2.2 Osmosis Date: 04.02.2012

**What is osmosis?**

* Osmosis is the movement of *water* molecules from a solution of *higher water potential* to a solution of *lower water potential*, through a *partially permeable membrane*.
* Water moves **DOWN** the *water potential gradient*.

**What is water potential and how is it related to osmosis?**

* Water potential is a **measure** of tendency of water to move from one place to another.
* The term ‘*water potential*’ is always used/connected to **OSMOSIS**.
* A **dilute** solution *contains more water molecules* per unit volume than a **concentrated** solution – therefore, has a **HIGHER** concentration than a concentrated solution.

Q. **Which one has a higher water potential?** Ans: **Beaker A** – More water, less sucrose molecules.

**Containing:**

10% sucrose solution

Beaker B

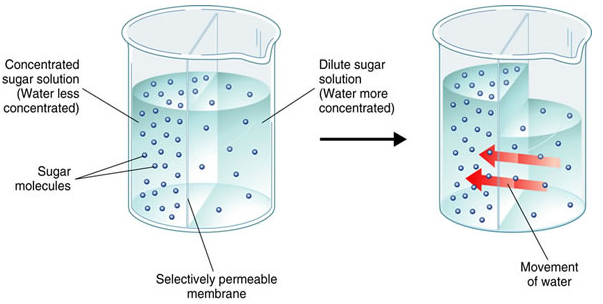
**Containing:**

5% Sucrose solution

Beaker A

* When a *partially permeable membrane separates two solutions of different water potentials*, a **water potentials gradient** is established.
* When a water potential gradient is established, the process of **osmosis** will occur.

*For example:*



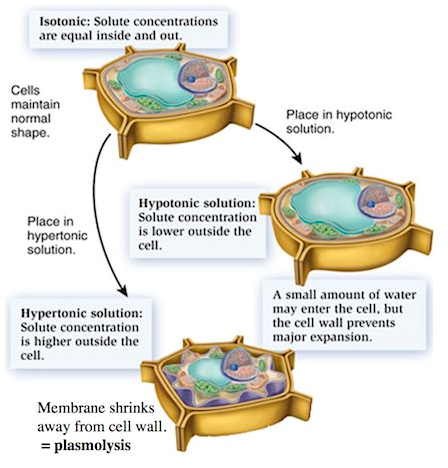
**Remember:**

The **cell wall** of plants = **permeable**! , While the **cell membrane** is = partially permeable!

**How does osmosis affect living organisms?**

* A plant cell *behaves differently* from an animal cell when placed in solutions with differing water potentials, due to the presence of the **cell wall** in plant cells.

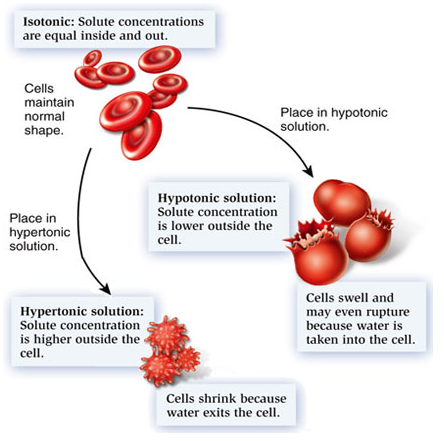
Q. **What happens to a plant cell in a solution with high/low/equal water potential?**



|  |  |  |
| --- | --- | --- |
| Isotonic solution | Hypertonic solution | Hypotonic solution |
| * The solute concentrations are equal on both sides – equal water potential. * Therefore, normal movement of water inside and out. * Cell maintains its shape. | * The solute concentrations are **higher outside** compared to the cell sap – **low water potential outside**. * Water molecules moves outside by *osmosis*. * The cytoplasm shrinks away from cell wall - **Cell plasmolysis**. | * The solute concentration is **lower** outside the cell – **high water potential outside**. * Water molecules enter by *osmosis*. * Cell enlarges and becomes **turgid**. * *Cell wall prevents cell from bursting*. |

* The turgidity of the cell with water is called **turgor**, and the pressure exerted by the water on the cell wall is the **turgor pressure**.

Q. **What happens to an animal cell in a solution with high/low/equal water potential?**



|  |  |  |
| --- | --- | --- |
| Isotonic solution | Hypertonic solution | Hypotonic solution |
| * There is equal water potential inside and outside of the cell. * Therefore, normal movement of water inside and out. * Cell maintains its shape. | * There is **low water potential outside** of the cell, and **high water potential inside** the cytoplasm. * Water molecules leaves by *osmosis*. * The cell **shrinks** in size (**crenated)**. | * There is **high water potential outside** the cell, and **low water potential** in the cytoplasm. * Water molecules enter by *osmosis*. * Cell expands and **bursts**. |

* When the cell *shrinks* and *little spikes appear* on the *cell surface membrane*, this process is called **crenation**.
* An animal cell will become *dehydrated* and *eventually die* when placed in a solution of low water potential.

Q. **Why is turgor important in plants?**

* **Turgor** enables plant to **remain firm and erect** (due to turgor pressure within their cells).
* When there is **high evaporation** of water from the cells, they *lose their turgidity* and the *plant wilts.*
* **Plasmolysis** causes **tissues to become limp or flaccid**. Cells will be *killed if they remain plasmolysed for too long.*