OSMOSIS

Important Quantities and their units:

x	position	[m]
t	time	[sec]
$c_i(x,t)$	concentration of solute *i*	$[\frac{\text{mole}}{\text{m}^3}]$
$c_e(x,t)$	osmolarity	$[\frac{\text{osmole}}{\text{m}^3} = \frac{\text{mole}}{\text{m}^3}]$
r_m	density	$[\frac{kg}{m^3}]$
V	volume	[m^3]
Φ	osmotic flux	$[\frac{\text{m}^3}{\text{sec}\cdot\text{m}^2} = \frac{\text{m}}{\text{sec}}]$
k	hydraulic permeability	$[\frac{\text{m}^2}{\text{Pa}\cdot\text{sec}}]$
L_v	hydraulic conductivity	$[\frac{\text{m}}{\text{Pa}\cdot\text{sec}}]$
p	hydraulic pressure	[Pa]
p	osmotic pressure	[Pa]
R	molar gas constant	$8.314\frac{\text{N}\cdot\text{m}}{\text{mol}\cdot\text{K}}$
T	temperature	[K]

General Equations:

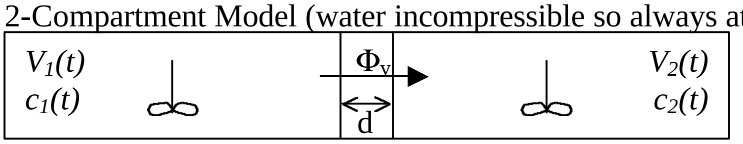
$c_\Sigma = \sum_i n_i c_i$ (where the i^{th} solute dissociates into n_i particles) Definition of Osmolarity

$p = RTc_\Sigma$ van't Hoff's Law

$\Phi_v(x,t) = -k\frac{\partial}{\partial x}(p - p)$ Darcy's Law

$-\frac{\partial}{\partial x}(r_m \cdot \Phi_v) = -\frac{\partial}{\partial t} r_m$ Continuity equation

2-Compartment Model (water incompressible so always at SS):



A=cross-section area

$\Phi_v = -\frac{1}{A}\cdot\frac{d}{dt}V_1$ Definition of volumetric flux

$L_v = \frac{k}{d}$ Hydraulic conductivity

$\Phi_v = L_v((p_1 - p_1) - (p_2 - p_2))$ Darcy's Law

$c_\Sigma^1(0)V_1(0) + c_\Sigma^2(0)V_2(0) = c_\Sigma^1(t)V_1(t) + c_\Sigma^2(t)V_2(t) = c_\Sigma^1(\infty)V_1(\infty) + c_\Sigma^2(\infty)V_2(\infty)$ conservation of solute

$V_1(0) + V_2(0) = V_1(t) + V_2(t) = V_1(\infty) + V_2(\infty)$ conservation of solvent

} closed system only