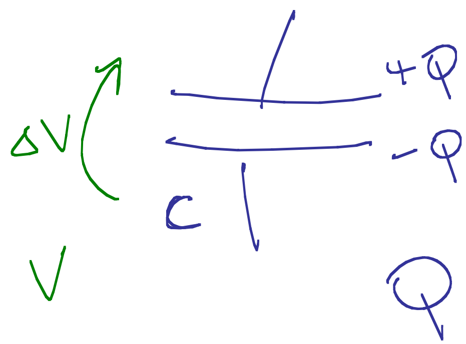
Phys 2120-4 9/21/12

Note Title 9/21/2012

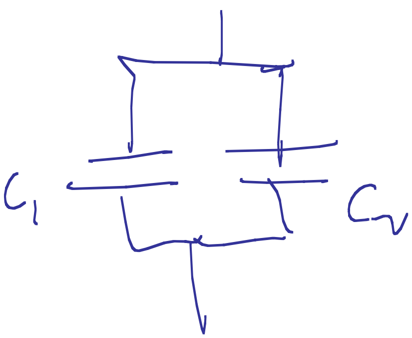
Capacitors



$Q = CV$

C in Farads

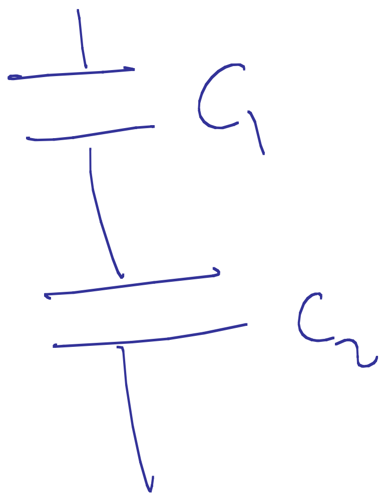
Combine capacitors



$C_{eq} = C_1 + C_2$

Energy stored at potential V

$U = \frac{1}{2} C V^2$

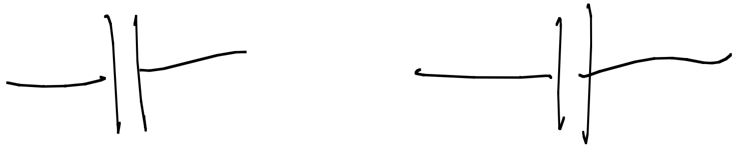


$$\frac{1}{C_{eq}} = \left(\frac{1}{C_1} + \frac{1}{C_2}\right)$$

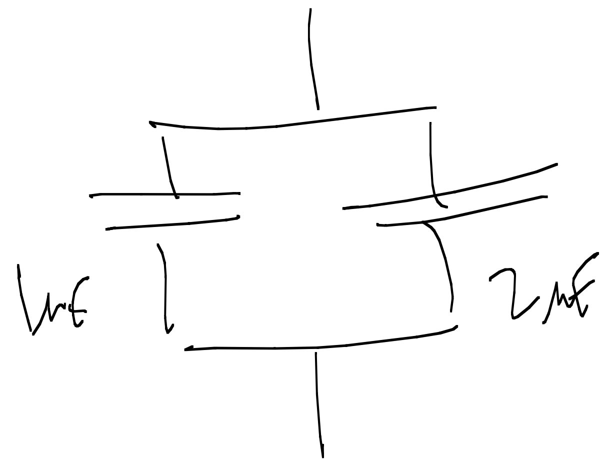
in general:

$$\frac{1}{C_{eq}} = \left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots\right)$$

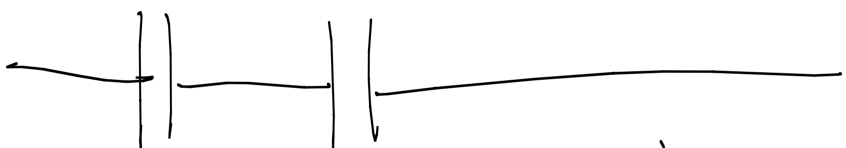
23.29 You have a 1.0 μF and 2.0 μF capacitor. What cap. can you get by conn. is series or parallel?



1.0 μF   2.0 μF



$= 3\ \mu F$

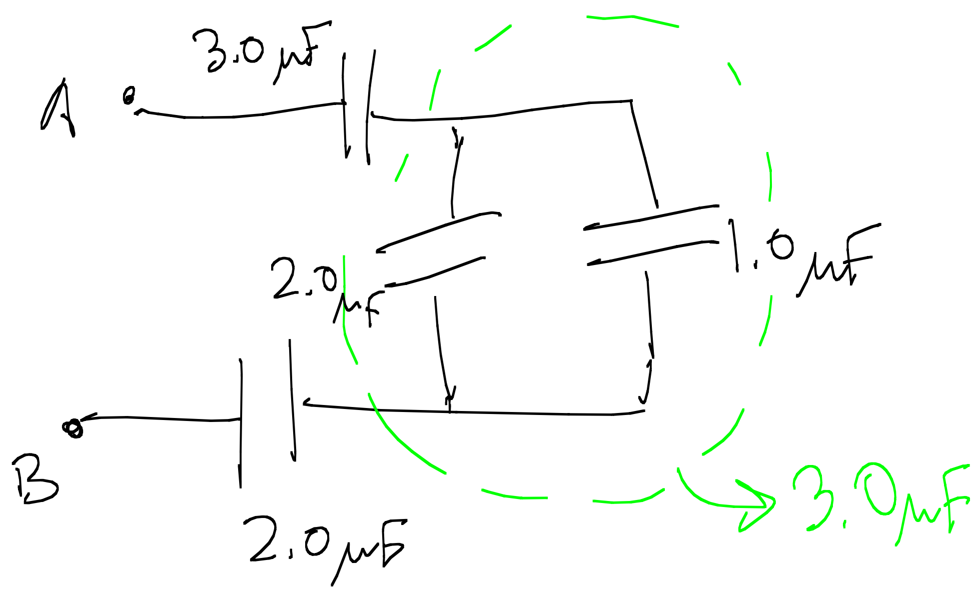


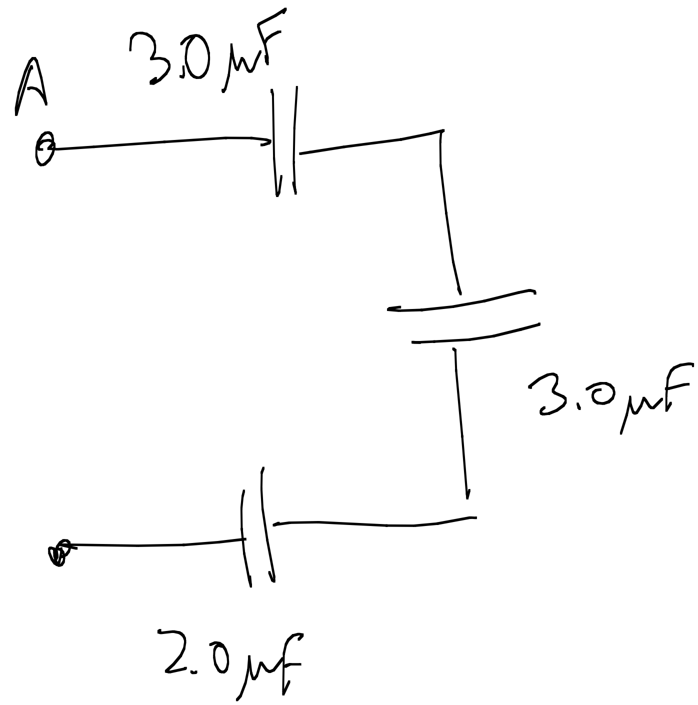
1 μF   2 μF

$$\frac{1}{C_{eq}} = \left(\frac{1}{1\,\mu F} + \frac{1}{2\,\mu F}\right)$$

$C_{eq} = 0.667$ μF

23.51 What's the equivalent cap. measured between A and B:





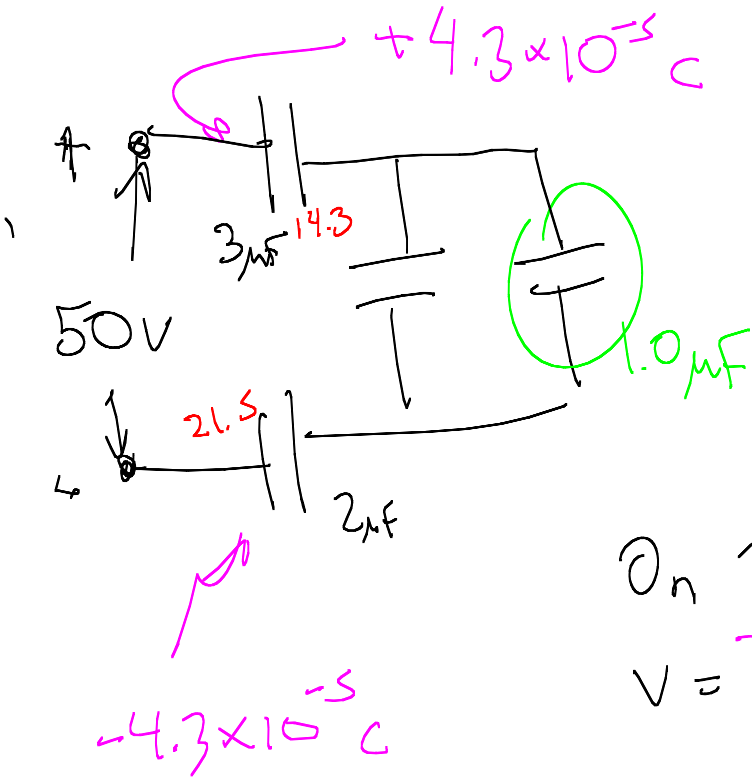
Now, 3 in series

$$\frac{1}{C_{eq}} = \left(\frac{1}{3\mu F} + \frac{1}{3\mu F} + \frac{1}{2\mu F} \right)$$

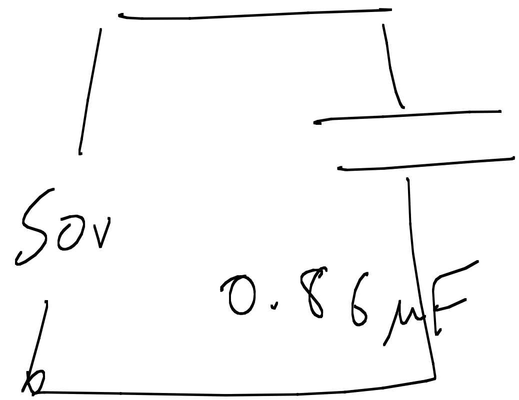
$$\boxed{C_{eq} = 0.86\mu F}$$

Next problem

23.52 In this config of cap's find the energy stored in the 1.0 μF cap when a 50-V battery is conn'd across A & B ?



$$U = \frac{1}{2} C V^2$$



On $3\mu F$

$$V = Q/C = \frac{4.3\times10^{-5}\,C}{3\,\mu F}$$

$$= 14.3\,V$$

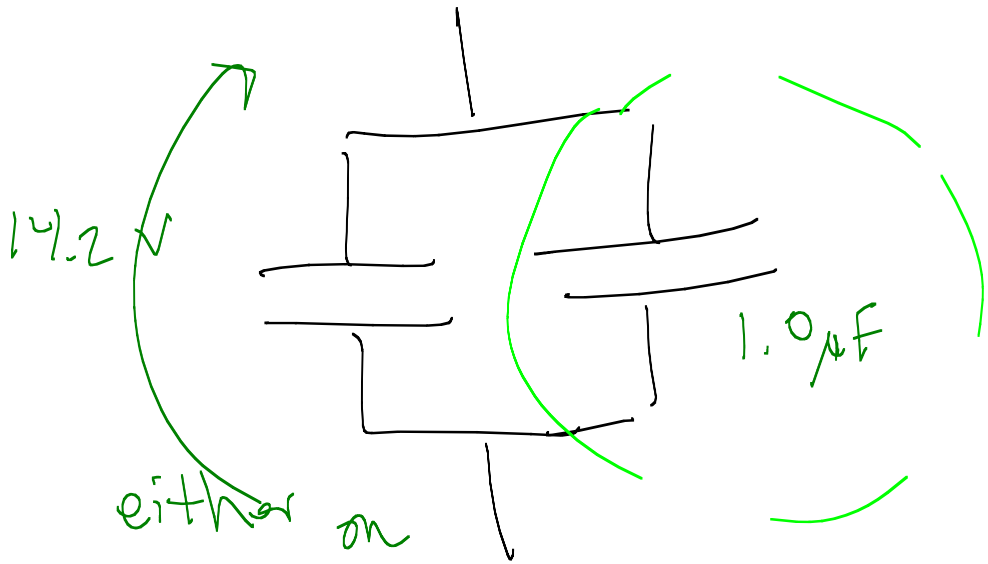
$$Q = (50)(0.86\,\mu F)$$

$$= 4.3\times10^{-5}\,C$$

On $2\mu C$ $\quad V = \frac{Q}{C} = \frac{4.3\times10^{-5}\,c}{2\,\mu F} = 21.5\,V$

Potential across the parallel pair is

$$50\,V - 14.3 - 21.5 = 14.2\,V$$



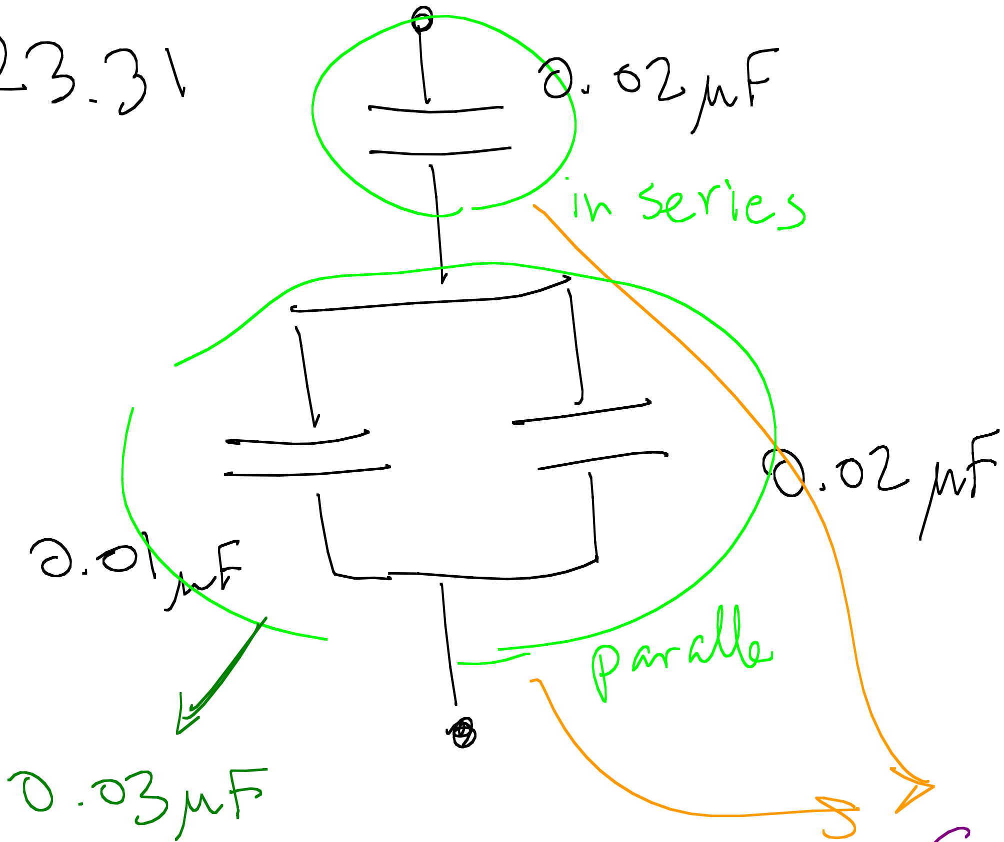
$$U = \frac{1}{2} C V^2$$

$$= \frac{1}{2} (1.0\,\mu F)(14.2\,V)^2$$

$$= 1.00 \times 10^{-4}\,J$$

$$= 100\,\mu J$$

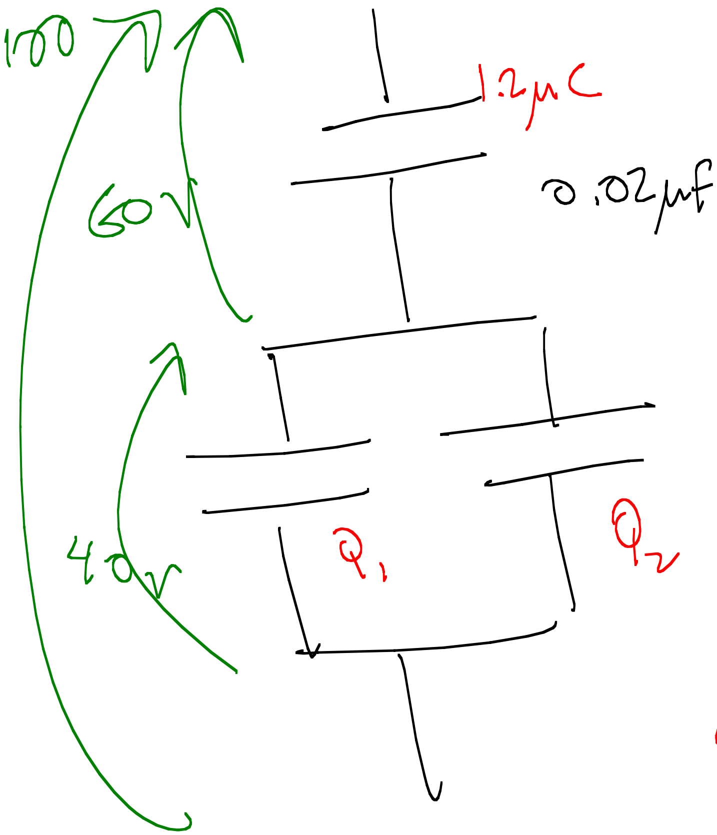
23.31



a) Find C_{eq}

b) Find charge & voltage on each cap when 100-V battery is connected across terminals.

$C_{eq} = 0.012\ \mu F$



$$\underline{100\text{V}}$$

$C_{eq} = 0.012\ \mu F$

$Q = CV$

$Q = (0.012\mu F)(100V)$

$= 1.2\ \mu C$

$Q_1 + Q_2 = 1.2\ \mu C$

On top capacitor $V = \frac{Q}{C} = 60\ V$

$= 1.2\mu C / 0.02\mu F$

On the bottom two cap's

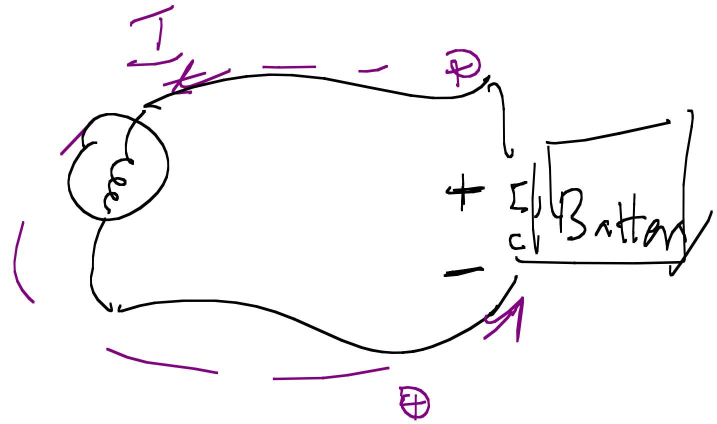
$V_1, V_2 = 40\,V$

$Q_1 = C_1 V_1 = 0.4\,\mu C$ $\qquad$ $Q_2 = C_2 V_2 = 0.80\,\mu C$

$$\left(Q_1 + Q_2 = 1.2\,\mu C \right)$$ ✓

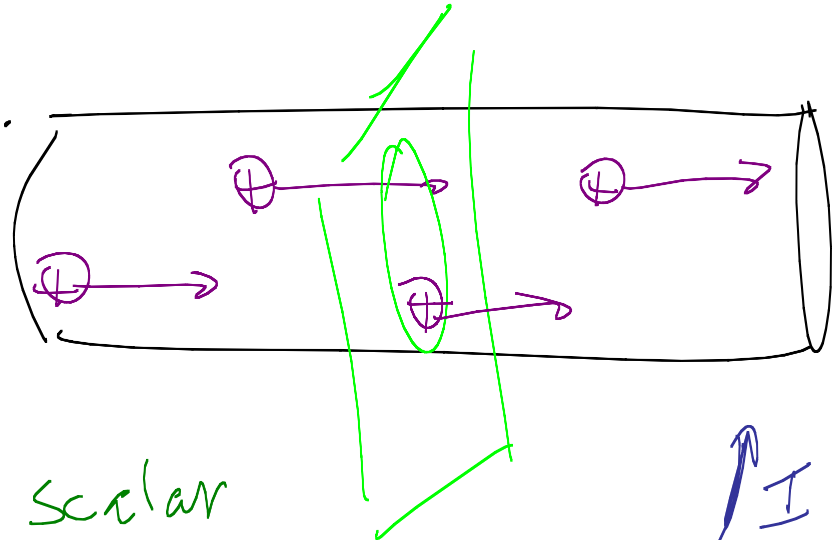
Chap 24 Electric Current

Current is produced when we maintain a potential diff across conductor, allow charge to keep flowing



Pictures denote a fictitious positive current

Reality, neg. electrons move.

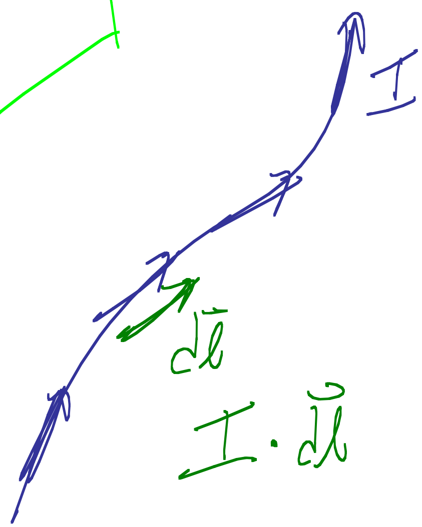


Measure charge per time crossing plane. ⟶ current.

I scalar

$[I] = \dfrac{\text{Coulomb}}{\text{sec}}$

$= \text{Amp}$

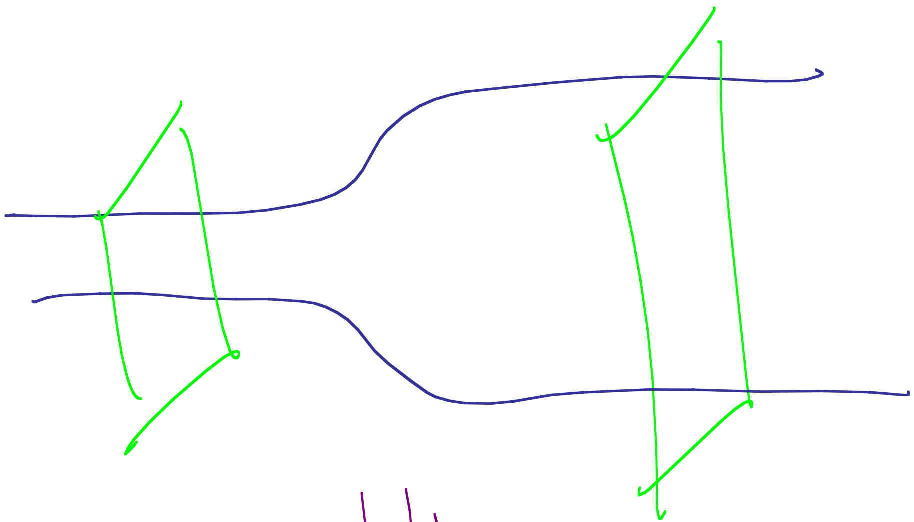


Ampere

$= \text{Elec. current} = I$

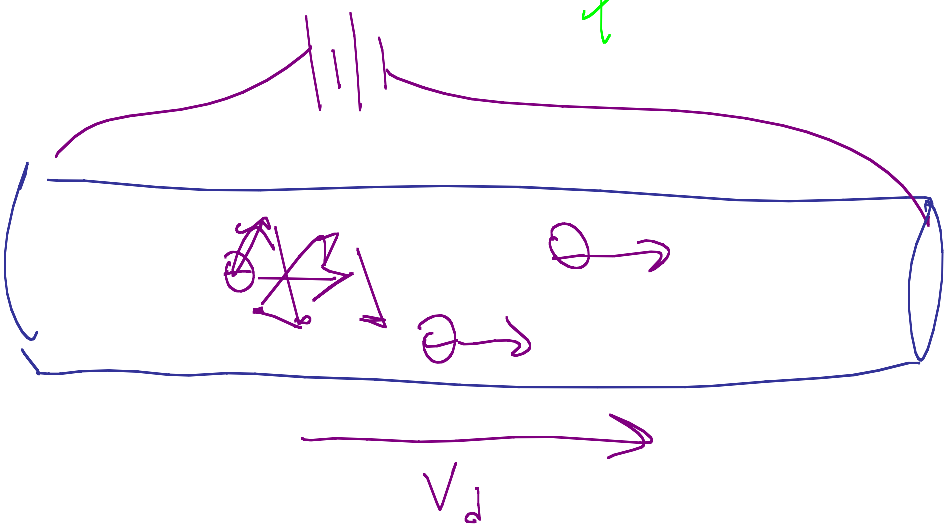
$= Q/t$

$I \cdot d\vec{l}$ later



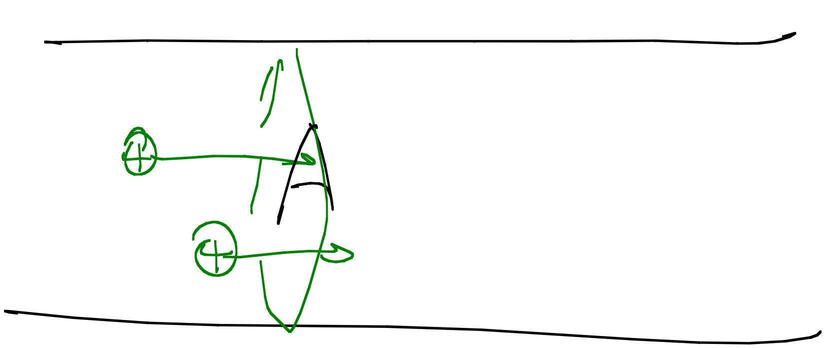
$$I = \frac{dQ}{dt}$$

I will be time-dep't



V_d (net vel of electrons) extremely slow

Snail's pace



A = x sec area of wire

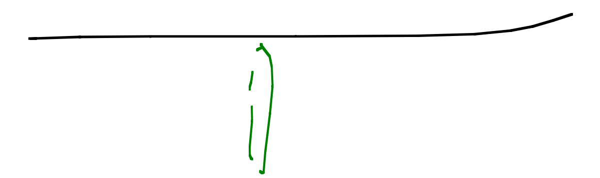
q = charge of one charge carrier

V_d = drift velocity

n = number density / volume

Can show

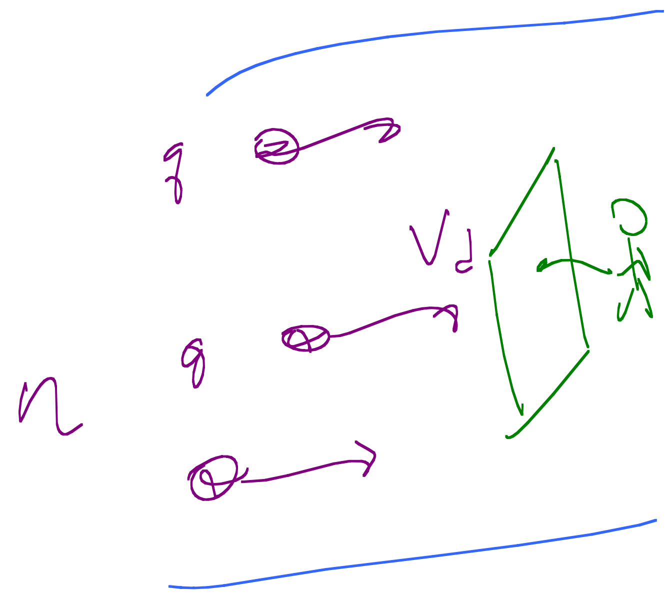
$$I = n A q V_d \quad C/s$$



Sometimes deal with current density

$$J = I/A = n q V_d \qquad Amp/m^2$$

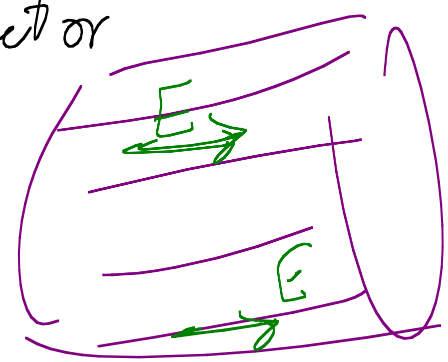
Really vectors $\vec{J} = nq\vec{v}_d$



In a real conductor current is related to potential difference of ends of particular conductor

Actually, discuss $\vec{E}$

$\vec{J} = \sigma \vec{E}$



$J = nqv_d$