3 solutions of sucrose; 5%, 10%, 15%
- Water
- Visking tubing
- Funnel

Method

Pour 50 cm^3 of water into each beaker.
Cut equal lengths of visking tubing.
Tie one end of each piece of tubing.
Use a funnel to pour water into the first piece of tubing. Tie the other end.
Measure the circumference of the filled tubing using string.
Place this 'balloon' of water into beaker 1.
In the same way fill the next piece of visking tubing with 5% sucrose solution and place in beaker 2.
Repeat for 10% and 15% sucrose solutions, place into beaker 3 and 4.



Results

Record the results in a suitable table.

A sample table is shown

BEAKER	**Visking tubing contains**	**Circumference (mm)**	
		Start	**After 24hrs**
1	Water		
2	5% sucrose		
3	10% sucrose		
4	15% sucrose		

Conclusion

The visking tubing acts as the semi-permeable membrane. If the concentration of water is higher in the beaker than inside the tubing, the water will move into the tubing and it will increase in size.

If the concentration of water is the same then there will be no movement and no change in size.