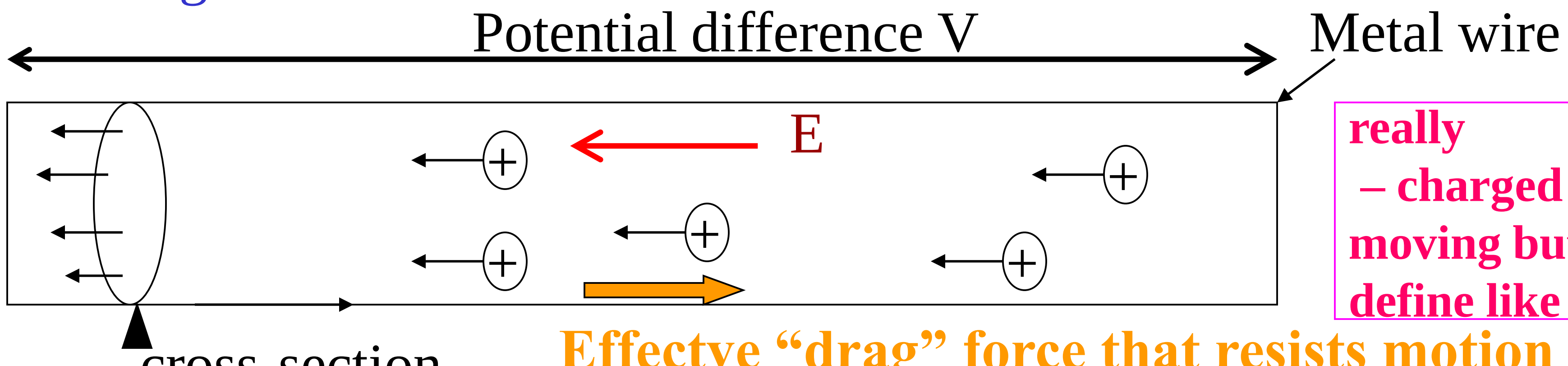
Charges in motion



really – charged e^- moving but define like +

Effectve "drag" force that resists motion

charge Δq flows through in Δt

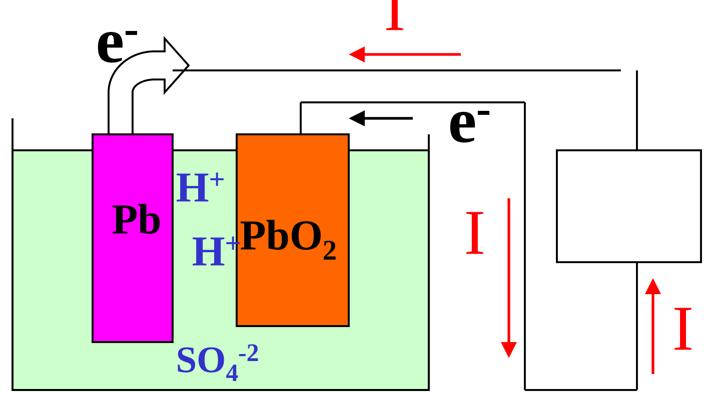
$$I = \frac{\Delta q}{\Delta t}$$

$$\text{current} = \frac{\text{coulombs}}{\text{sec}} = \text{ampere}$$

Electric Potential Source

$Pb + SO_4^{-2} \Rightarrow PbSO_4 + 2\ e^-$

$PbO_2 + SO_4^{-2} + 4H^+ + 2e^- \Rightarrow PbSO_4 + H_2O$



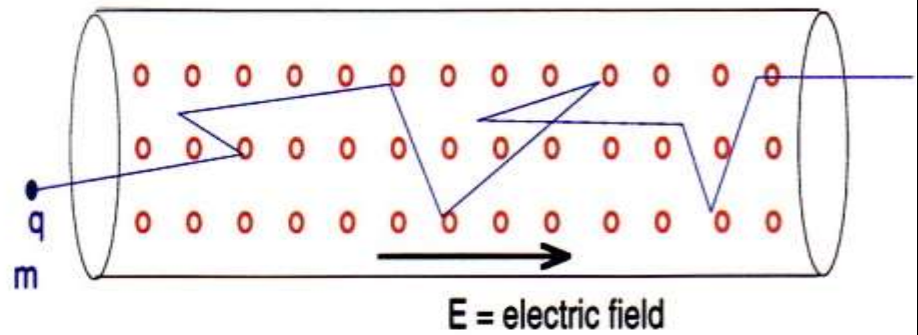
I (+ current by def.)

Battery – dry cell 1.5V

Hg cell 1.35V

Chemical energy ⟶ electrical energy

3.1-OLO



in straight paths between collisions

$$F = ma \longrightarrow qE = ma \longrightarrow \boxed{E = \frac{m}{q} a}$$

E & a constant

(along E direction)

$$\boxed{v = v_i + a\,t}$$

<u>collision time approximation</u>

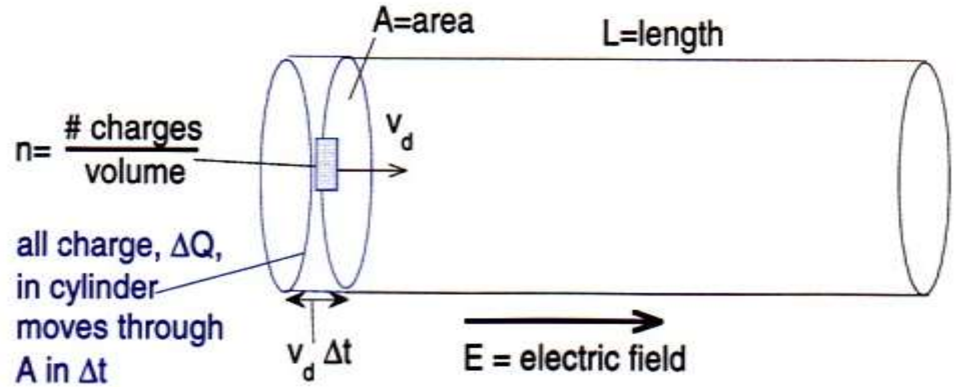
on average after time (2 τ) collision brings charge q to a dead stop [v= 0]

$$v_{drift} = v_d \longrightarrow v_d = \bar{v} = \frac{0 + 2a\tau}{2} = a\tau \longrightarrow \boxed{a = \frac{v_d}{\tau}}$$

$$v_i = 0 \qquad v_f = 2a\tau$$

$$\bar{v} = \frac{v_i + v_f}{2}$$

$$\therefore \boxed{E = \frac{m}{q\tau} v_d}$$



$$\Delta Q = n\,(v_d \Delta t) A$$

$$I = \frac{\Delta Q}{\Delta t}$$ = electric current (charge flowing through wire /time

$$\therefore \; I = n\,A\,v_d \qquad \boxed{v_d = \frac{I}{n\,A}}$$

but recall

$$\boxed{E = \frac{m}{q\tau} v_d} \longrightarrow E = \frac{m}{q\tau}\frac{I}{n\,A}$$

$$E = \left[\frac{m}{n\,q\tau}\right]\left[\frac{1}{A}\right] I$$

multiplying both sides by the lenght of the wire L

$$EL = \left[\frac{m}{n\,q\tau}\right]\left[\frac{L}{A}\right] I$$

3-2-OLO

$$EL = \left[\frac{m}{n q \tau}\right]\left[\frac{L}{A}\right] I$$

$$V = \rho \left[\frac{L}{A}\right] I$$

electrical resistivity

$$\rho = \left[\frac{m}{n q \tau}\right]$$

marerial's reluctance
to carry current

Ohm's Law

$$V = R\,I$$

applied voltage

resistance

current

$$R = \rho \left[\frac{L}{A}\right]$$

material property

geometrical factor