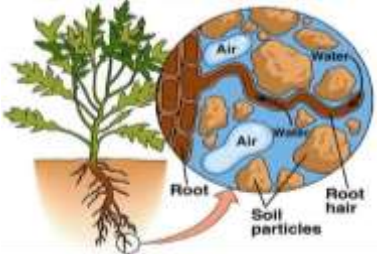
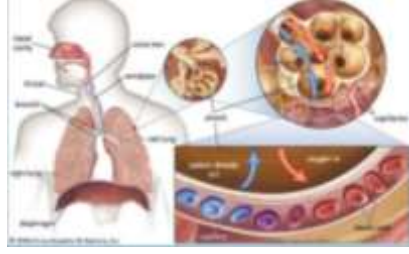
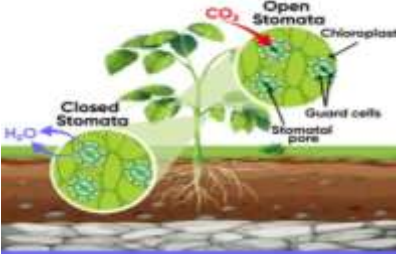
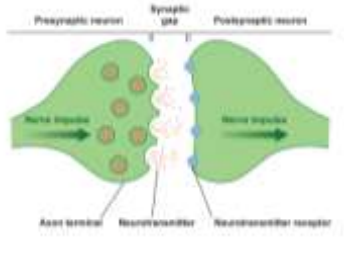
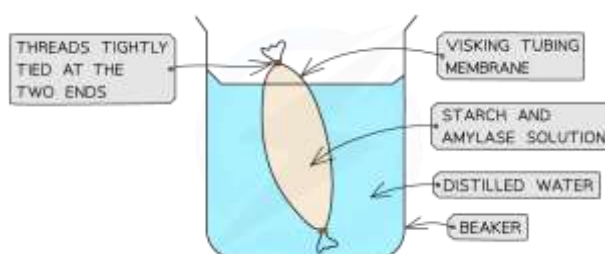


MOVEMENT OF SUBSTANCES

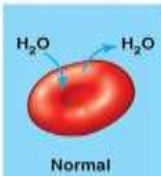
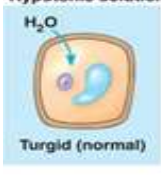
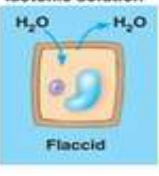
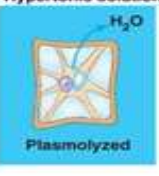
1. Diffusion

Definition	Diffusion is the net movement of molecules, ions or atoms from a region of higher concentration to a region of lower concentration.		
Concepts	- Diffusion occurs down the concentration gradient, no need energy - No diffusion when dynamic equilibrium is reached/ both regions have same concentration. But particles are still in constant random motion.		
Factors	- Higher temperature, ↑ diffusion rate - Steeper concentration gradient, ↑ diffusion rate - Shorter diffusion distance (eg. one-cell thick layer), ↑ diffusion rate - Higher SA:VR (eg. smaller piece), ↑ diffusion rate		
Example		Plant	Animal
	With membrane	Absorption of mineral salts from soil (in root) 	Exchange of gases across alveoli and blood capillaries 
	Without membrane	Loss of water vapour from the stomata (in leaf) 	Neurotransmitters move across synapse/between neurones 
Application	Transdermal medicine patch Advantage : Painless, quick termination, suitable for drugs that is difficult to absorbed by digestive system into blood. Disadvantage: Unsuitable for sensitive skin, may cause local irritation. Not suitable drugs that can irritates the skin or low skin permeability.		

Note: Visking tubing is a type of artifical membrane.

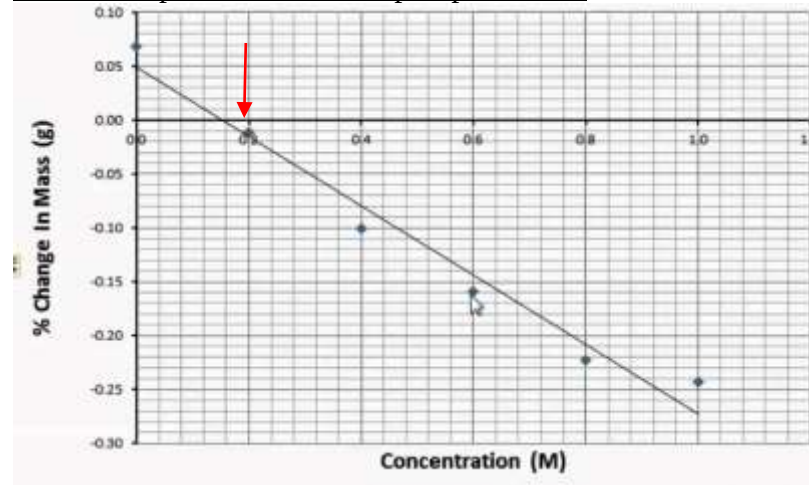


2. Osmosis

Definition	Osmosis is the net movement of water from a region of higher water potential to a region of lower water potential through partially permeable membrane.														
Concepts	- Osmosis occurs down the water potential gradient, no need energy - If partially permeable membrane is destroyed by heat/pH/ethanol(alcohol) 1. No osmosis 2. Cell contents also leaves, causing cell mass and size decreases greatly - Water potential: (lowest) concentrated < dilute < distilled water (highest) 80% sucrose < 20% sucrose < 0% sucrose solution - Water enter the cell can cause increase in mass, volume, length & pressure														
Effect on cells	Hypotonic solution  Lysed Isotonic solution  Normal Hypertonic solution  Shriveled Hypotonic solution  Turgid (normal) Isotonic solution  Flaccid Hypertonic solution  Plasmolyzed														
Phrasing:	<table><tr><td></td><td>Animal cell</td><td>Plant cell</td></tr><tr><td>1) compare water potential</td><td> - Cell has lower water potential - Water molecules enters - Cell swells/expands and bursts (as cell surface membrane is overstretched due to increasing pressure) </td><td> - Cell has lower water potential - Water molecules enters - Cell becomes firm and turgid, turgor pressure exerted. (as cell wall exerts opposing pressure, prevent plant cell from bursting) </td></tr><tr><td>2) water enter/leave the cell</td><td> - Cell has higher water potential - Water molecules leaves - Cell shrinks and crenates </td><td> - Cell has higher water potential - Water molecules leaves - Large central vacuole decrease in size and plasmolysis occurs (cell surface membrane and cytoplasm pulls away from cell wall). Cell becomes soft and flaccid/ plasmolysed. </td></tr><tr><td>3) effect on cell</td><td></td><td></td></tr></table>				Animal cell	Plant cell	1) compare water potential	- Cell has lower water potential - Water molecules enters - Cell swells/expands and bursts (as cell surface membrane is overstretched due to increasing pressure)	- Cell has lower water potential - Water molecules enters - Cell becomes firm and turgid, turgor pressure exerted. (as cell wall exerts opposing pressure, prevent plant cell from bursting)	2) water enter/leave the cell	- Cell has higher water potential - Water molecules leaves - Cell shrinks and crenates	- Cell has higher water potential - Water molecules leaves - Large central vacuole decrease in size and plasmolysis occurs (cell surface membrane and cytoplasm pulls away from cell wall). Cell becomes soft and flaccid/ plasmolysed.	3) effect on cell		
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	<u>Pure water in animal cell:</u> - Pure water has higher water potential than cytoplasm in red blood cell - Water molecules enters cytoplasm of red blood cell by osmosis through partially permeable membrane - Red blood cells swells/expands and bursts as partially permeable membrane is overstretched due to increasing pressure <u>Salt water in animal cell:</u> - Salt water has lower water potential than cytoplasm in red blood cell - Water molecules leaves cytoplasm of red blood cell by osmosis through partially permeable membrane - Red blood cells shrinks and crenates <u>Pure water in plant cell:</u> - Pure water has higher water potential than cell sap in plant cell - Water molecules enters cell sap of plant cell by osmosis through partially permeable membrane - Plant cell becomes firm and turgid, turgor pressure exerted. Cell wall exerts opposing pressure to prevent cell burst. <u>Salt water in plant cell:</u> - Salt water has lower water potential than cell sap in plant cell - Water molecules leaves the cell sap of plant cell by osmosis through partially permeable membrane - Large central vacuole decrease in size, cell surface membrane and cytoplasm pulls away from cell wall, plant cell becomes soft and flaccid/ plasmolysed. Process: Plasmolysis.														

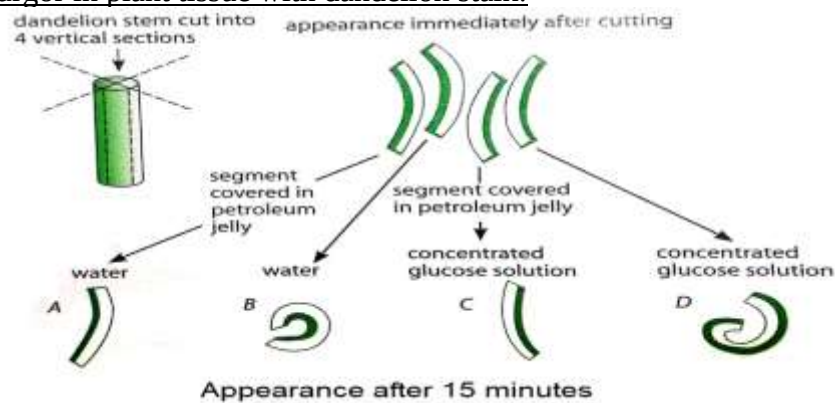
Application

Find water potential of cell sap in plant cell :



Water potential of cell sap in plant cell → No net movement of water = no change in mass = both region same water potential.

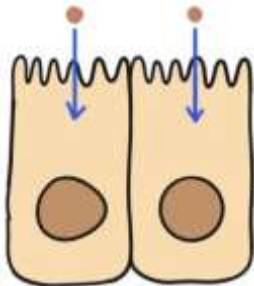
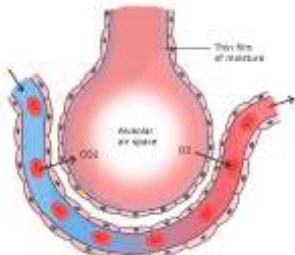
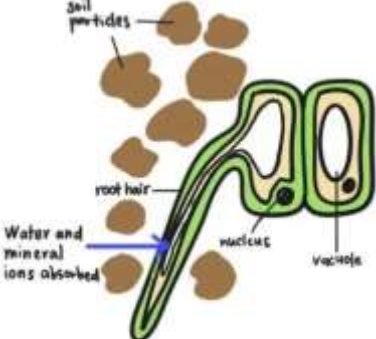
Turgor in plant tissue with dandelion stalk:



- cutting the strip lengthwise causes them to **curl outwards** immediately due to the **pressure in the cortex cells**(white). Cortex cells are prevented from expanding by epidermis and **inelastic cuticle layer** (green).
- A & C: **Petroleum jelly prevents movement of water** in cell, **no change** in tissue.
- B: water **enters by osmosis**, causing **cortex cell to expand more** than on the inner side due to the **restraint** exerted by outer epidermis and inelastic cuticle layer, cause it to **curl outwards**.
- D: water **leaves by osmosis**, causing **cortex cell to shrink**. **Pressure** exerted by outer epidermis and inelastic cuticle layer cause inner side to **curl inwards**.

Osmosis	Diffusion
High water potential to low water potential	High concentration to low concentration
Energy not required	Energy not required
Partially permeable membrane needed	Partially permeable membrane may or may not be needed
Involve water molecules only	Involve any particles except water molecules

3. Movement of substances in nutrient uptake and gas exchange

Nutrient uptake	Gas exchange
Digested food substances such as glucose, and amino acids diffuse into epithelial cells of villi in the small intestine 	O₂ dissolves into the thin film of moisture lining the alveolar air space, then diffuses into the blood plasma Conversely, CO₂ diffuses from the blood plasma into the alveoli air space 
Mineral salts are transported from the soil into root hair cells by diffusion, to maintain a high concentration of mineral salts in their vacuoles This creates a region of lower water potential than the surrounding soil, so that water flows in by osmosis 	O₂ diffuses from the intercellular air spaces of the leaf to the surrounding air, through the stomata CO₂ diffuses from the surrounding air into the intercellular air spaces of the leaf, through the stomata 