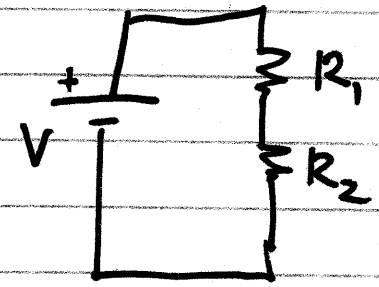
 Phys 1402 2014-01-18

$V = IR$ $P = IV$

Series: $I = I_1 = I_2 = \cdots$

$V_{Tot} = V_1 + V_2 + \cdots$

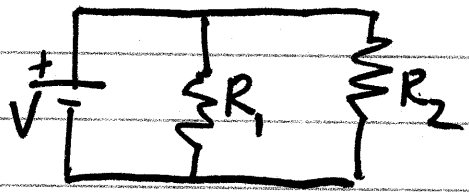
$R_{eq} = R_1 + R_2 + \cdots$



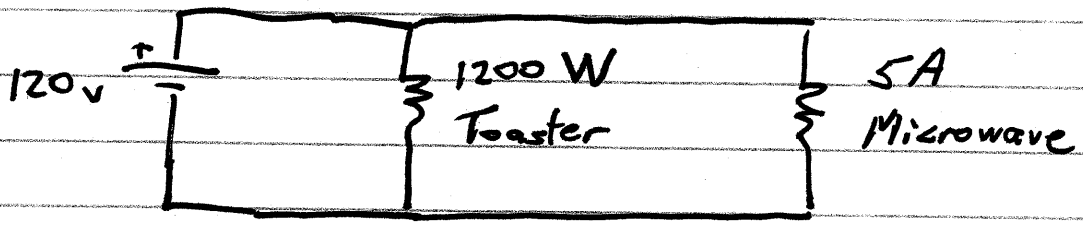
Parallel: $I_{tot} = I_1 + I_2 + \cdots$

$V = V_1 = V_2 = \cdots$

$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \cdots\right)^{-1}$



Parallel Example:



	V	I	R	P
Toaster	120 V	10 A	12 Ω	1200 W
Microwave	120 V	5 A	24 Ω	600 W
Total	120 V	15 A	8 Ω	1800 W

$\frac{120\,V}{15\,A} = 8\,\Omega$ $\left(\frac{1}{12} + \frac{1}{24}\right)^{-1} = 8\,\Omega$

Electrical Measurements

Basic Needs for all measurement:

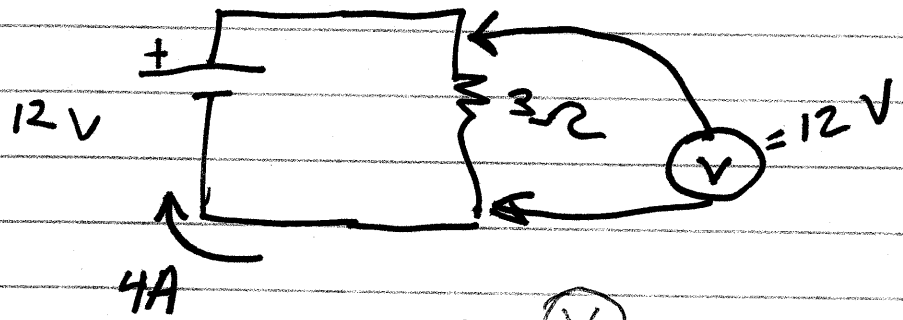
- Our meter must share the same measurement value as the subject.
- The measurement should not disturb the system.

Voltage: In parallel $V = V_1 = V_2 = V_3 = \ldots$

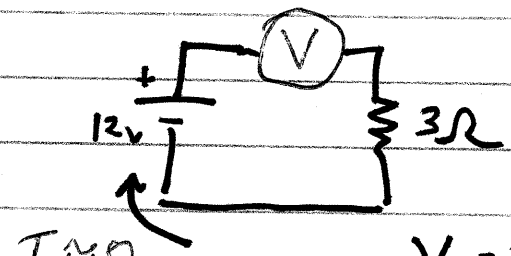
- Hook up voltmeter in parallel.

$$I_{tot} = I_1 + I_2 + I_{meter}$$

- Voltmeter has zero current.



what if:



Incorrect Hookup

$I \approx 0$

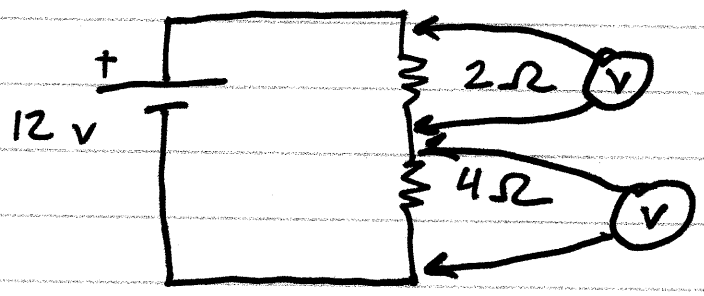
$V_R = IR = 0$ V

$V_{Tot} = V_1 + V_2$

$12\text{ V} = V_{meter} + (0\text{ V})$

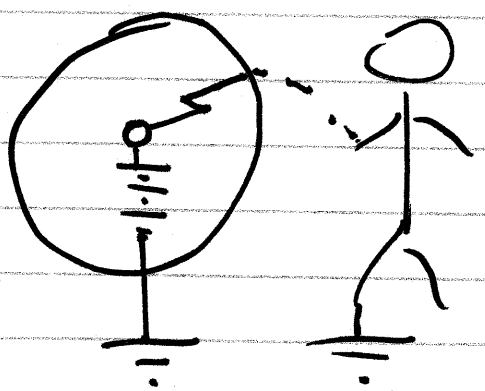
$V_{meter} = 12$ V = Battery voltage w/ no current.

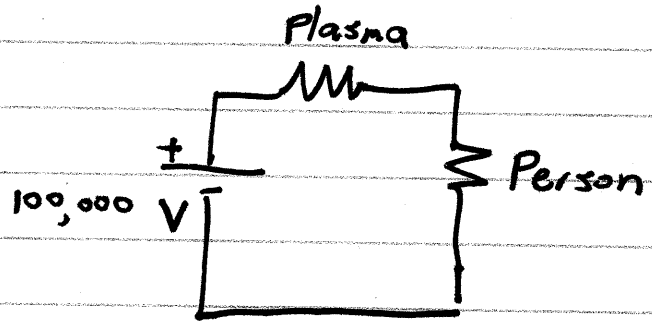
Measuring voltage of a series circuit



	V	I	R
R_1	4 V	2A	2Ω
R_2	8 V	2A	4Ω
Tot	12 V	2A	6Ω

Note: In series, bigger R gets more V.





$V_{tot} = V_1 + V_2$

$100000\ V = V_{plasma} + V_{person}$

Measuring Current

- Want same current in meter and device.

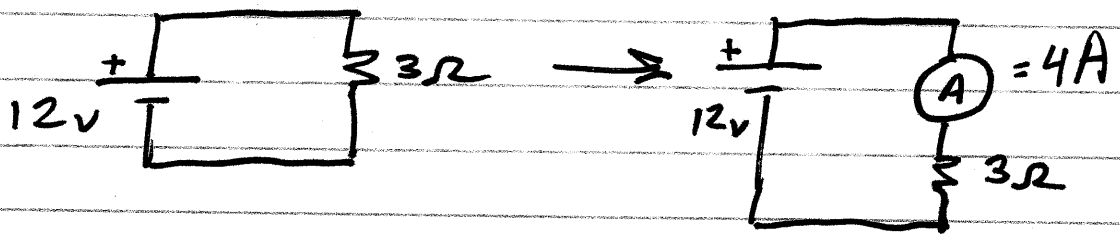
$I = I_1 = I_2 = \ldots$ in series

Hook meter in series.

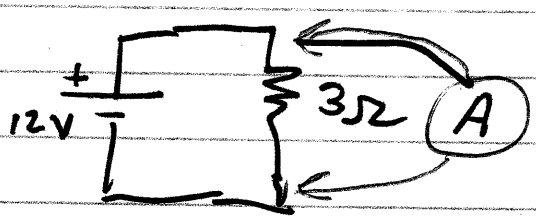
- Want to not disturb the system.

$R_{net} = R_1 + R_2 + R_{meter} + \ldots$

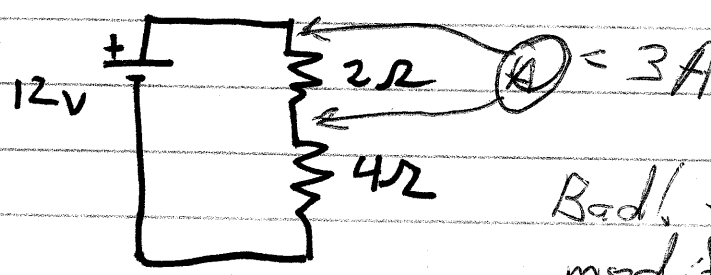
Meter has almost zero resistance.



What If:



Bad!
$I = \infty$?!?

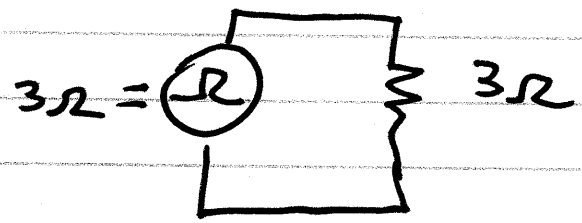


Bad! System modified.

Without meter, $I = 2$ A

Measuring Resistance

- Meter provides V, measures I, calculates R.



Measuring Power

- Need Both I and V