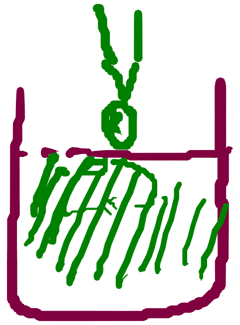
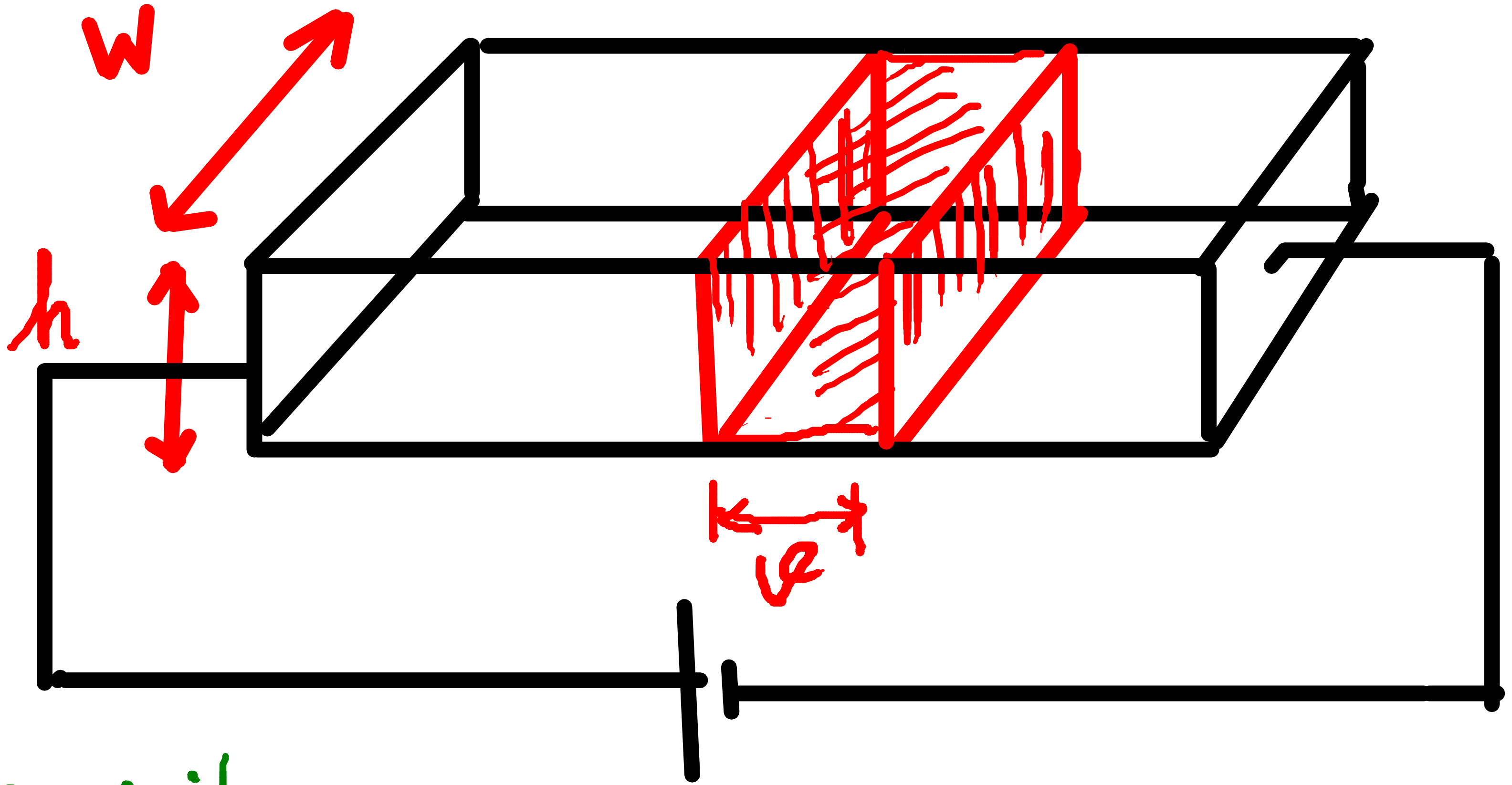


n: total no of e's

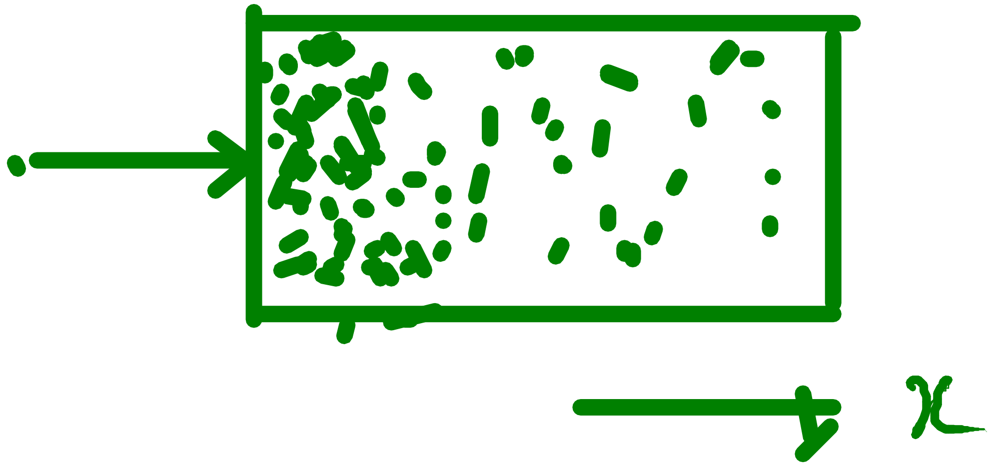
$v = \mu E$



$$I = (w \times h \times v) \cdot n \cdot q$$

$$\frac{I}{A} = \boxed{J = nqv}$$

Dn: Diffusivity



Drift Current Density

$$J \propto \frac{dn}{dx} \rightarrow nq$$

$$\boxed{J_n = q D_n \frac{dn}{dx}}$$

Drift Current density	Diffusion Current Density
→ Due to applied potential	→ Difference in the concentration

Drift Current density

→ Due to applied potential

→ $J_n = q n v$

$\boxed{J_n = q n \mu_n E}$ Electrons

$\boxed{J_p = q p \mu_p E}$ Hole

μ_n : mobility of e^-s

μ_p : — " — holes

Diffusion Current Density

→ Difference in the concentration

→ $\boxed{J_n = D_n q n \frac{dn}{dx}}$ Electrons

$\boxed{J_p = q n D_p \frac{dp}{dx}}$ Holes

D_n : Diffusivity of e^-s

D_p : — " — holes.

Einstein Relation

$$T = 273 + T\,^{\circ}C$$
$$(^{\circ}K)$$

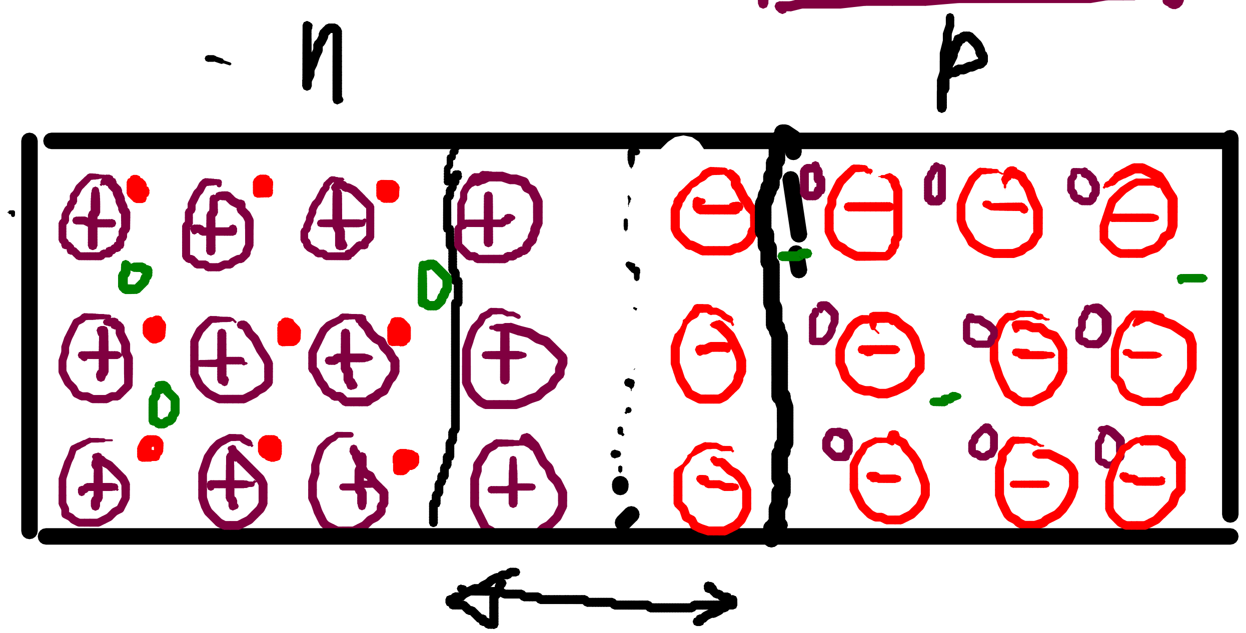
$$\frac{D_n}{\mu_n} = \frac{D_p}{\mu_p} = \frac{kT}{q} =$$

$$\frac{E}{q} = V$$

$$q = \frac{E}{V} = \frac{J}{V}$$

At room temp, $\boxed{26\ mV}$

$$\frac{J/K \times K}{J/V}$$

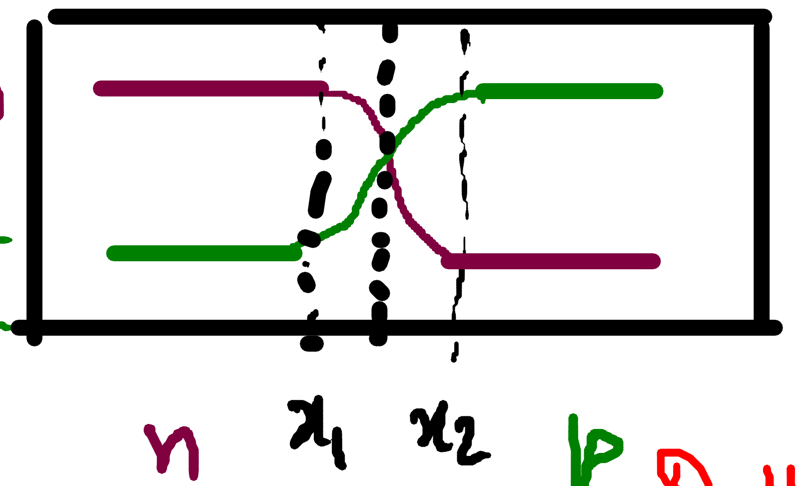


Rusel Ohl

1940

$n_n = N_D$

$p_n = \frac{n_i^2}{N_D}$



$p_p = N_A$

$n_p = \frac{n_i^2}{N_A}$

Equilibrium Condition

$$n \cdot p = n_i^2$$

$$N_D + p = \cancel{N_A} + n$$

$$N_D \approx n$$

$$p = \frac{n_i^2}{N_D}$$

$$n \cdot p = n_i^2$$

$$\cancel{N_D} + p = N_A + n$$

$$N_A \approx p \qquad n = \frac{n_i^2}{N_A}$$

Drift = Diffusion

$$\cancel{q}\, p\, \mu_p E = \cancel{q}\, D_p \frac{dp}{dx}$$

$$\int_{n_i^2/N_D}^{N_A} \frac{D_p}{\mu_p} \frac{1}{p}\, dp = \int_{x_2}^{x_1} E\, dx$$

Integrate

$$\boxed{\frac{D_p}{\mu_p} \ln\left(\frac{N_A N_D}{n_i^2}\right) = V_0}$$

At Room Temp ; $\boxed{V_0 = 26\text{mV} \ln\left(\frac{N_A N_D}{n_i^2}\right)}$ Built-in Potential