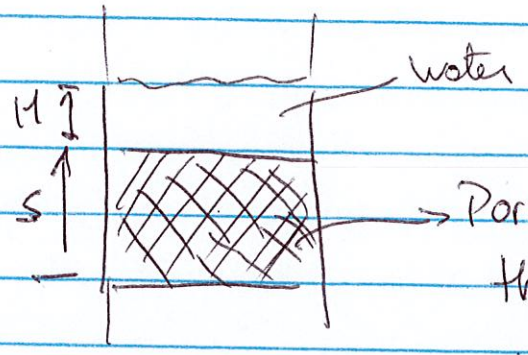
ASIDE DARCY'S LAW



→ Porous Media, component moves through pores by a pressure difference but it is not MOLECULAR DIFFUSION

$$n^v = -K \frac{\partial H}{\partial s}$$

H: Height of liquid.

s: Saturation of soil [Soil mechanics]

K: permeability.

Diffusion with chemical reaction

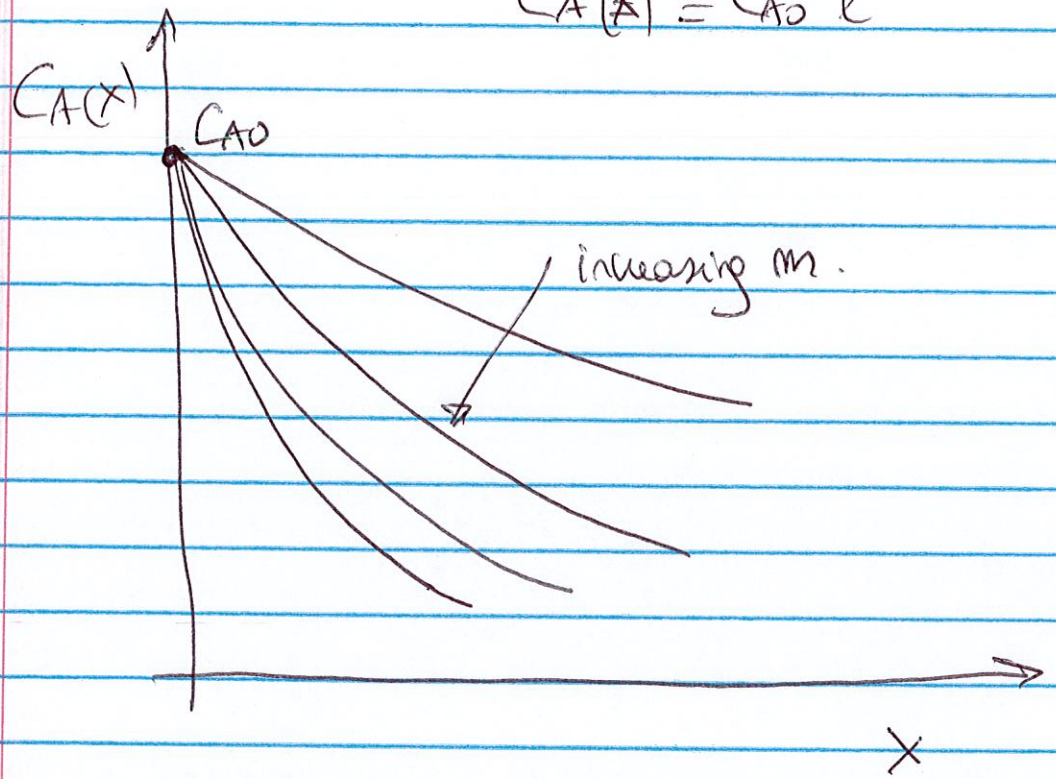
$$\frac{d^2 C_A(x)}{dx^2} - m^2 C_A(x) = 0$$

$$m^2 = \frac{K}{D} \Rightarrow m = \sqrt{\frac{K}{D_{A,m}}}$$

For m large

$$C_A(x) = C_{A0}\, l^{-mx}$$

$$C_A(x) = C_{AO}\, e^{-mx} \qquad (2)$$



if D_{AB} has units of $\frac{m^2}{s}$ why $\dot{n}$ (mol) flow has units of mass/mol per time.

$$N_{A,x} = -D_{AB} A \frac{dC_A}{dx}$$

Mass flow

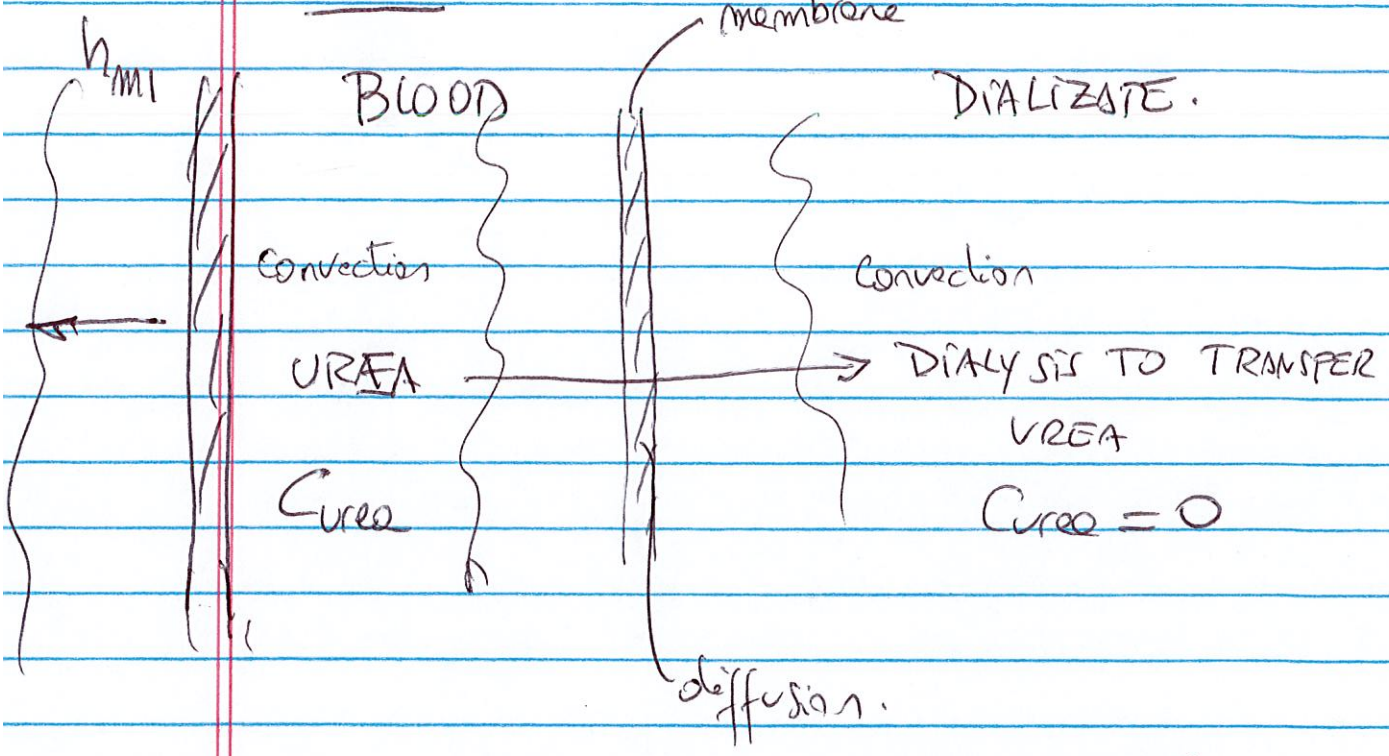
$$\frac{m^2}{s} \times m^2 \times \frac{kg}{m^3/m} = \frac{kg}{s}$$

$$\frac{mol}{m^3} \rightarrow \frac{moles}{s}$$

MASS FLUX

$$n_{Ax} = \frac{N_{A,x}}{A} = \frac{moles}{m^2 \cdot s} \text{ or } \frac{mol}{m^2 \times s}$$

Problem 1



steady state versus ~~unsteady state~~ ??

$$n_{ureax} = \frac{C_{urea,blood} - C_{urea,dializate}}{\frac{1}{h_{m1}} + \frac{\ell}{D_{urea,m} \times K^*} + \frac{1}{h_{m2}}}$$

$\frac{1}{h_{m1}}$ ← mass convection in blood

$\frac{\ell}{D_{urea,m} \times K^*}$ ← diffusion in membrane

$\frac{1}{h_{m2}}$ ← mass convection in dializate

what units will have $n_{urea,x}$? $\frac{g}{m^2 \cdot s}$

how could we calculate the number of tubes.

$$N_{urea,x} = A \times \Gamma_{urea,x}$$

A: $\pi D L \times N_T$ — Area of tube.

$N_{urea,x}$: $\frac{g}{s}$ — FLOW

$\Gamma_{urea,x}$: $\frac{g}{s \times m^2}$ — FLUX