 Phys 1402 2015-09-17 Lec 7

HW2 - Work on it!
- Use "Ask Your Teacher"

Qualcomm Quick Charge (Android)
- Battery charger supplies energy
- Faster rate = less time

$P = I V$

Usu: $V = 5.0\ V$

More power is from more I.

Ex: 500 mA, 1.0 A, 2.0 A

Limit $P = (5.0\ V)(2.0\ A)$
$= 10.0\ W$

- New Tech: Allows 9.0 V, 12.0 V DC

Ex: $(12.0\ V)(2.0\ A) = 24\ W$

Simultaneous Equations (Linear Eqns)

* Can use calculator
* Manually

$$I_1 + I_2 = 5.0$$

$$3I_1 - 2I_2 = -5.0$$

* Pick an eqn, solve for a variable

$$I_2 = 5 - I_1$$

* Sub into other eqn(s).

$$3I_1 - 2(5 - I_1) = -5$$

$$3I_1 - 10 + 2I_1 = -5$$

$$5I_1 = 5$$

$$I_1 = 1.0\ A$$

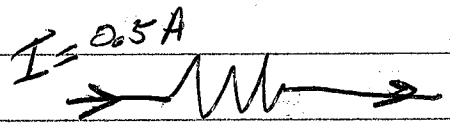
* Sub back into other eqn.

$$I_2 = 5 - (1.0A) = 4.0\ A$$

Circuit Analysis Principles

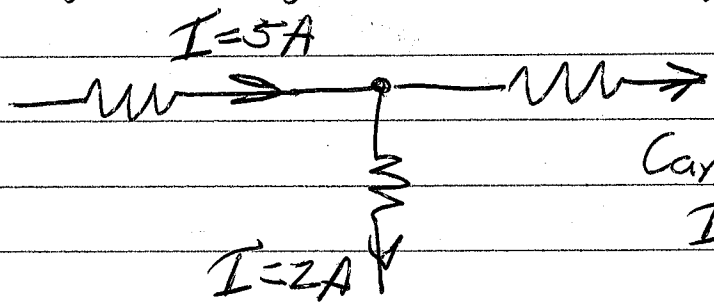
Cons. of Charge

Must account for flow of charge (Current, I) in circuit.
What goes in must come out



We know I = 0.5A out

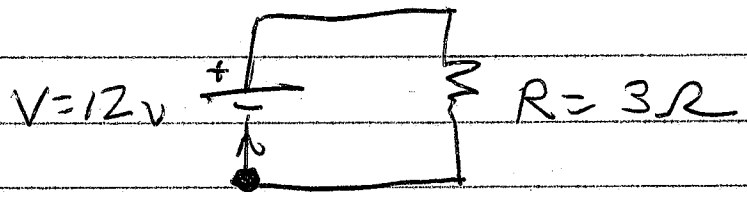
Current goes "through."
At a junction, current "splits".



Can deduce
I = 3A

Cons of Energy per Charge

- When a charge circulates around a circuit, its energy gains equal its losses.
- Voltage is energy per charge.

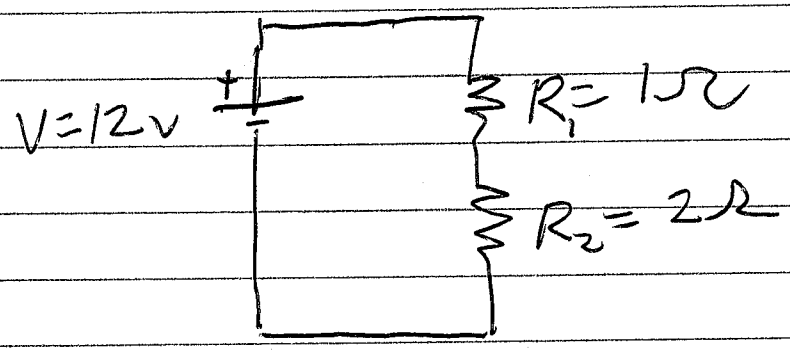


- Heading up thru batt $\Delta V = +12V$
- Going down thru R $\Delta V = -12V$

Total $\Delta V = 0$

$$- V_{Batt} = V_R$$

Series Circuit - current passes thru components one after another.



$V = IR$

- Batt $\quad \Delta V = +12V$
- $R_1 \quad \Delta V = -I_1 R_1$
- $R_2 \quad \Delta V = -I_2 R_2$

Gains = Losses

$$(12V) = I_1 R_1 + I_2 R_2$$

Series - There is only one current.

$$(12V) = IR_1 + IR_2$$

$$12V = I(R_1 + R_2)$$

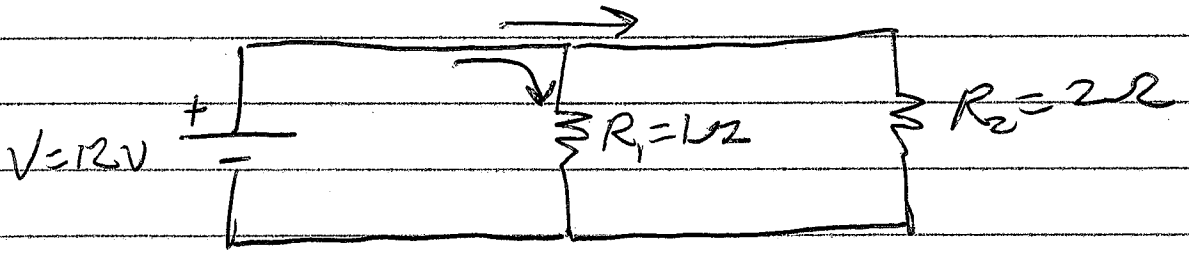
R_{eq} "seen" by batt.

In series $\quad R_{eq} = R_1 + R_2 + \ldots$

$I = 4A \quad V_1 = (4A)(1\Omega) = 4V$

$V_2 = (4A)(2\Omega) = 8V$

Parallel Circuits



Any charge going thru the battery has a choice about which R to go thru.

R_1 Loop

$(12V) = I_1 R_1$

R_2 Loop

$(12V) = I_2 R_2$

Both resistors "see" the full voltage.

$I_1 = 12A$ $\qquad$ $I_2 = 6A$

The batt must provide both.

$I_{Batt} = I_1 + I_2 + \cdots$

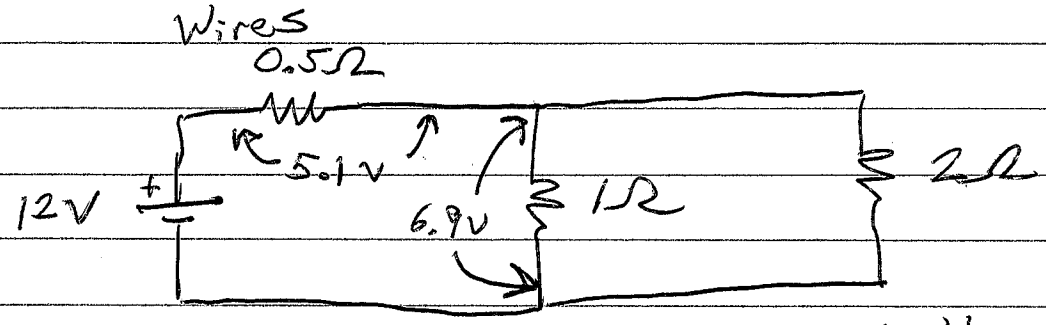
$V_{Batt} = I_{Batt} R_{eq}$

$\frac{12V}{18A} = R_{eq} = 0.667\ \Omega$

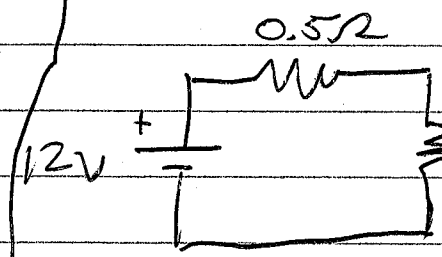
$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \cdots$

	Series	Parallel
Current	$I = I_1 = I_2 = \dots$	$I_T = I_1 + I_2 + \dots$
Voltage	$V_T = V_1 + V_2 + \dots$	$V = V_1 = V_2 = \dots$
Resistance	$R_{eq} = R_1 + R_2 + \dots$	$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \dots\right)^{-1}$

Combination Circuit



$V = IR$



Mic/Lights

$0.667\ \Omega = \left(\frac{1}{1\Omega} + \frac{1}{2\Omega}\right)^{-1}$

$(12V) = I(0.5\Omega + 0.667\Omega)$

$I = 10.3\ A$

$V_{wire} = IR_{wire} = (10.3A)(0.5\Omega) = 5.1V$

$V_{M/L} = (10.3A)(0.667\Omega = 6.9V$

$I_M = \frac{6.9V}{1\Omega} = 6.9A$

$I_L = \frac{6.9V}{2\Omega} = 3.4A$

} Tot $= 10.3\ A$