3.2.3 Osmosis

Key terms:

Osmosis: the movement of water from a region of high water potential to a region of lower water potential through a selectively permeable membrane.

Water potential: a measure of the pressure created by water. The higher the water potential the more water is present, so the higher the pressure and the more likely the water is to move.

Core content:

negative isotonic equilibrium turgid zero hypertonic pressure hypotonic shrivel membrane water potential turgor burst flaccid more negative isotonic

Osmosis describes the movement of _____ only and can occur only across a partially permeable _____. Water _____ indicates the likelihood that water will move to or from a location based on the _____ it exerts. The maximum water potential is _____, which is the water potential of pure water. When substances (solutes) are dissolved in water (the solvent), they lower the water potential, making it a _____ value. The more solutes that are dissolved, the more _____ the value becomes. Water will always move across a membrane from an area with a higher (less negative) water potential to an area with a lower (more _____) water potential.

However, water moves in both directions across the membrane at any given time, but the net movement will be toward the area with the more negative water potential. This net movement continues until the water potential is equal on both sides of the membrane, known as _____.

The solution around a cell is described as _____ if it has the same solute concentration as the cell (and therefore the same water potential), _____ if it has a higher solute concentration (more negative/lower water potential) than the cell, and _____ if it has a lower solute concentration (less negative/higher water potential) than the cell.

When animal cells are placed in a hypertonic solution, they _____. When plant cells are placed in a hypertonic solution, they become _____. When animal cells are placed in a hypotonic solution, they swell and _____. When plant cells are placed in a hypotonic solution, they become _____ as the cell wall prevents bursting.

Plant cells rely on _____ pressure (the high pressure in cells or their vacuoles when water is forced to move in by osmosis) to provide structural support and keep them upright. Most animal cells require _____ surroundings to maintain their shape and allow chemical reactions to occur under normal conditions.

Skills development

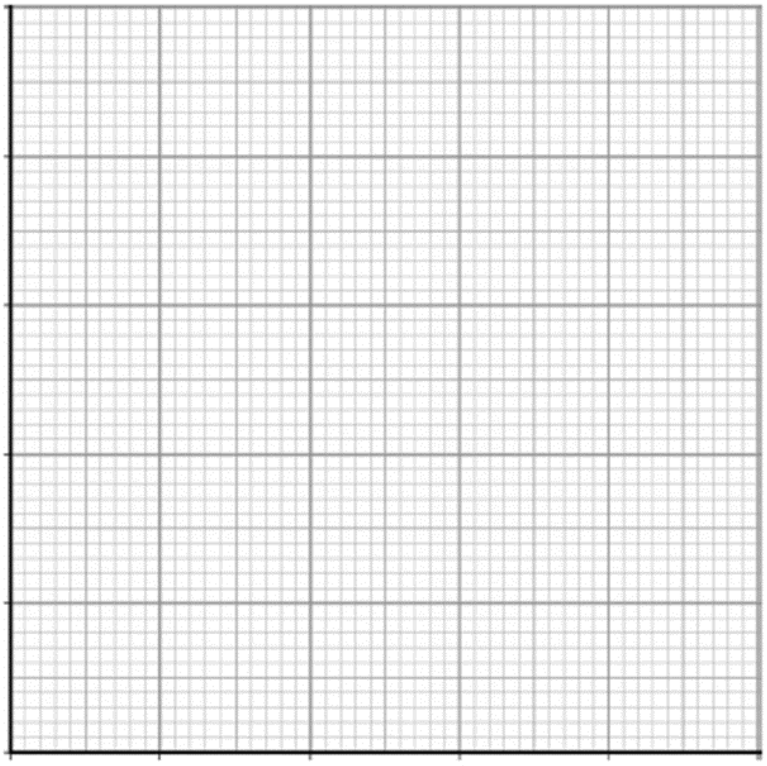
MS 3.2 - Students could plot the data from their investigations in an appropriate format.

MS 3.4 - Students could determine the water potential of plant tissues using the intercept of a graph of, eg, water potential of solution against gain/loss of mass.

The table show the mass of potato chips in different concentrations of sucrose solution.

Concentration of sucrose solution / $mol.dm^{-3}$	Initial mass of chip / g	Final mass of chip / g	Change in mass /g
0.0	2.79	3.82	
0.2	2.75	2.97	
0.4	2.78	2.67	
0.6	2.69	2.31	
0.8	2.72	2.20	
1.0	2.77	1.99	

1. Complete the table by calculating the change in mass.
2. Plot a graph of your calculated values against concentration of sucrose solution on the graph paper.



3. Use your graph to calculate the concentration of solutes in the potato.

Questions:

1. What substance moves during osmosis?

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2. Through what type of membrane does osmosis occur?

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3. What term indicates the likelihood of water movement?

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4. What is the water potential of pure water?

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5. Does the addition of solutes make water potential more positive or negative?

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6. Toward which water potential does water move across a membrane?

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7. What is the term for when water potential is equal on both sides of a membrane?

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8. What happens to animal cells in a hypertonic solution?

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9. What happens to plant cells in a hypotonic solution?

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10. What do plant cells rely on for structural support?

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Core content mark scheme

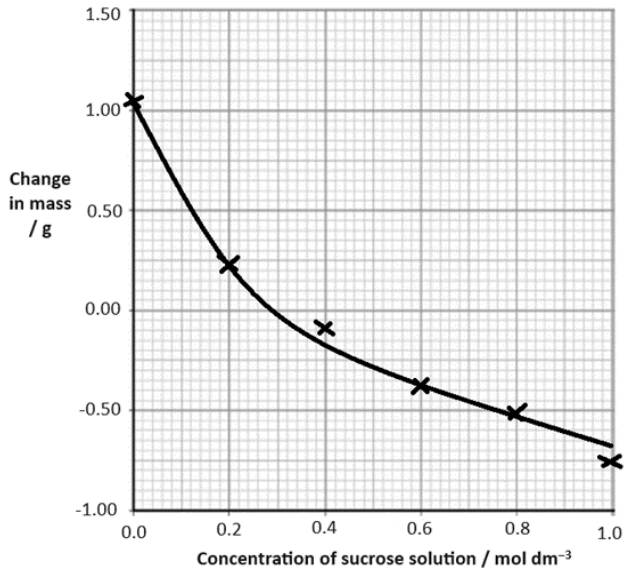
water membrane potential pressure zero negative negative negative equilibrium isotonic hypertonic hypotonic shrivel flaccid burst turgid turgor isotonic

Skills development mark scheme

1.

Concentration of sucrose solution / mol dm^{-3}	Initial mass of chip / g	Final mass of chip / g	Change in mass /g
0.0	2.79	3.82	+1.03
0.2	2.75	2.97	+0.22
0.4	2.78	2.67	-0.11
0.6	2.69	2.31	-0.38
0.8	2.72	2.20	-0.52
1.0	2.77	1.99	-0.78

2.



3. Value taken from the x axis of the graph at the point where the line crosses 0 change in mass e.g. 0.29g

Questions mark scheme

1. Water
2. Partially permeable
3. Water potential
4. Zero
5. Negative
6. More negative
7. Equilibrium
8. Shrivel
9. Turgid
10. Turgor pressure