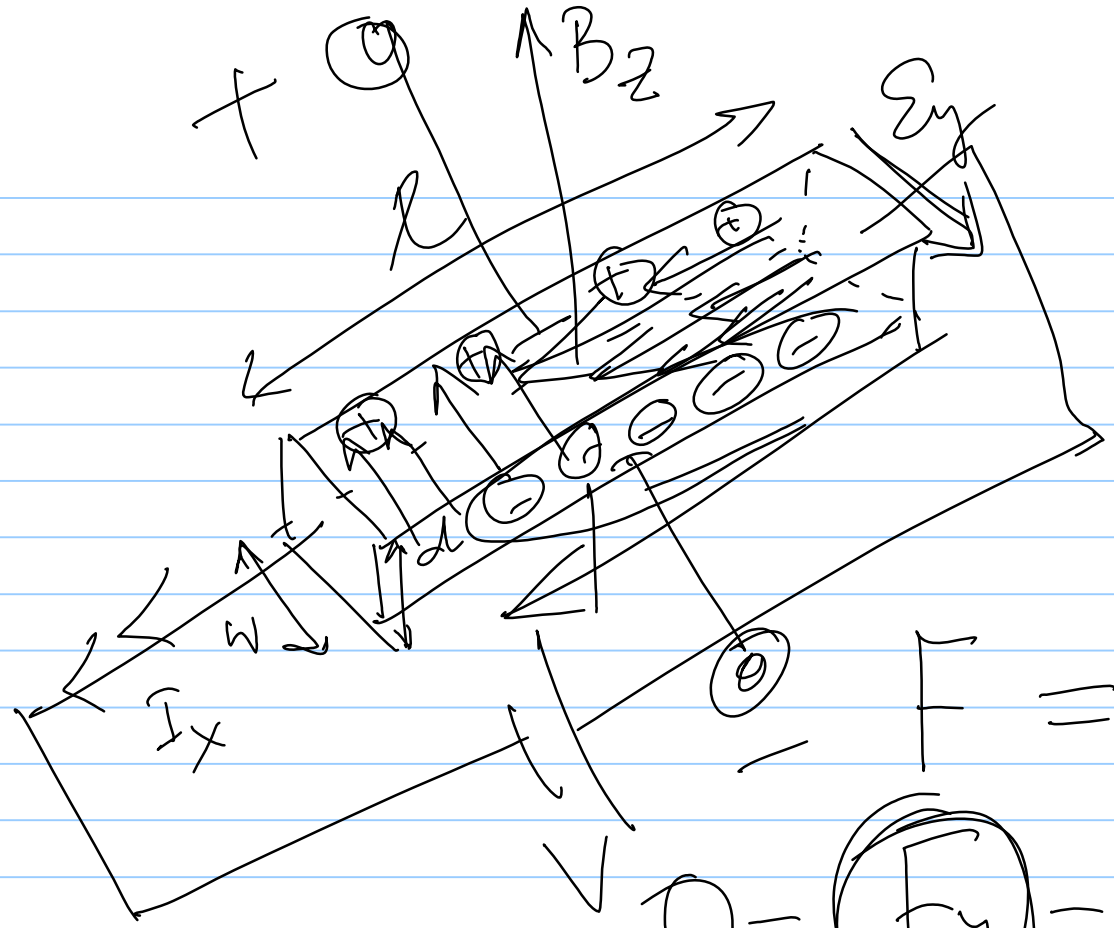
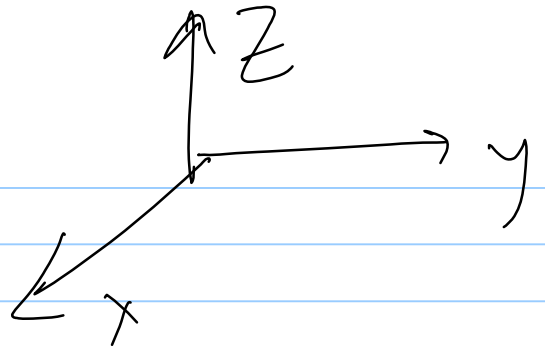
Hall Effect

1/9/2014

⇒ Four Probe method (Conductivity measurement)

- Determine the carrier type
- Determine the concentration
- Mobility





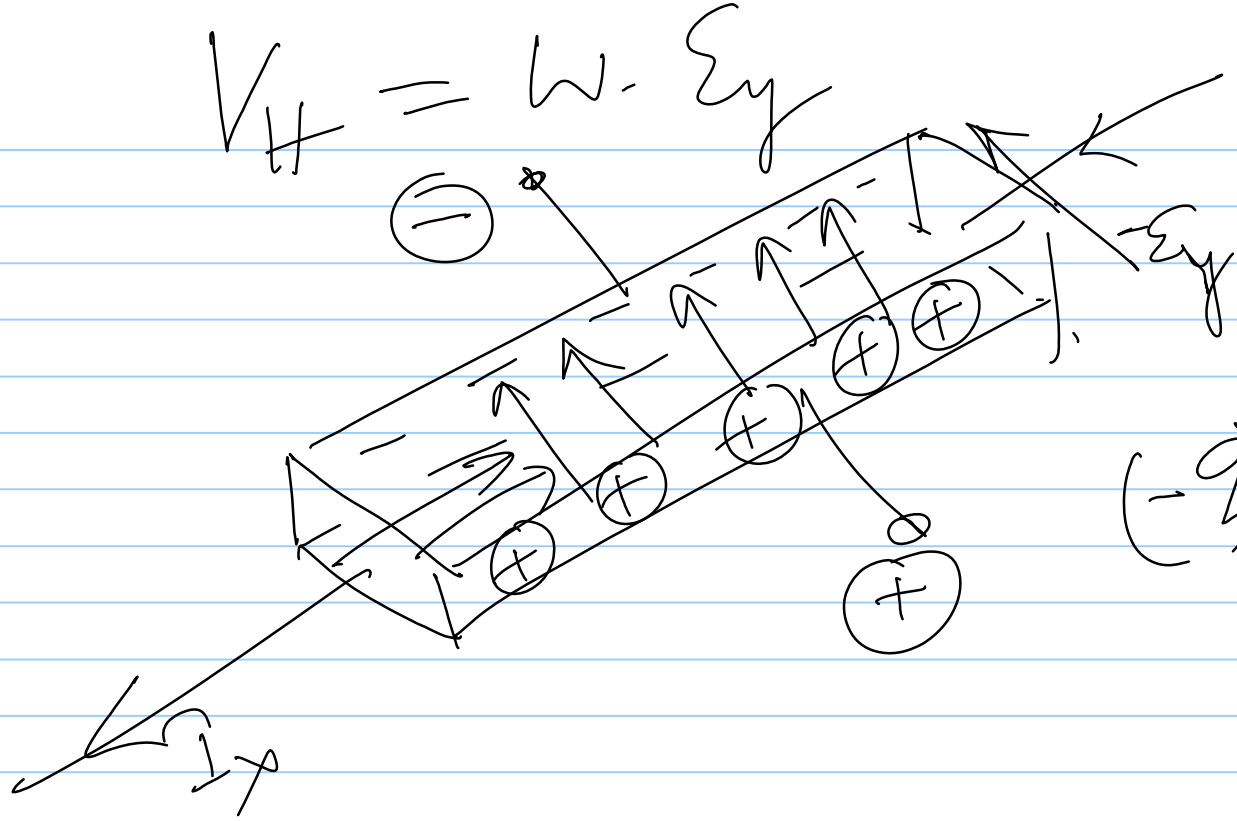
$v \times B$

$$F = q(\mathcal{E} + v \times B)$$

$$0 = F_y = q(\mathcal{E}_y - v_x B_z)$$

$$\boxed{\mathcal{E}_y = v_x B_z}$$

$V_H = w \cdot \mathcal{E}_y$



$(-q)(v) \times B$

$V_H = \mathcal{E}_y w \longrightarrow$ Hall Voltage

$$E_y = v_x \cdot B_z$$

$$= J_x \, B_z$$

$$= \rho \, J_x \, B_z$$

Hall field

$$E_y = R_H \, J_x \, B_z$$

$$E_y = \mu_H \, E_x \, B_z$$

$$\frac{I}{w \cdot d} = J_x$$

R_H = Hall Coeff^n.

$\mu_H \rightarrow$ Hall mobility

$B_z \rightarrow$ Webar/cm^2

$\mu_H \rightarrow$ cm^2/V-sec

Given

I_x, $w, t, d \longrightarrow J_x$

$V_H = E_y \cdot w$

$R_H = -\frac{1}{qn}$

$n = -\frac{1}{e} \cdot \frac{1}{R_H} = \frac{1}{e}\left(\frac{J_x B_z}{-E_y}\right) = ?\ /cm^3$

$\mu_H = \frac{E_y}{E_x B_z}$ //