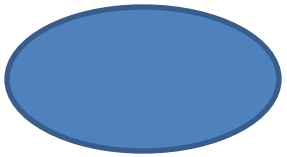


Understanding Water Potential

Water Potential

Water potential (ψ): H_2O moves from high ψ → low ψ potential

Water potential equation:

$$\psi = \psi_S + \psi_P$$

- Water potential (**ψ**) = free energy of water
- Solute potential (ψ_S) = solute concentration (osmotic potential)
- Pressure potential (ψ_P) = physical pressure on solution; ***turgor pressure (plants)***
  - Pure water: ψ_P = 0 MPa
  - Plant cells: ψ_P = 1 MPa

Calculating Solute Potential (ψ_s)

$$\psi_s = -iCRT$$

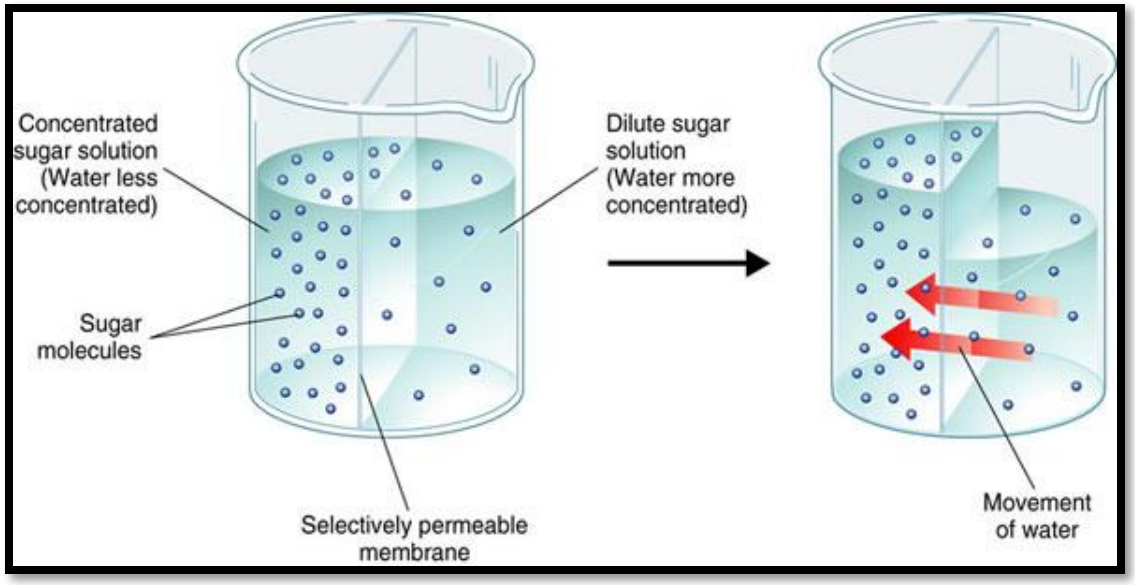
- i = ionization constant (# particles made in water)
- C = molar concentration
- R = pressure constant (0.0831 liter bars/mole-K)
- T = temperature in K (273 + ° C)

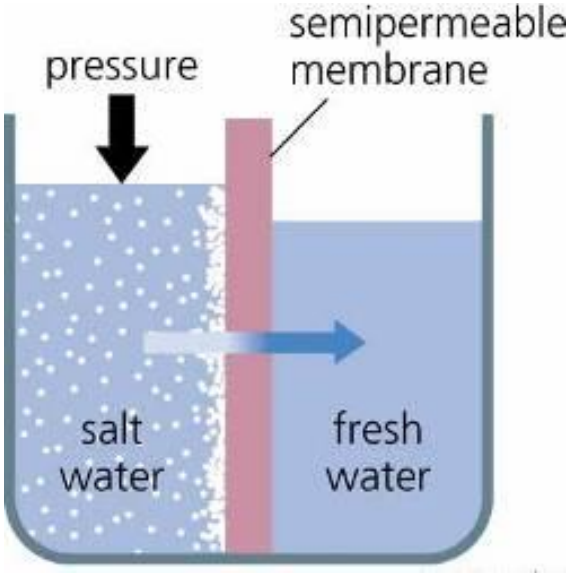
- The **addition of solute** to water ***lowers*** the solute potential (more negative) and therefore ***decreases*** the water potential.

Where will **WATER** move?

From an area of:

- higher ψ → lower ψ (more negative ψ)
- low solute conc. solute → high solute conc. solute
- high pressure → low pressure





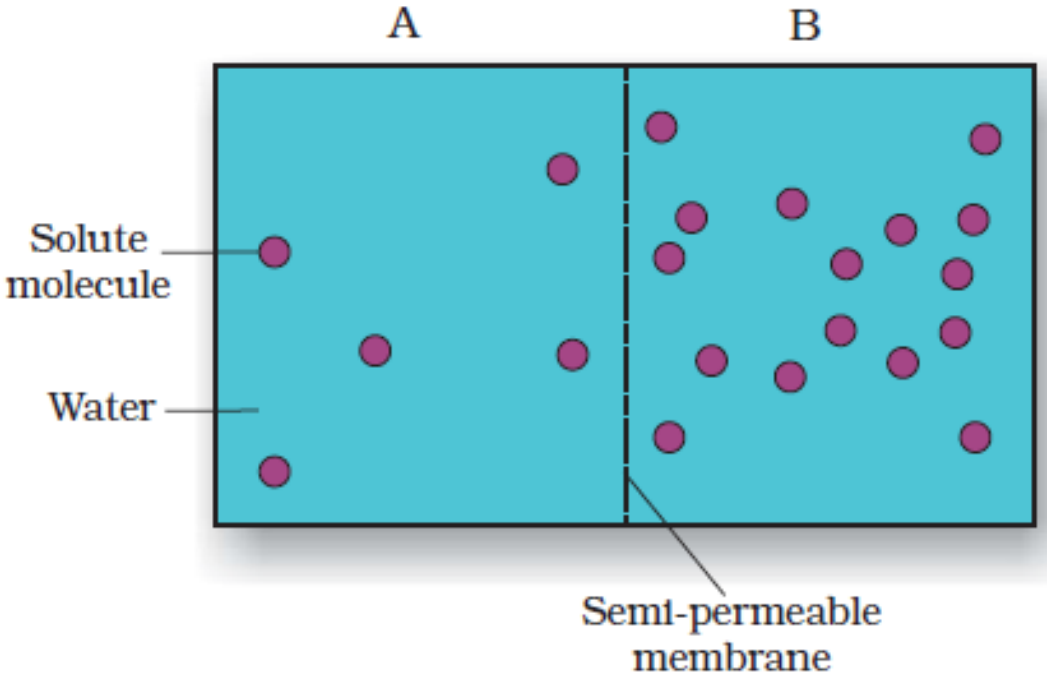


Figure 11.3

1. Which chamber has a lower water potential?
2. Which chamber has a lower solute potential?
3. In which direction will osmosis occur?
4. If one chamber has a Ψ of -2000 kPa, and the other -1000 kPa, which is the chamber that has the higher Ψ?

Low water potential

Atmosphere ψ: –95.2 MPa
(Changes with humidity; usually very low)

Leaf ψ: –0.8 MPa
(Depends on transpiration rate; low when stomata are open)

Root ψ: –0.6 MPa
(Medium–high)

Soil ψ: –0.3 MPa
(High if moist; low if extremely dry)

High water potential

Figure 36-3 Biological Science, 2/e
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Sample Problem

1. Calculate the solute potential of a 0.1M NaCl solution at 25° C.

2. If the concentration of NaCl inside the plant cell is 0.15M, which way will the water diffuse if the cell is placed in the 0.1M NaCl solution?