



FALMOUTH
UNIVERSITY

COMP140 Creative Computing Project

Register Attendance



Figure 1: Attendance monitoring is in place. It is your responsibility to ensure that you have signed yourself in.

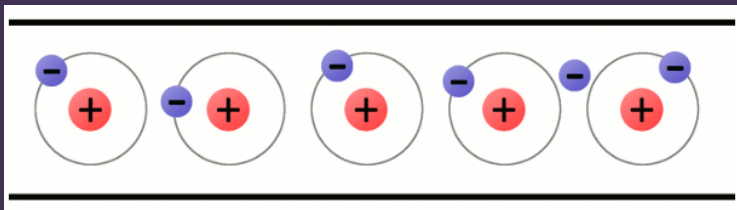
Learning Outcomes

After this session you will be able to:

- ▶ **Explain** the difference between current, voltage, and resistance
- ▶ **Predict** the characteristics of basic circuits using simple formulas
- ▶ **Choose** components based on their purpose and characteristics

What is current electricity?

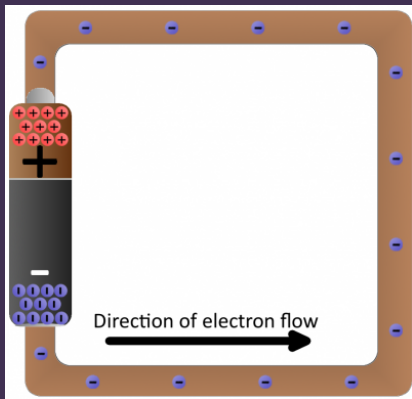
(the stuff that makes our gadgets tick)



source: <https://learn.sparkfun.com/tutorials/what-is-electricity/allmar>

- ▶ The flow of electrons through
- ▶ a closed circuit (wire, components, etc)
- ▶ Induced by an electric field (battery)

Battery Example



source: <https://learn.sparkfun.com/tutorials/what-is-electricity/allrmar>

Basic characteristics

- ▶ **Voltage (V)** - The relative level of electrical energy between any two points in a circuit. Voltage is measured in *volts*.
- ▶ **Current (I)** - The amount of electrical energy passing through any point in a circuit. Current is measured in *amps*
- ▶ **Resistance (R)** - The amount that any component in the circuit resists the flow of current. Resistance is measured in *ohms*

Water Analogy

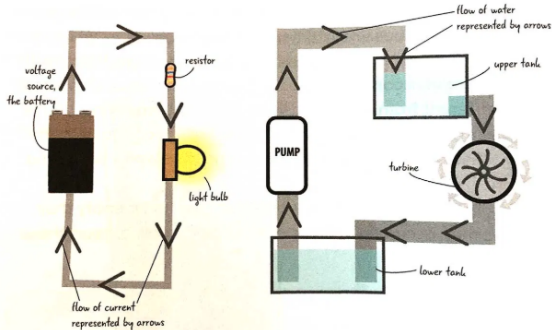
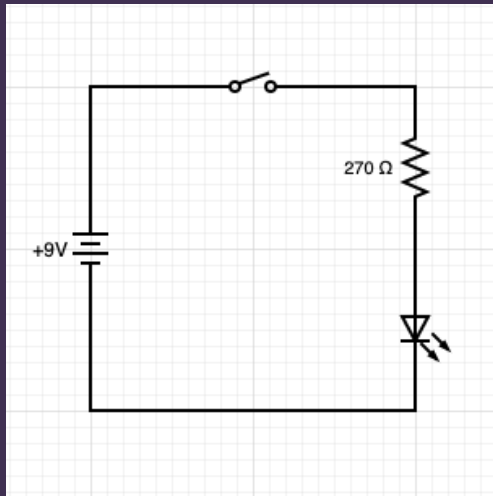


FIGURE 5.34: Water analogy for electricity

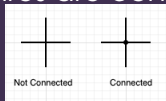
Hagan, J. (2017). Learn Electronics with Arduino. Maker Media, Inc

Reading Schematic Diagrams

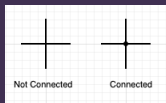


The Rules

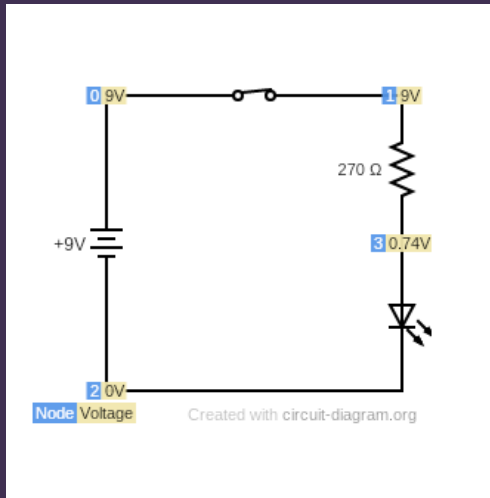
- ▶ Positive volatages are uppermost
- ▶ Things happen left to right
- ▶ All components have a name and values
- ▶ Remember symbols
- ▶ Dots show that the wires are connected:



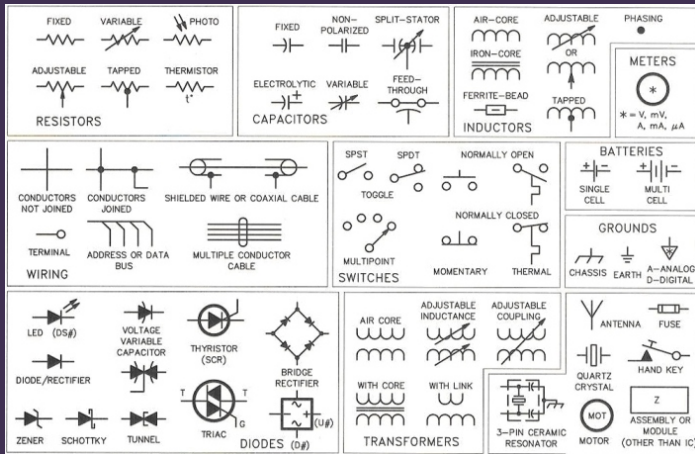
- ▶ Nets: Inferred connection based on symbol or name:



Reading Schematic Diagrams (answer)

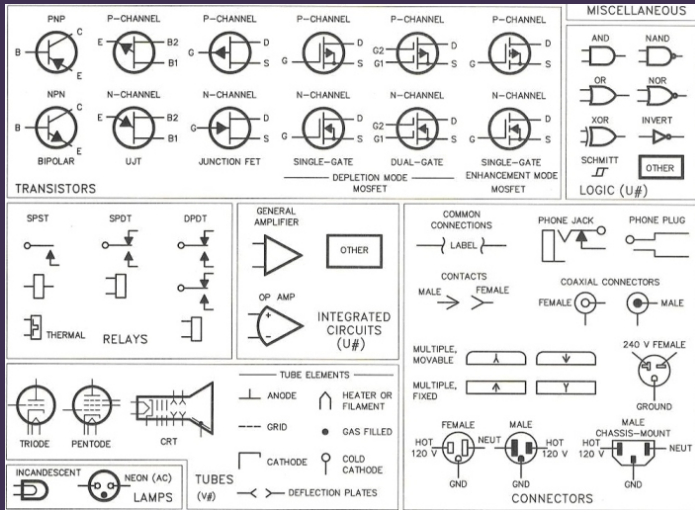


Schematic Circuits 1



source: <https://www.autodesk.com/products/eagle/blog/how-to-read-your-first-autode>

Schematic Circuits 2

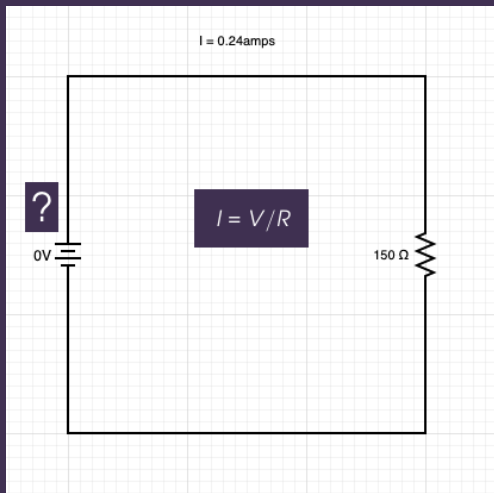


Ohm's Law

$$I = V / R$$

- ▶ If the voltage increases, whe the current (a) increase or (b) decrease.
- ▶ If the resistance increases will the current (a) increase or (b) decrease.

Ohm's Law Example 1



Ohm's Law Example 1 - Answer

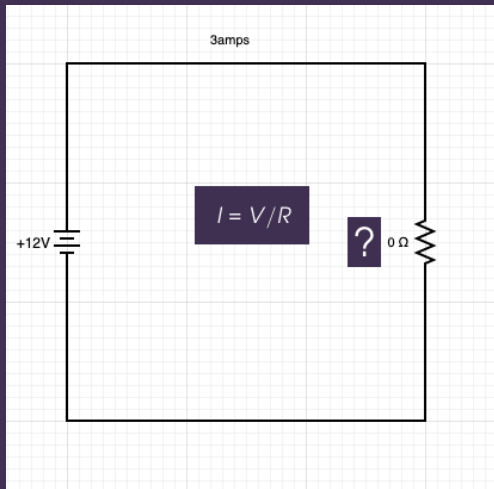
$$I = V/R$$

$$0.24 \text{ amps} = ? / 150 \text{ ohms}$$

$$V = 0.24 * 150$$

Answer = 36 Volts

Ohm's Law Example 2



Ohm's Law Example 2 - Answer

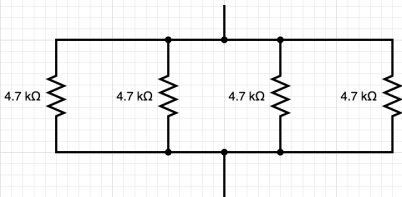
$$I = V/R$$

$$3\text{amps} = 12\text{volts}/?$$

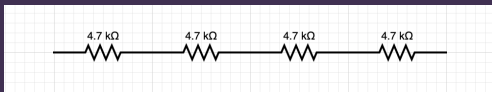
$$R = 12/3$$

Answer = 4Ohms

Resistors (Series vs. Parallel)



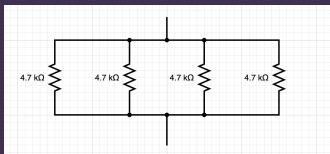
Series



$$R_T = R_1 + R_2 + R_3 + R_4$$

$$R_T = 4700 + 4700 + 4700 + 4700 = 18000\text{ohms} = 18\text{kohms}$$

Parallel



$$\text{Conductance}(G) = \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

Then calculate the resistance based on the reciprocal:

$$\text{Conductance}(G) = \frac{4}{4700} \text{ Reciprocal} = \frac{4700}{4}$$

$$\text{Resistance} = 1175\text{ohms} = 1.175\text{kohms}$$

Power Dissipation (Watts-W)

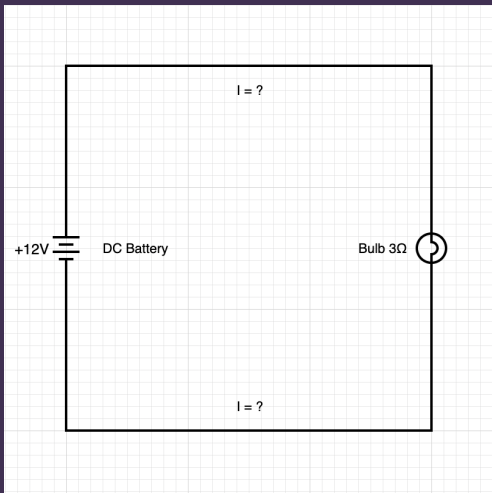
Similar to current, Power is a measure of change over time. Instead of charge, power is the amount of energy converted into heat over time.

- ▶ When the flow of current is resisted, heat is generated
- ▶ Calculated by measuring the voltage across a load times the current flowing through it

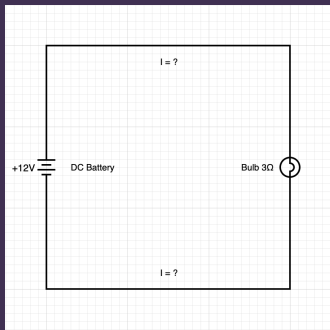
$$P = I * V$$

$$P = V^2 / R$$

Power Example



Power Example Answer



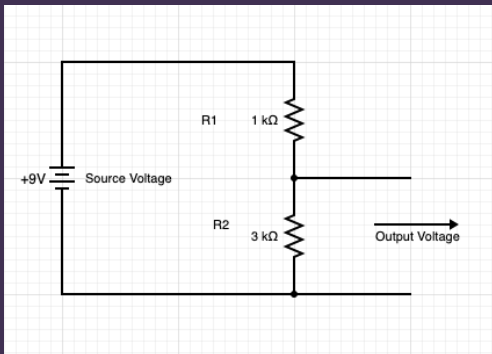
$$I = 12/3 = 4$$

$$W = 12 * 4 = 48$$

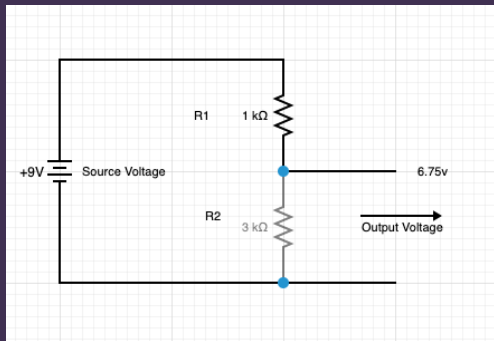
Power Dissipation = 48 Watts

Voltage Divider

- ▶ Used to step down the voltage
- ▶ Involves a pair of resistors



Voltage Divider Formula



$$V_{out} = \frac{V_s \times R_2}{(R_1 + R_2)}$$