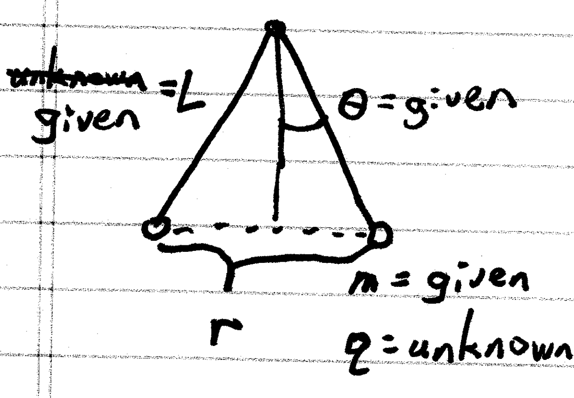
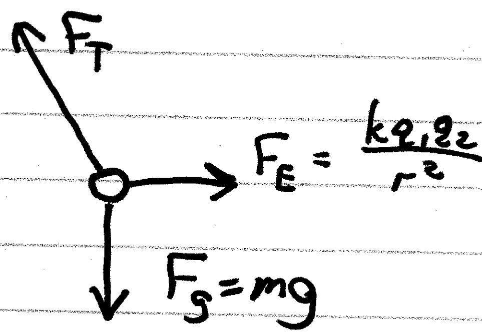
Phys 1402 2014-09-11

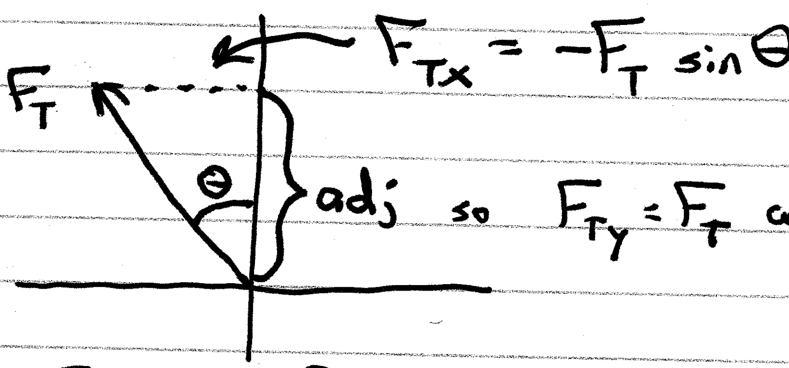
HW1 #5

Static Equilib: Net Force = 0



	x	y
F_E	kq^2/r^2	0
F_g	0	$-mg$
F_T	$-F_T\sin\theta$	$F_T\cos\theta$
Total	0	0





① Find F_T from y-forces.
② Using x-forces, $F_E = F_T \sin\theta$
③ $r = 2(L\sin\theta)$ from geometry

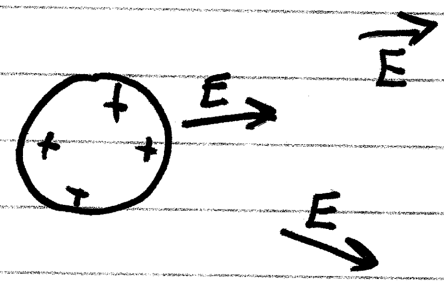
HW1 #9

$E = 3 \times 10^{6}$ N/C is max allowed

Metal ball w/ given R.

$$E = \frac{kq}{r^2} \quad (\text{if } r \geq R)$$

$k = 9 \times 10^{9}$ Nm^2/C^2



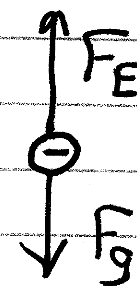
HW1 #10

$E = 4 \times 10^{4}$ N/C $\qquad e = 1.6 \times 10^{-19}$ C

$g = 9.8$ N/kg $\qquad m = ?$

Balance: $F_g = F_e$

$mg = qE$



(1) Find m of droplet.

$$\text{Density} = \frac{m}{Vol}$$

(2) Find Vol

$$Vol = \frac{4}{3}\pi r^3$$

(3) Find r

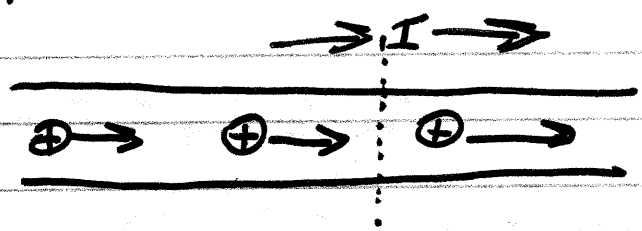
Electron is ⊖. It "bubbles" upward toward higher V. E-Field points "downhill". e^- is pushed against $\vec{E}$.

④ Flow of Charges

Current = I = rate of charge flow

$= \Delta Q / \Delta t$

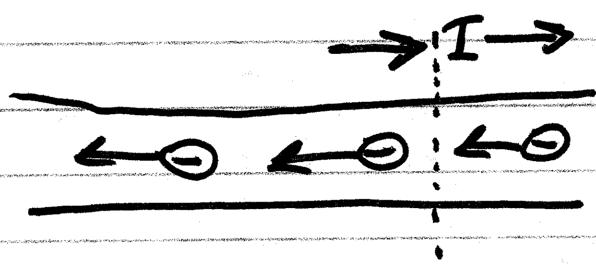
one ampere = 1 A = 1 C/s



ΔQ = charge that passes dashed line

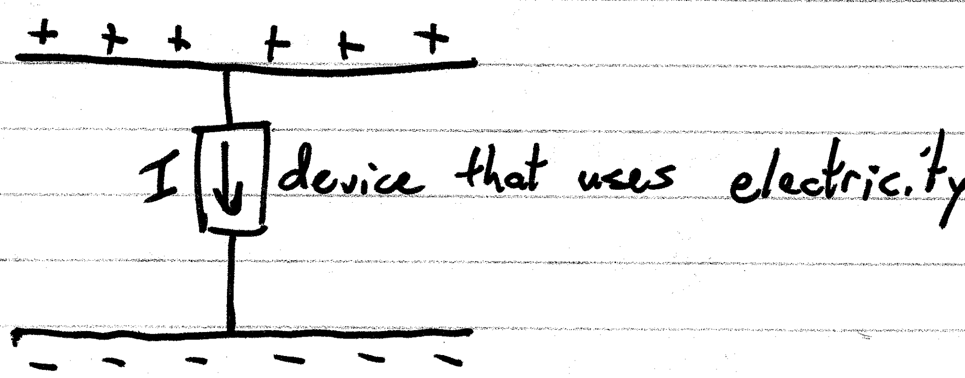
$\Delta Q = I \Delta t$

Conventional Current vs. Electron Flow

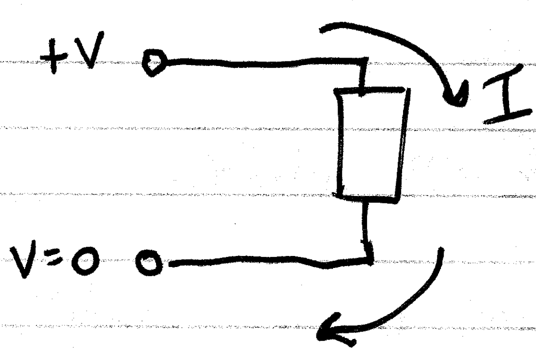


⑤ What makes charges move?

Like water that flows downhill, electric ⊕ charges flow from high-V to Low-V.



Another way of looking at it:



With higher V more I will flow.

Since $V = \frac{\text{Energy}}{\text{charge}}$, changing V means changing the energy of the charges.

See notes from 9-Jul-2014.

$$I = V/R \qquad V = IR$$

$$\text{What you accomplish} = \frac{\text{How hard you try}}{\text{Difficulty of task.}}$$

Example: Typical cell phone

voltage: $V = 4.5\ V$

Current: $I = 0.25\ A$

Effective resistance: $R = \frac{V}{I} = \frac{4.5V}{0.25A} = 18\ \Omega$

Resistance is R measured in ohms (Ω).

Resistance of wires:

Ideally: $R = 0$

Actually: R = small, finite

Longer Length → higher R

Wider width → lower R

The material affects R.

$$R = \rho \ell / A$$

↳ "rho" = resistivity in $\Omega \cdot m$