**Topic 3. Movement in & out of cells**

**3.1 Diffusion**

**Define diffusion**

Diffusion is as the net movement of particles from a region of their higher concentration to a region of their lower concentration down a concentration gradient, as a result of their random movement

**Describe the importance of diffusion of gases and solutes**

|  |  |
| --- | --- |
| **Substance diffused** | **Site of diffusion** |
| Oxygen | From the alveoli into blood capillaries |
| Carbon dioxide | From blood capillaries into the alveoli.  From air, through stomata & into the leaf for photosynthesis. |
| Soluble products of digestion | From small intestine to the blood capillaries. |
| Scent made of tiny molecules | From flowers into the bee’s body. |

Importance of water as a solvent:

* Most cells contain about 75% of water;
* Many important metabolic reactions take place in aqueous solution;
* Many substances move around a cell dissolved in water (and also around organisms, e.g. in blood, xylem & phloem).

**State that substances move into and out of cells by diffusion through the cell membrane**

**State that the energy for diffusion comes from the kinetic energy of random movement of molecules and ions**

**Investigate the factors that influence diffusion, limited to surface area, temperature, concentration gradients and distance**

Factors that help diffusion are as follows:

* Distance (the shorter the better) e.g. thin walls of alveoli and the capillaries.
* Concentration gradient (the bigger the better). This can be maintained by removing the substance as it passes across the diffusion surface.
* Size of the molecules (the smaller the better).
* Surface area for diffusion (the larger the better) e.g. there is millions of alveoli in a lung, giving a huge surface area for diffusion of oxygen.
* Temperature (molecules have more kinetic energy at higher temperatures).

**3.2 Osmosis**

**State that water diffuses through partially permeable membranes by osmosis**

**State that water moves in and out of cells by osmosis through the cell membrane**

**Define osmosis**

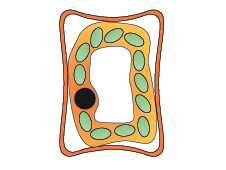
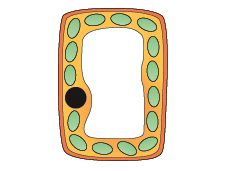
Osmosis is the net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane

**Investigate and describe the effects on plant tissues of immersing them in solutions of different concentrations**

**Explain the effects on plant tissues of immersing them in solutions of different concentrations by using the terms turgid, turgor pressure, plasmolysis and flaccid**

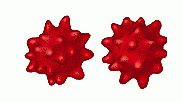
*Effects of osmosis on plant and animal tissues:*

* When placed in pure water, plant and animal cells will take in the water by osmosis;
* This is because there is a higher concentration of water molecules outside the cell than inside it;
* Plants become **turgid**, but do not burst because of their tough cell wall;
* Animal cells will **burst**, because they have no cell wall;
* The reverse happens when plant and animal cells are placed in a concentrated sugar or salt solutions. This is because there is a higher concentration of water molecules inside the cell than outside it;
* Plant cells become **flaccid** and the cytoplasm is no longer pressed against the cell wall;



Turgid plant cell Flaccid plant cell

* Animal cells also become flaccid and their shape changes- they can become **crenated**.

RBC burst Crenated RBC

**State that plants are supported by the pressure of water inside the cells pressing outwards on the cell wall**

**Explain how plants are supported by the turgor pressure within cells, in terms of water pressure acting against an inelastic cell wall**

**Explain the importance of water potential and osmosis in the uptake of water by plants**

*Importance of osmosis in the uptake of water by plants:*

* Usually, the water in the soil is more dilute than that in root hair cells
* So water enters root hair cells by osmosis (a passive process – requiring no energy)
* Water potential is the correct term for saying ”water concentration” a high water potential is equivalent to a low solute concentration and vice versa;
* For plants to take in water through their roots they must have a high solute concentration or low water potential in the roots and low solute concentration or high water potential outside the roots.
* In osmosis, water molecules diffuse down a water potential gradient.

**Explain the importance of water potential and osmosis on animal cells and tissues**

**3.3 Active Transport**

**Define active transport** - the movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration using energy from respiration

**Discuss the importance of active transport as a process for movement across membranes:**

**– e.g. ion uptake by root hairs & uptake of glucose by epithelial cells of villi & kidney tubules**

**Explain how protein molecules move particles across a membrane during active transport**