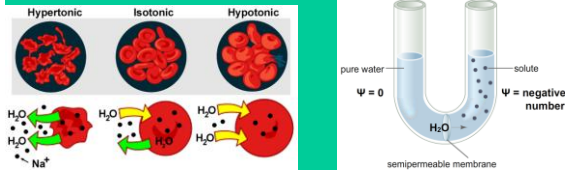


2.8 Tonicity and Osmoregulation



ENDURING UNDERSTANDING

ENE-2 Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.

outer face
inner face
hydrophilic (polar) head of phospholipid
hydrophobic (nonpolar) fatty acid tail of phospholipid
sugar side chain
cholesterol
integral (intrinsic) proteins
peripheral (extrinsic) protein
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ENE-2.H Explain how concentration gradients affect the movement of molecules across membranes.

- External environments can be hypotonic, hypertonic or isotonic to internal environments of cells
 - Solute concentration in solvents can differ inside and outside of cells
 - Tonicity is a measure of this differential solute concentration across a membrane

Figure 2. Tonicity.

ENE-2.H Explain how concentration gradients affect the movement of molecules across membranes.

- Water moves by osmosis from areas of high water potential/low osmolarity/low solute concentration to areas of low water potential/high osmolarity/high solute concentration.

Osmosis
- Low solute - High water potential
- High solute - Low water potential
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ENE-2.H Explain how concentration gradients affect the movement of molecules across membranes.

- Osmosis is diffusion of water across a selectively permeable membrane.
 - Produced by water diffusing towards higher solutes
 - Osmotic pressure is hydrostatic pressure.

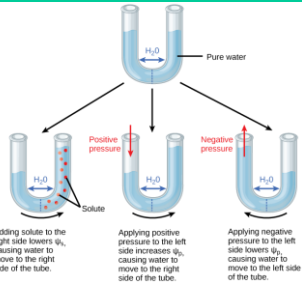
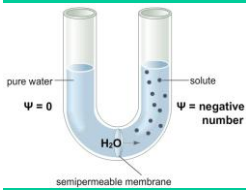
ENE-2.H Explain how concentration gradients affect the movement of molecules across membranes.

- Direction of Tonicity
 - Isotonic to External- relative solute concentration of two environments are equal.
 - Hypotonic to External- relative solute concentration of external environment is less than internal (water moves in)
 - Hypertonic to External- relative solute concentration of external environment is greater than internal (water moves out)

ENE-2.H Explain how concentration gradients affect the movement of molecules across membranes.

– RELEVANT EQUATION

Water Potential: $\Psi = \Psi_p + \Psi_s$
 Ψ_p = pressure potential
 Ψ_s = solute potential



ENE-2.I Explain how osmoregulatory mechanisms contribute to the health and survival of organisms

□ Growth and homeostasis are maintained by the constant movement of molecules across membranes.

- ETC generates ATP
- Intestine absorbs glucose
- Kidneys regulate water balance and ions

ENE-2.I Explain how osmoregulatory mechanisms contribute to the health and survival of organisms

□ Osmoregulation maintains water balance and allows organisms to control their internal solute composition/water potential

ENE-2.I Explain how osmoregulatory mechanisms contribute to the health and survival of organisms

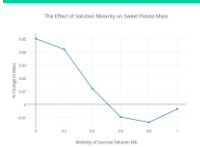
□ SOLUTE POTENTIAL OF A SOLUTION

$\Psi_s = -iCRT$

where:

- i = ionization constant
- C = molar concentration
- R = pressure constant
- R = (0.0831 L*bars/mol*K)
- T = temperature in Kelvin (°C + 273)

i for:
 Sucrose = 1
 NaCl = 2



Distilled water
 $\Psi_s = 0$
 $+\Psi_s = 0$
 $\Psi = 0$

Plant cell immediately after being put into distilled water
 $\Psi_s = 0$
 $+\Psi_s = -2$
 $\Psi = -2$

Plant cell after being in distilled water for some time
 $\Psi_s = +2$
 $+\Psi_s = -2$
 $\Psi = 0$