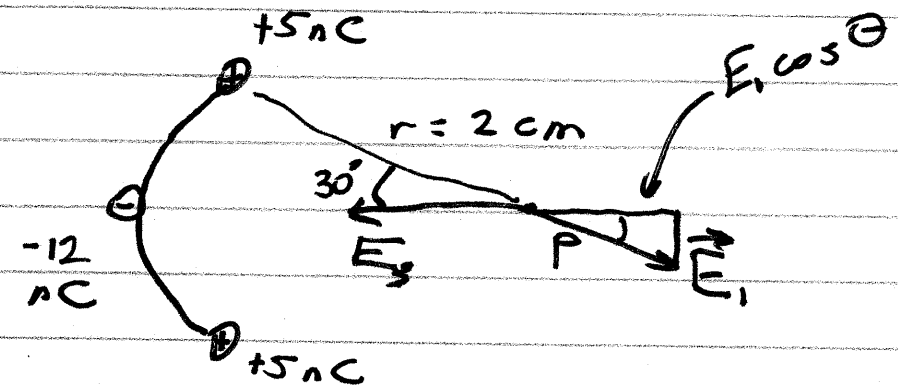
 Phys 2426 2014-09-15

HW1 #7



$\vec{E}$ @ P = ?

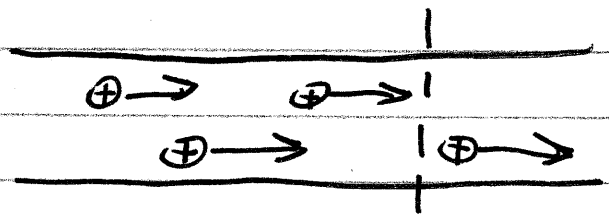
Each contributes $E = \frac{kq}{r^2}$, but w/ different q and in diff dir.

	Magn. tude (N/C)	x	y
Upper +5nC	1.125×10^5	$+9.743 \times 10^4$	−
Lower +5nC	"	"	+
−12 nC	E_3	$-E_3$	
		Total E_x	

Electric Current

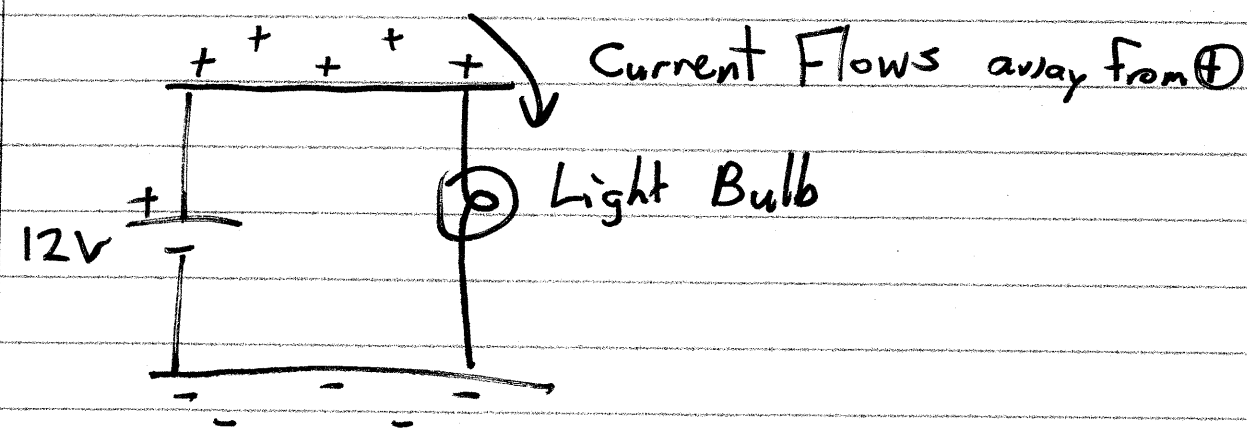
Rate of flow of charge is current, I, measured in amps (A)

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



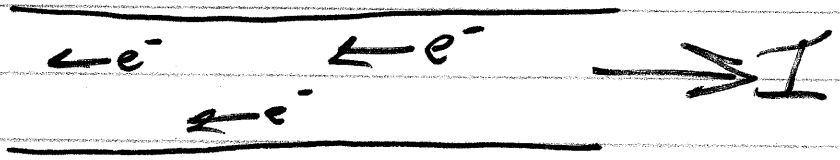
ΔQ is charge crossing the line per sec.

What makes current flow? Voltage.



With the circuit, ΔQ can be large. Many coulombs.

Electron motion vs. Current

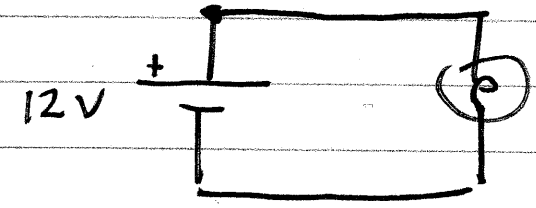


This region becomes ⊖

This region becomes more ⊕

What Limits the current? Resistance

Ohm's Law $V = IR$



$I = \frac{V}{R} = \frac{12V}{3\Omega}$

$= 4A$

* resistance, R, is in ohms (Ω)

Two connections are always needed!

Ideally, wires have $R = 0$

Voltage is $\frac{\text{Energy}}{\text{Charge}}$

$$V \cdot I = \frac{\text{Energy}}{\text{Charge}} \cdot \frac{\text{Charge}}{\text{Time}} = \frac{\text{Energy}}{\text{Time}} = P$$

power, P, is in watts (W). $1\,W = 1\,J/s$

(4)

Cost of electricity $\sim 0.12 \frac{\$}{kWh}$

$1\ kWh = (1\ kW)\cdot(1\ hr) = (1000\ J/s)(3600\ s)$

$= 3600000\ J = 3.6\ MJ$

0.3 MJ for a penny

15 W light bulb on all month.

$15\ W \cdot 1\ month = (0.015\ kW)(30\ days)\left(\frac{24\ hr}{day}\right)$

Substitution

Mult by 1

$= 10.8\ kWh$

Total Cost = (Cost/ea)(Items)

$= (\$0.12/kWh)(10.8\ kWh)$

$= \$1.30$

Battery Charge in A·h or mAh

$I\Delta t = \Delta Q$

$3200\ mAh = (3200\ mA)(3600\ s)$

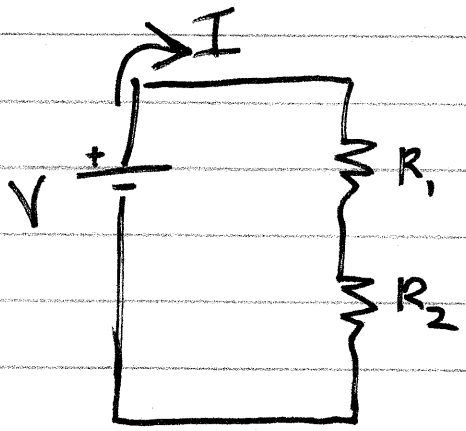
$= 11520\ A\cdot s = 11520\ C$

How many e^-?

$1e^- = 1.6\times10^{-19}\ C$

$\frac{11520\ C}{1.6\times10^{-19}\ C} = 7.2\times10^{22}$

Series vs. Parallel



Series

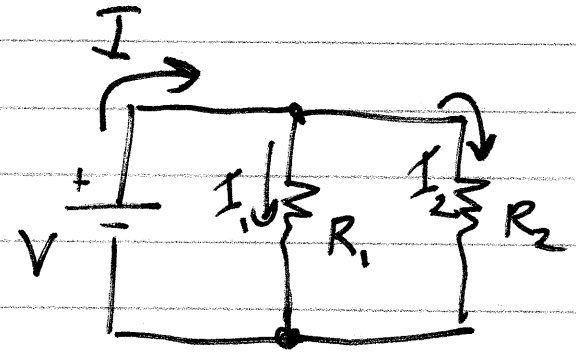
Same Current

$I = I_1 = I_2$

Batt gives total V_{tot}.

Each device takes some V.

$V_{Tot} = V_1 + V_2$



Parallel

$I_{tot} = I_1 + I_2$

Branch goes from node to node

Batt gives V_{Tot}

One device or the other takes some V.

No V is left.

$V_{Tot} = V_1$

$V_{tot} = V_2$