Physics 114 - February 9, 2010

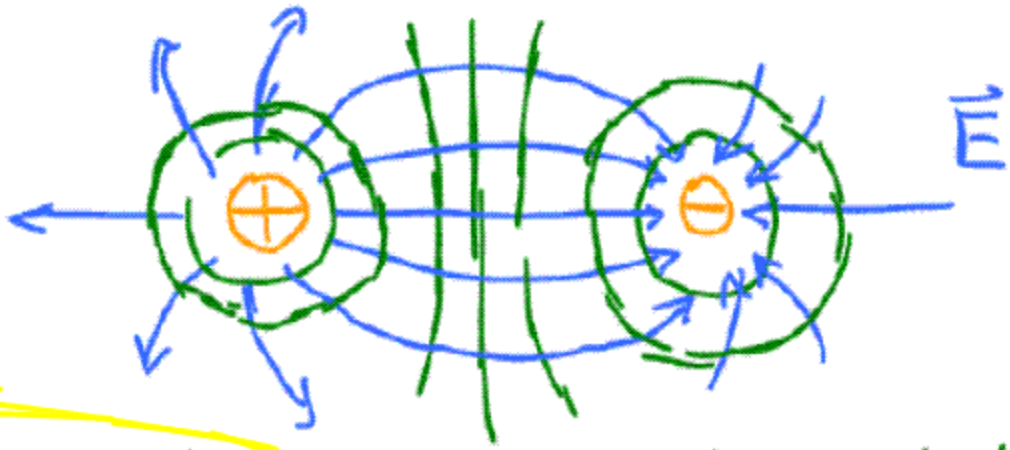
- Exam 1 This Thursday
- P.S. 4 Due a week from Thursday
  Don't let it go too long....
- No lecture in Hoyt Tuesday, Feb. 16

  PDF Slides + Mp3 Audio file } on your own before class on Feb 18

  Will post + send links soon.

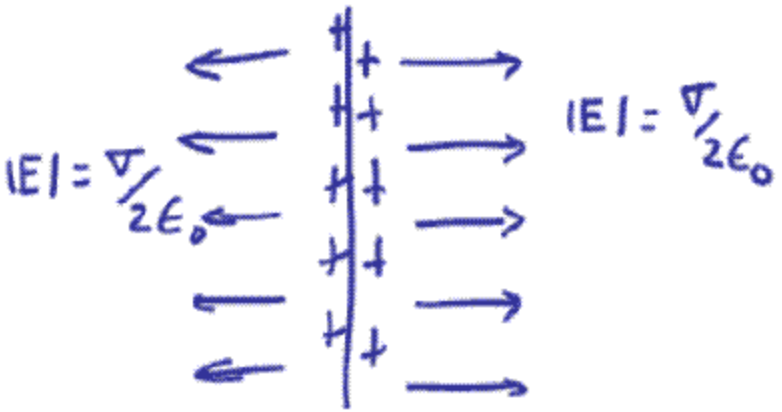
Last Time:

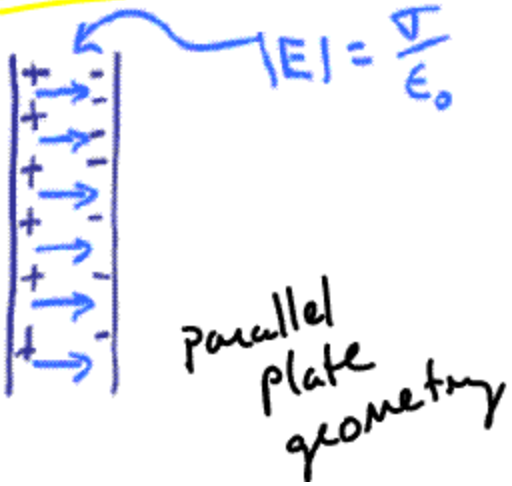
Equipotential lines $\perp$ to $\vec{E}$

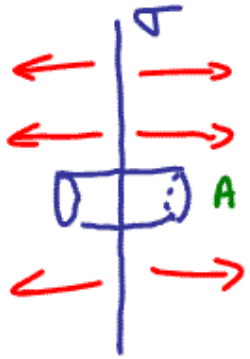


lines of equipotential

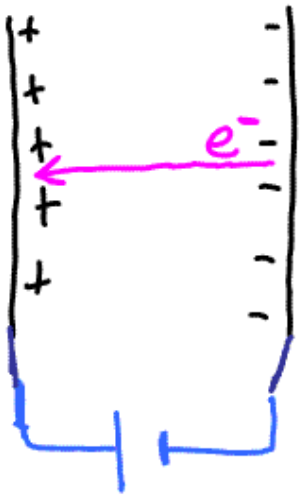
∞ plane of chg







$$\oint E \cdot dA = 2EA = \frac{\sigma A}{\epsilon_0}$$



1 Volt

What is energy of e^-?

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

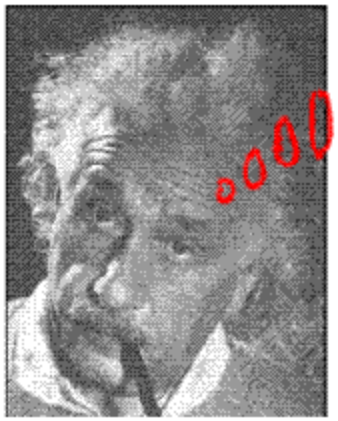
$W = 191\ V$ = KE gain by e^-

$$KE = \left(1.6\times10^{-19}\ C\right) 1\ \frac{J}{C}$$

$$= 1.6\times10^{-19}\ J$$

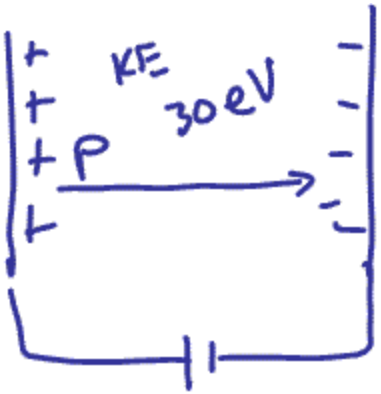
Unit of energy ≡ electron-Volt = eV

$$1\ eV = 1.6\times10^{-19}\ J$$



$E = mc^2$

Speed of light



$$m = E/c^2$$

$$m_{election} = 0.511\ MeV/c^2$$

Physicists often Drop the c being a bit lose

$$m_e = .511\ MeV$$

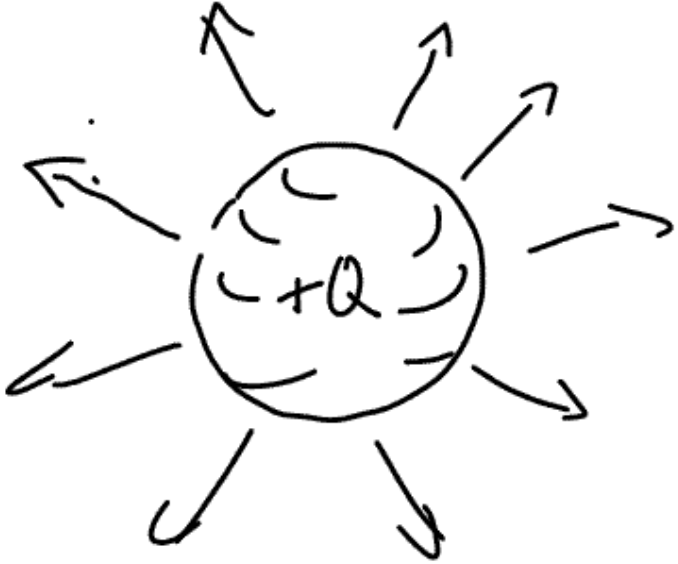
can lead to confusion

Million election-Volts

how does the Potential energy Stored in the system change as Mass 2 is Moved from A → B

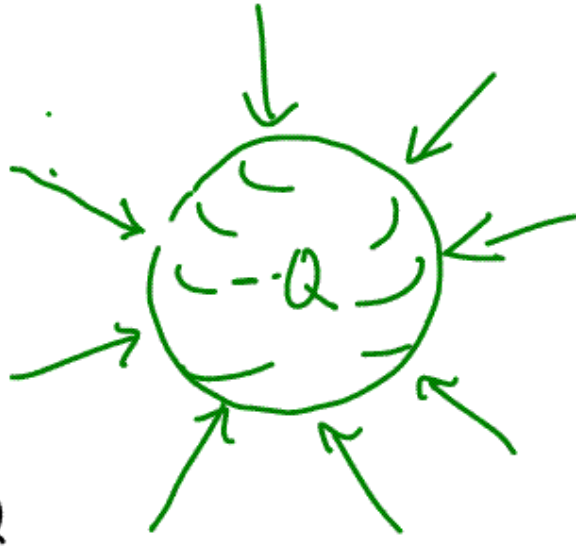
It gets smaller ... imagine Mass 1 being Earth — PE ~ Mgh, if h is smaller the Pot. energy in reduced

Get similar behavior for electromagnetism



$$V_+ = \frac{kQ}{R} \qquad V_+ \propto Q$$

$$\Delta V = V_+ - V_- = 2\frac{kQ}{R} \qquad \Delta V \propto Q$$



$$V_- \propto Q \qquad V_- = -\frac{kQ}{R}$$

$V \propto Q$

$C = \frac{Q}{V} = \frac{\text{Coul}}{\text{Volt}} \equiv \text{Farad}$

$Q = CV$

$C \equiv$ Capacitance

↳ CONSTANT of proportionality

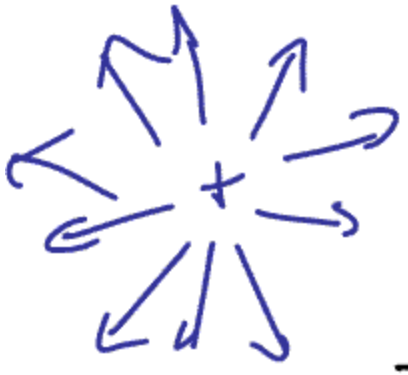
$C \equiv$ Capacitance

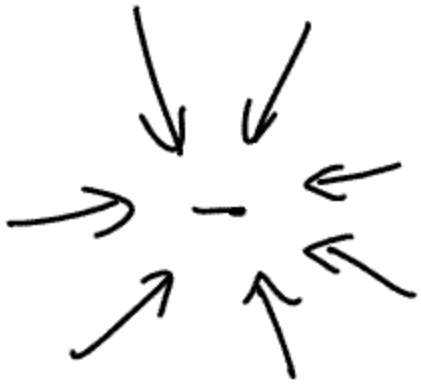
$C \equiv$ Calorie

$C \equiv$ heat capacity

$C \equiv$ speed of light

$C \equiv$ Charge





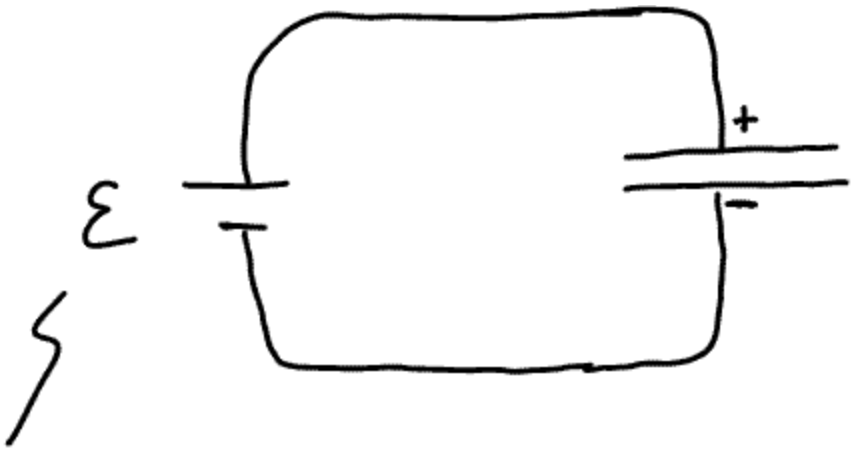
$Q = CV$

↑

Capacitance

Capacitance depends on geometry only

$Q = CV$



C ≡ capacitor

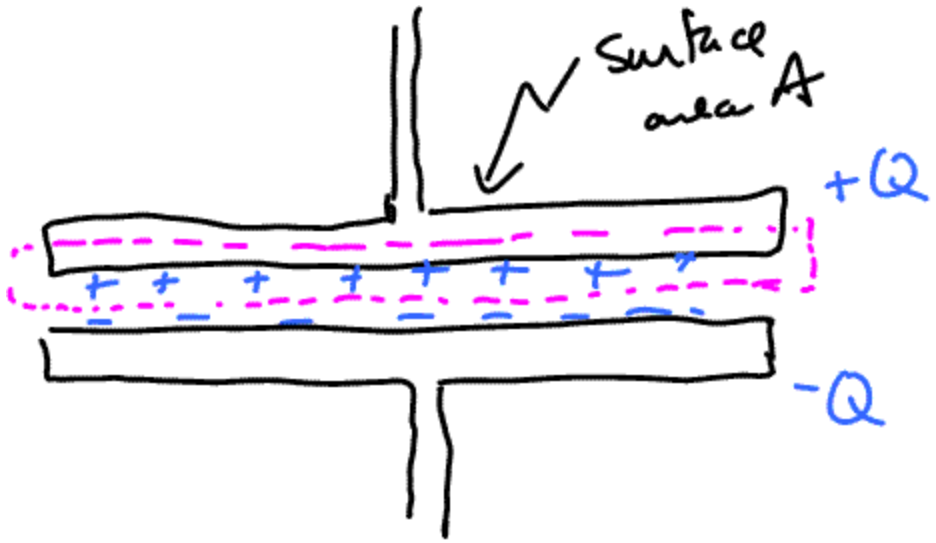
$Q = CV$

$= C\mathcal{E}$

EMF ≡ Electro Motive force

Think of "battery"

ℰ ≡ Maintains potential difference ($\mathcal{E}$) across two points



$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{encl}}{\epsilon_0}$$

$$|\vec{E}|A = \frac{Q_{encl}}{\epsilon_0}$$

$$Q_{encl} = EA\epsilon_0$$

$$Q = CV$$

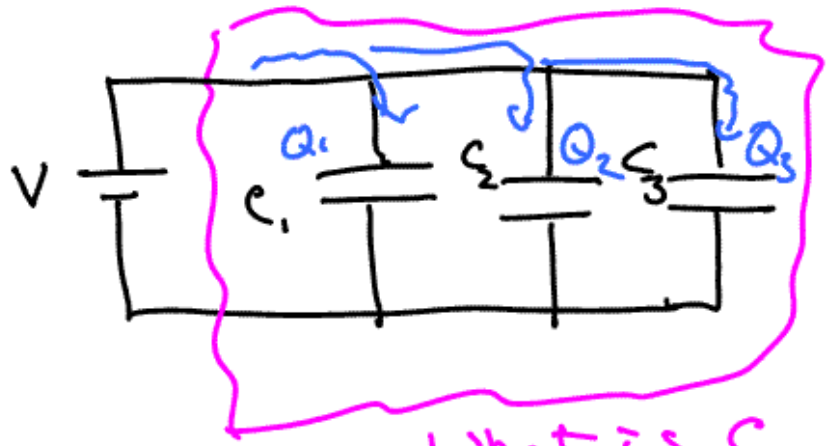
$$C = \frac{Q}{V}$$

$$V = \frac{\omega}{q} = \frac{Fd}{q} = Ed$$

$$C = \frac{EA\epsilon_0}{Ed} = \frac{\epsilon_0 A}{d}$$

Capacitance depends only on geometry

Capacitors in parallel



$Q = CV$

What is C in terms of C_1, C_2, C_3

$Q = CV$

$Q_1 = C_1 V$

$Q_2 = C_2 V$

$Q_3 = C_3 V$

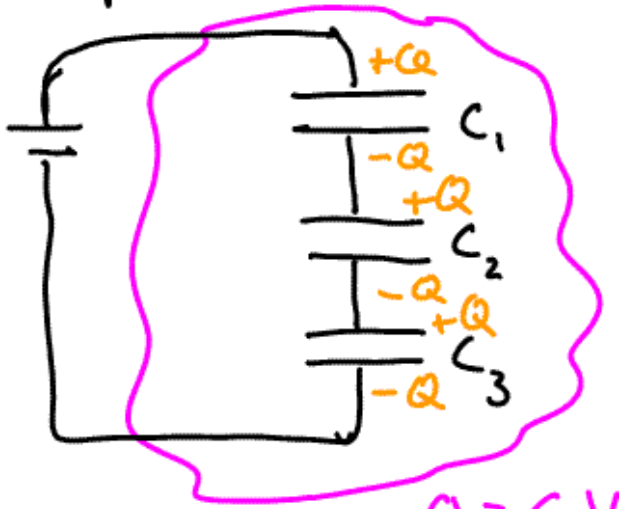
$Q = Q_1 + Q_2 + Q_3$

$Q = C_1 V + C_2 V + C_3 V$

$Q = (C_1 + C_2 + C_3) V$

$$C = \sum C_i$$

Capacitors in series



$Q = CV$

$V = V_1 + V_2 + V_3$

$\frac{Q}{C} V = \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3}$

$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

$$\frac{1}{C} = \sum \frac{1}{C_i}$$