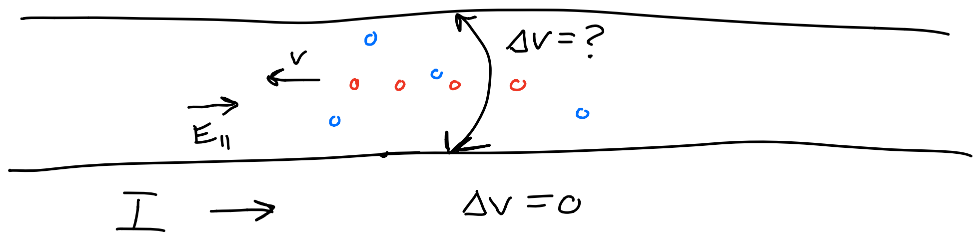
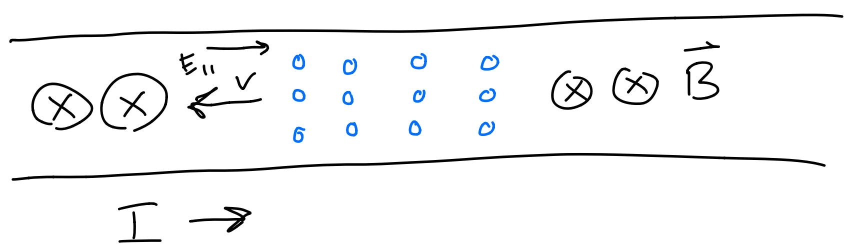
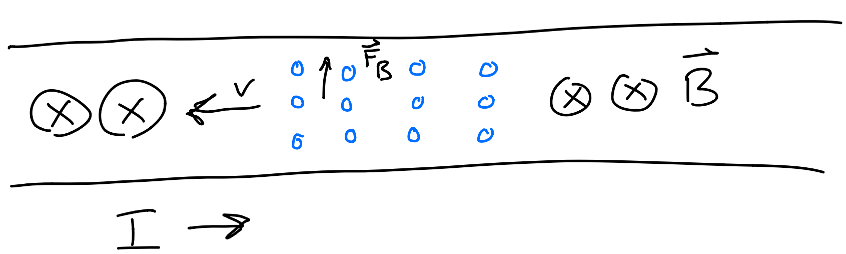


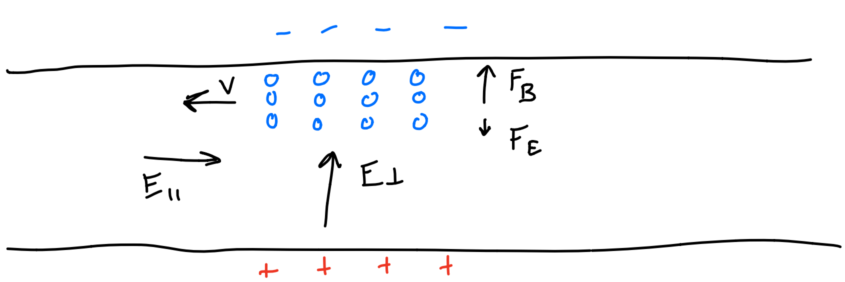
$\Delta V = ?$
v
$E_{\parallel}$
I
$\Delta V = 0$



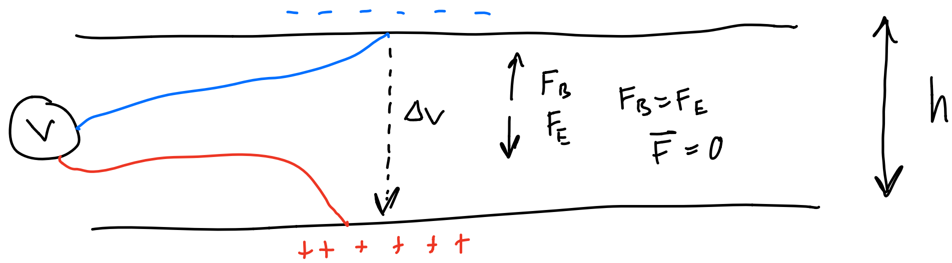
$E_{\parallel}$
v
$\vec{B}$
I



$\vec{F}_B$
v
$\vec{B}$
I



v
F_B
F_E
$E_{\parallel}$
$E_{\perp}$



$\vec{F}_B = \vec{F}_E$

$qvB = qE_\perp , \quad E_\perp = vB$

$$\Delta V = vBh$$

"Hall effect"

Hall Voltage

Example:

$I = 15A$

$h = 5\text{ cm}$

$B = 2T$

$n = 8.4 \times 10^{28}$ (Fe)

$A = 10^{-5}\ m^2$

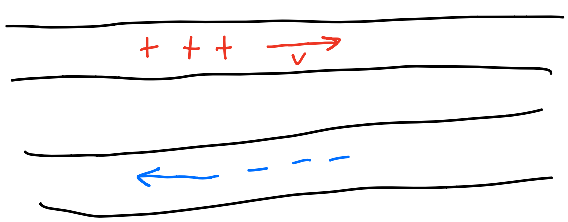
$\Delta V = vBh, \quad I = enAv \Rightarrow v = \dfrac{I}{enA} = \dfrac{15}{(1.6\times10^{-19})(8.4\times10^{28})(10^{-5})}$

$v = 1.11 \times 10^{-4}\ m/s$

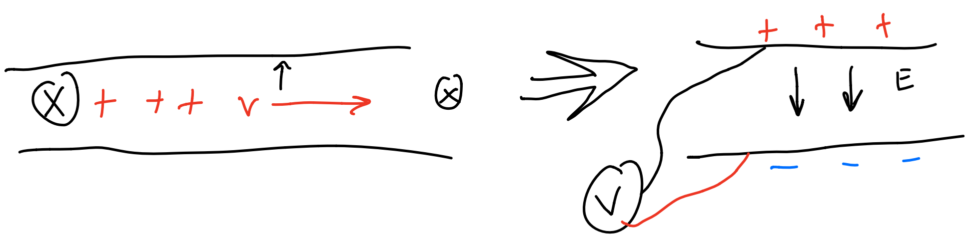
$\Delta V = vBh = (1.11\times10^{-4})(2)(0.05) = 4.5\times10^{-6}\,V$

Applications of Hall Voltage

- Determine sign of charge carriers



$\vec{B}$ field is the same



$\Delta V = -vBh$

- Determine "n"

$$\Delta V_{Hall} = vBh \,, \quad v = \frac{I}{enA}$$

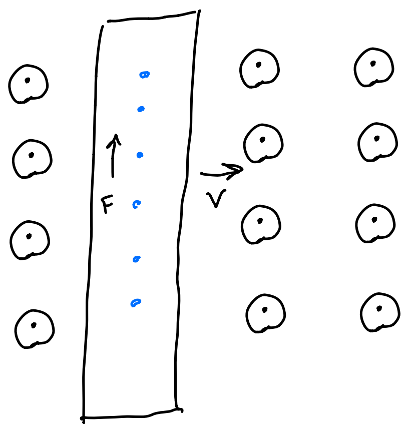
$$\Delta V_H = \frac{IBh}{enA}$$

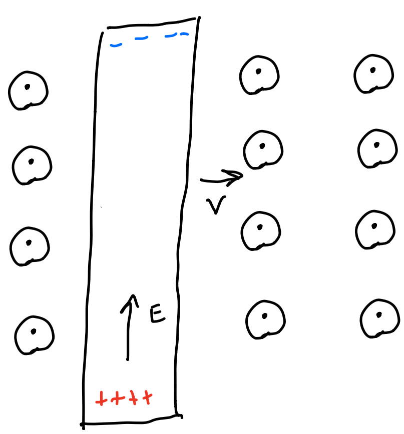
$$n = \frac{IBh}{e\Delta V_H A}$$

Motional EMF

Motional EmF

- External Field exerts a force on current
- Moving wire within a magnetic field generates a current in a moving wire





Eq: $E = vB$