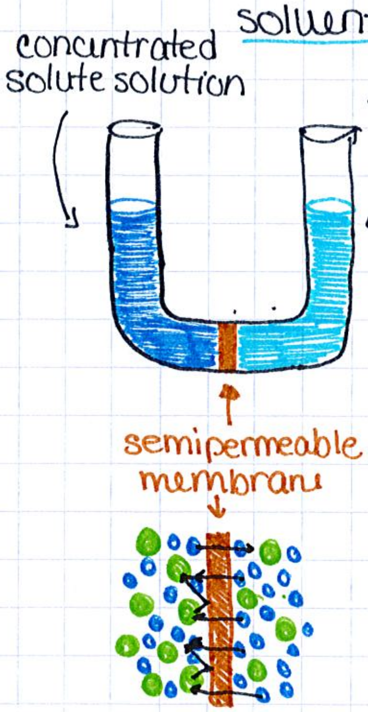
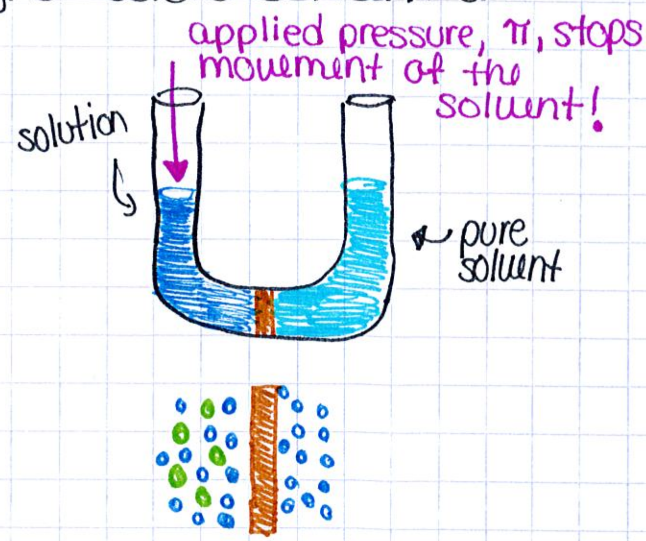
↳ Osmosis

- Some substances form semipermeable membranes, allowing smaller particles to pass through, but blocking out larger particles
    - In biological systems, most semipermeable membranes allow H_2O to pass through, but solutes are not free to do so.
- In osmosis, there is net movement of solvent from an area of higher solvent concentration (lower solute concentration) to an area of lower solvent concentration (higher solute concentration)



Osmosis stops when the column of the solution on the left becomes high enough to exert sufficient pressure at the membrane to counter the net movement of the solvent. At this point, the solution on the left is more dilute than it was before (but the 2 sides do not have equal concentrations)



Applied pressure on the left arm of the apparatus stops net movement of solvent from the right side of the membrane. This applied pressure is the Osmotic Pressure of the solution

$$\Pi = \left(\frac{n}{V}\right)RT = MRT$$

↑ molarity

If the osmotic pressure is the same on both sides of the membrane, the solutions are isotonic.

Ex (11) The average osmotic pressure of blood is 7.7 atm at 25°C. What is the molarity of glucose ($C_6H_{12}O_6$) that will be isotonic with blood?

$$\pi = MRT$$

$$7.7\,atm = M\left(.08206 \frac{L\,atm}{mol\,K}\right)(298K)$$

$$.315M = M$$

Ex (12) What is the osmostic pressure at 20°C of a .0020M sucrose solution ($C_{12}H_{22}O_{11}$)?

$$\pi = MRT = .0020M\left(.08206 \frac{L\,atm}{mol\,K}\right)(293K)$$

$$= .0481\,atm$$

Ex (13) A sample of 2.05g of polystyrene of uniform polymer chain length was dissolved in enough toluene to form 0.100L of solution. The osmotic pressure of this solution was found to be 1.21kPa at 25°C. Calculate the molar mass of the polystyrene.

$$n = \frac{mass}{MM}$$

$$MM = \frac{mass}{n}$$

$$1.21kPa\left(\frac{1\,atm}{101.325kPa}\right) = .0119\,atm$$

$$\pi = MRT$$

$$.0119\,atm = M\left(.08206 \frac{L\,atm}{mol\,K}\right)(298K)$$

$$4.88 \times 10^{-4} M = M$$

$$M = \frac{n}{V}$$

$$n = M \cdot V = (4.88 \times 10^{-4} M)(.100L)$$

$$n = 4.88 \times 10^{-5}\,mol$$

$$MM = \frac{2.05\,g}{4.88 \times 10^{-5}\,mol} = 42008\,g/mol$$