Lecture 31 review:

$-\frac{\partial \mu}{\partial x} - \gamma v + F_{random} = ma \approx 0$

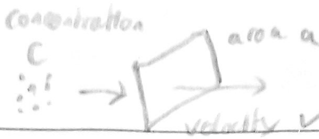
γv: $F_{friction}$

solving in random case: $\mu = 0 \rightarrow \langle \delta x^2 \rangle = 2Dt$, $\gamma = \frac{1}{u} = \frac{k_B T}{D}$

case #2: $F_{random} = 0 \rightarrow V_{drift} = \frac{z}{\gamma} \mathcal{E}$

- z ← molar charge
- $\mathcal{E}$ ← electric field
- γ ← friction coefficient

Flux: concentration C



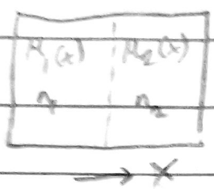
$J\left(\frac{moles}{m^2 \cdot s}\right) = V \cdot C$ (V: m/s; C: moles/m³)

$J = \frac{-1}{\gamma} \frac{\partial \mu}{\partial x} \cdot C = \tau U \frac{\partial \mu}{\partial x}$

Lecture 32: "Physicochemical reactions"

- Reactions } dynamics, like $c(x,t)$
- Diffusion }

- $G = \mu n$, $\mu = \frac{\partial G}{\partial n}$



$\rightarrow J = \tau U \frac{\partial \mu}{\partial x}$

- $\frac{-\partial \mu}{\partial x}$ = molar force
- $\left(\frac{\partial E}{\partial x}\right)_{S,V}$ = -force (at const. S, V)
- $\left(\frac{\partial G}{\partial x}\right)_{T,P}$ = force (at const. T, P)
- $\frac{\partial G}{\partial x \partial n} = \frac{\partial \mu}{\partial x}$ = -force (at const T, P, per mole)

- F_{random} is neglected → can't apply this to single or few molecules.
- How much is enough? C.L.T.

$\bar{x} = N\langle x_i \rangle$, $\sigma_x^2 = N(\sigma_{x_i}^2)$ } $\frac{\sigma_x}{\bar{x}} = \frac{1}{\sqrt{N}}$

- HWK: T1.1

$\mu_{gi} = \mu(T, P, x) + \mu_{fi}$

E	$q \cdot V_e$ (q: coulombs)	$F \cdot L$	$A \cdot \sigma$ (A: area; L: force/distance)
μ	$z \cdot V_c$ (z: coulombs/mole)	$F \cdot l$	$a \cdot \sigma$ (a: area/mol; σ: surface tension)

$\frac{\partial \mu_{gi}}{\partial x} = \frac{\partial \mu_i}{\partial x} + \frac{\partial \mu_i}{\partial T}\frac{\partial T}{\partial x} + \frac{\partial \mu_i}{\partial P}\frac{\partial P}{\partial x} + \frac{\partial \mu_{fi}}{\partial x}$

($\frac{\partial \mu_i}{\partial T}$: S_i; $\frac{\partial \mu_i}{\partial P}$: V_i)

$= \frac{\partial \mu_i}{\partial x} + S_i \frac{\partial T}{\partial x} + V_i \frac{\partial P}{\partial x} + \frac{\partial \mu_{fi}}{\partial x}$

Two Postulates of P.C.M.

1. $\mu_{gi}(x) = \mu_i(T, P, x) + \mu_{fi}(x)$
   - $\mu_i(T, P, x)$: like μ_i but depends on x.
   - $\mu_{fi}(x)$: all other terms, like charge... etc.

2. flux

$J_{xi} = U_i C_i \frac{\partial \mu_{gi}}{\partial x}$