**Topic 1.4: Membrane Transport**

**Essential Idea: Membranes control the composition of cells by active and passive transport.**

**Statements & Objectives:**

**1.4.U1 Particles move across membranes by simple diffusion, facilitated diffusion, osmosis and active transport.**

Describe simple diffusion.

**(Describe**: Give a detailed account)

Explain two example of simple diffusion of molecules into and out of cells.

(**Explain**: Give a detailed account including reasons or causes)

Outline factors that regulate the rate of diffusion.

**(Outline:** Give a brief account or summary)

Describe facilitated diffusion.

**(Describe**: Give a detailed account)

Describe one example of facilitated diffusion through a protein channel.

**(Describe**: Give a detailed account)

Define osmosis.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Predict the direction of water movement based upon differences in solute concentration.

**(Predict**: Give an expected result)

Compare active transport and passive transport.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

Explain one example of active transport of molecules into and out of cells through protein pumps.​

(**Explain**: Give a detailed account including reasons or causes)

**1.4.U2 The fluidity of membranes allows materials to be taken into cells by endocytosis or released by exocytosis. Vesicles move materials within cells.**

Describe the fluid properties of the cell membrane and vesicles.

**(Describe**: Give a detailed account)

Explain vesicle formation via endocytosis.

(**Explain**: Give a detailed account including reasons or causes)

Outline two examples of materials brought into the cell via endocytosis.

**(Outline**: Give a brief account or summary)

Explain release of materials from cells via exocytosis.

**Explain**: Give a detailed account including reasons or causes)

Outline two examples of materials released from a cell via exocytosis,

**(Outline**: Give a brief account or summary)

**1.4.U3 Vesicles move materials within cells.**

List two reasons for vesicle movement.

**(List**: Give a sequence of brief answers with no explanation.)

Describe how organelles of the endomembrane system function together to produce and secrete proteins (rough ER, smooth ER, Golgi and vesicles).

**(Describe**: Give a detailed account)

Outline how phospholipids and membrane bound proteins are synthesized and transported to the cell membrane.​​

**(Outline**: Give a brief account or summary)

**1.4.A1 Structure and function of the sodium-potassium pumps for active transport and potassium channels for facilitated diffusion in axons.**

We will visit this understanding during the nervous system unit

**1.4.A2 Tissues or organs to be used in medical procedures must be bathed in a solution with the same osmolarity as the cytoplasm to prevent osmosis.**

Explain what happens to cells when placed in solutions of the same osmolarity, higher osmolarity and lower osmolarity.

(**Explain**: Give a detailed account including reasons or causes)

Outline the use of normal saline in medical procedures.​

**(Outline**: Give a brief account or summary)

**1.4.S1 Estimation of osmolarity in tissues by bathing samples in hypotonic and hypertonic solutions. (Practical 2)**

Define osmolarity, isotonic, hypotonic and hypertonic.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Calculate the percentage change between measurement values.

(**Calculate**: Obtain a numerical answer showing the relevant stages in the working(unless-instructed not to do so).

Calculate the mean value of a data set.

(**Calculate**: Obtain a numerical answer showing the relevant stages in the working(unless-instructed not to do so).

Calculate the standard deviation value of a data set.

(**Calculate**: Obtain a numerical answer showing the relevant stages in the working(unless-instructed not to do so).

State that the term standard deviation is used to summarize the spread of values around the mean, and that 68% of the values fall within one standard deviation of the mean.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Explain how the standard deviation is useful for comparing the means and the spread of data between two or more samples.

(**Explain**: Give a detailed account including reasons or causes)

Determine the correct type of graph to represent experimental results.

(**Determine**: Obtain the only possible answer)

State that error bars are a graphical representation of the variability of data.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Accurately graph mean and standard deviation of data sets.

Determine osmolarity of a sample given changes in mass when placed in solutions of various tonicities.​

(**Determine**: Obtain the only possible answer)

**1.4.NOS Experimental design- accurate quantitative measurements in osmosis experiments are essential.**

Define quantitative and qualitative.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Determine measurement uncertainty of a measurement tool.

(**Determine**: Obtain the only possible answer)

Explain the need for repeated measurements (multiple trials) in experimental design.

(**Explain**: Give a detailed account including reasons or causes)

Explain the need to controlled variables in experimental design.​

(**Explain**: Give a detailed account including reasons or causes)

State the primary function of the cell membrane.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**Key facts**

1. Particles move across membranes by simple diffusion, facilitated diffusion, osmosis and active transport.
2. The fluidity of membranes allows materials to be taken into cells by endocytosis or released by exocytosis.
3. Diffusion is the passive movement of particles along a concentration gradient.
4. Osmosis is the passive movement of water across a partially permeable membrane along a concentration gradient.
5. Cells expend energy (ATP) during active transport. Passive transport does not involve the expenditure of ATP by the cell.
6. Endocytosis and exocytosis are examples of active transport. It is essential that the membrane has a degree of fluidity so that shape changes may occur to allow endocytosis and exocytosis to occur.
7. Vesicles are used to transport materials within the cell between the rough endoplasmic reticulum, the Golgi apparatus, and the plasma membrane.

**Key Terms**

facilitated diffusion

hyper-osmotic

phosphorylation

cis-

​pinocytosis

hypertonic solution

​vesicles

partially permeable

hypo-osmotic

intracellular

trans-

​ATP

solution

osmolarity

​iso-osmotic

extracellular

phagocytosis

​protein pump

​hypotonic solution

​solubility

transport

volume

ratio

diffusion

osmosis

​isotonic solution

passive transport

active transport

vesicles

endocytosis

exocytosis

equilibrium