

3.2 Osmosis

Definition: It is the net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane.

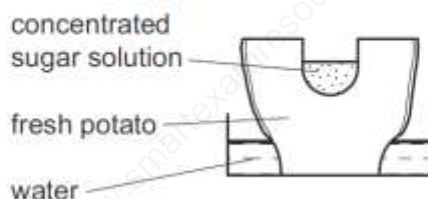
Osmosis is a special kind of diffusion involving water molecules. It occurs when two solutions are separated by a **partially permeable membrane**.

Note:

- A **dilute solution** is a solution with a **high concentration of water (High water potential)**
- A **concentrated solution** is a solution with a **low concentration of water (low water potential)**

Example:

The diagram shows an experiment using a potato.



Which shows the result of the experiment after 24 hours?



Ans:C

Water moves through the trough into the potato as it is at a high water potential compared to the water potential in the potato cells. The water then moves out of the potato as the concentrated sugar solution above the potato is at a low water potential compared to the water in the potato cell (Vacuole). Thus the water level in the trough drops while the level of the concentrated sugar solution rises.

Note:

- **Plants are supported by the pressure of water inside the cells pressing outwards on the cell wall**
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- **Effect on plant tissues of immersing them in solutions of different concentrations by using the terms turgid, turgor pressure, plasmolysis and flaccid:**
 - **Plants are supported by the pressure of water inside the cells pressing outwards on the cell wall**
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- **How the plants are supported by the turgor pressure within cells, in terms of water pressure acting against an inelastic cell wall**

Turgidity

The cell membrane of the plant cell is partially permeable and the cell sap inside the vacuole is a solution of salts and sugars. When plant cells are placed in water, the water enters the cells. This is because there is a water concentration gradient so that water molecules diffuse into the cells by osmosis.

As water enters it makes the cell swell up. The water pushes against the cell wall. Eventually the cell contains as much water as it can hold. The strong cell wall stops the cell bursting. Such a cell is a **turgid** cell.

Turgid cells give the plant support. They keep the stems of many plants upright.

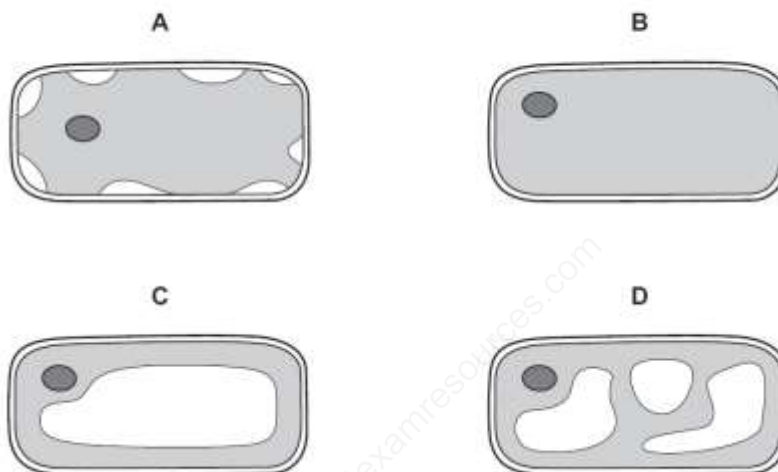
When cells lose water, they are no longer firm and turgid. Plant stems and leaves that have lost water are said to **wilt**.

Plasmolysis:

- When plant cells are placed into a concentrated sugar or salt solution water passes out of the cells by osmosis. As water passes out, the sap vacuole starts to shrink. These cells are no longer firm, and become limp. We say that they are **flaccid**.
- As more water leaves the cells the cytoplasm starts to move away from the cell wall. These cells are now **plasmolysed**.

Example:

Which diagram shows the appearance of a plant cell several minutes after it has been placed in a concentrated solution of sugar?



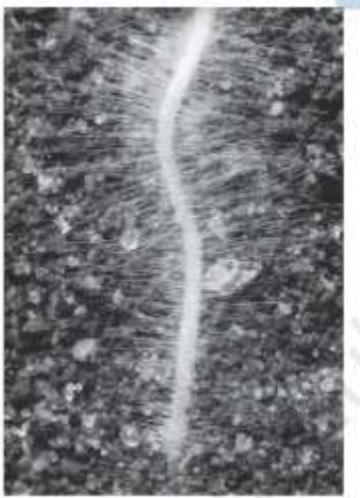
Ans: The diagram A .

Reason: The vacuole membrane is pulling away from the cell membrane as the cell has lost water as it is at a high water potential compared to the concentrated sugar solution. So water moves out via osmosis.

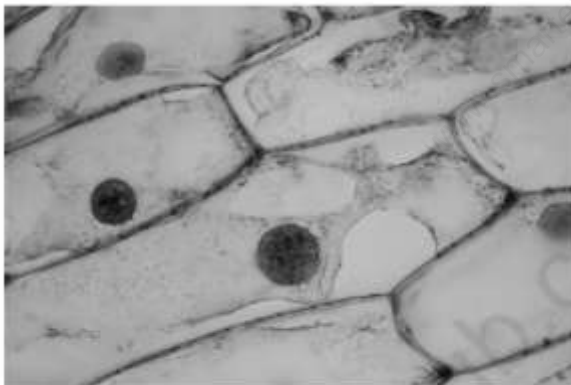
• **Plants may die when grown in salty soil:**

Because: The salt concentration in soil is higher than on the roots. So since the water potential is greater in roots, the water is drawn out of the cells via osmosis. The cells become flaccid and the plant wilts due to lack of water.

Absorption of water by the root hair cells:



Water diffuses from the soil down the water potential gradient via osmosis through the partially permeable membrane of the root hair cell which is at a low water potential.



Describe the effects of adding a concentrated salt solution to the cells shown aside

- The volume of the vacuole will decrease.
- Some cell membrane and cytoplasm will pull away from the

cell wall.

- Cells become plasmolyzed
- Cell walls no longer push outward.

Osmosis in animal cells

- Animal cells have no cell wall to stop them swelling so they burst when placed in mineral water.
- . When red blood cells are put into a concentrated salt solution , they shrink as water passes out of the cells by osmosis.
- If the cells have not changed in size after being placed in a solution, then it indicates that the water potential of the cells and the solution is the same.

Special vocabulary for describing the concentration of solutions:

- **Hypertonic:** Hypertonic solution is one of two solutions that has a higher concentration of a solute.
- **Hypotonic:** Hypotonic solution is one of two solutions that has a lower concentration of a solute.
- **Isotonic:** Isotonic solutions are two solutions that have the same concentration of a solute.