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6.1 Electric circuits

You use electricity to turn on the lights, charge your phone, and play video games on your computer at home.

Before we talk about electric circuits, we need to understand the concept of a charge.

Charges can be

___positive___ (Examples: proton, α-particle)

___negative___ (Examples: electron/β-particle)

Charges (Q) are measured in **coulombs (C).** For example, an electron has a charge of ______________________________.

When charges move, a **current** is generated. **Current (I)** is the amount of charge flow per unit of time, measured in **amperes** or **amps (A)**.

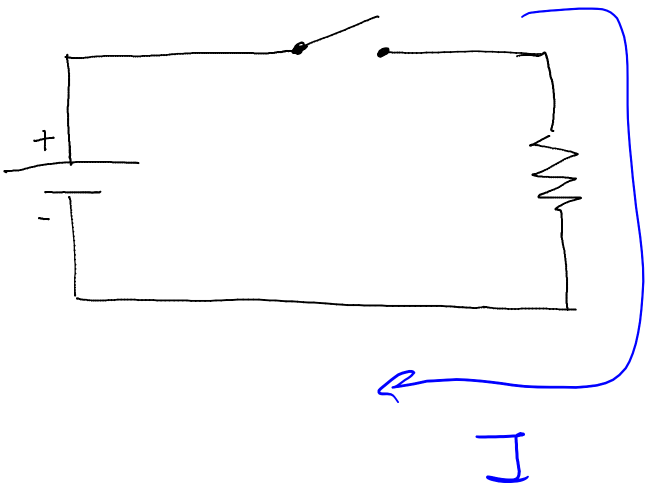
$$I = \frac{Q}{t}$$

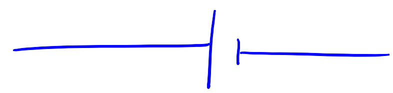
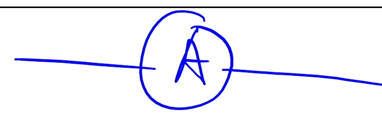
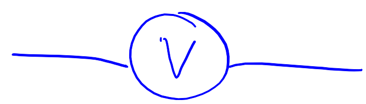
For current to flow, you'll need:

1) ___Power Source___(voltage source such as a battery or an electric outlet)

2) ___Complete circuit___

Below is an example of a circuit diagram:



Component	Schematic
Battery	
Resistor (ex. Light bulb)	
Switch	
Wire	
Ammeter	
Voltmeter	

Which direction is the current flow?

In reality, **electrons flow** from the ___negative___ terminal of the battery to the ___positive___ terminal of the battery.

However, we use the **conventional current** which describes the flow of positive charges from the ___positive___ terminal to the ___negative___ terminal of the battery.

→ we will be using this I direction

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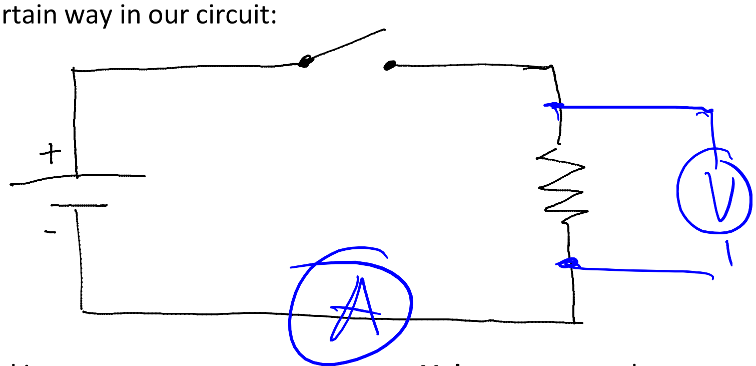
We can measure the **current** at any part of the circuit using an **ammeter**.

To measure the **voltage** drop across a resistor or a battery in a circuit, we use a **voltmeter** that measures in **volts**.

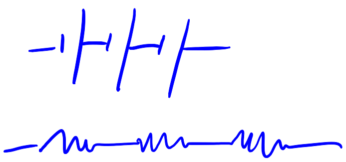
They must be connected a certain way in our circuit:



Ammeters must be connected in series.

Other examples:

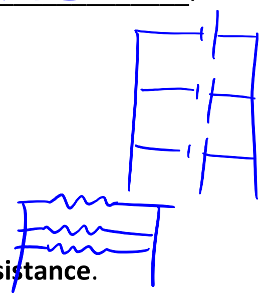
batteries:
resistors:



Voltmeters must be connected in paralle.

Other examples:

batteries:
resistors:



If we can measure the current and the voltage drop across a resistor, we can find it's **resistance**.

Ohm's Law: The current across a conductor is directly proportional to the voltage drop.

$$V = IR$$

Voltage: Energy per coulomb of charge (**volts**).

Resistance: How difficult it is for current to flow through a conductor, measured in **ohms (Ω).**

When you buy light bulbs at the store, you see a wattage reading. Watts are units of power.

We can express power using current (I), voltage (V), and resistance (R).

P = VI P = I^2R P = $\frac{V^2}{R}$

Notice that these are all variations using Ohm's Law.

We can derive this from voltage = Energy/charge

$V = \frac{\Delta E}{q}$

$\Delta E = Vq$

$P = \frac{\Delta E}{t} = \frac{(Vq)}{t}$

$P = VI$

Ex. 1: Using the diagram below, calculate the following:

a) The light bulb's resistance. (ANS: 11 Ω)

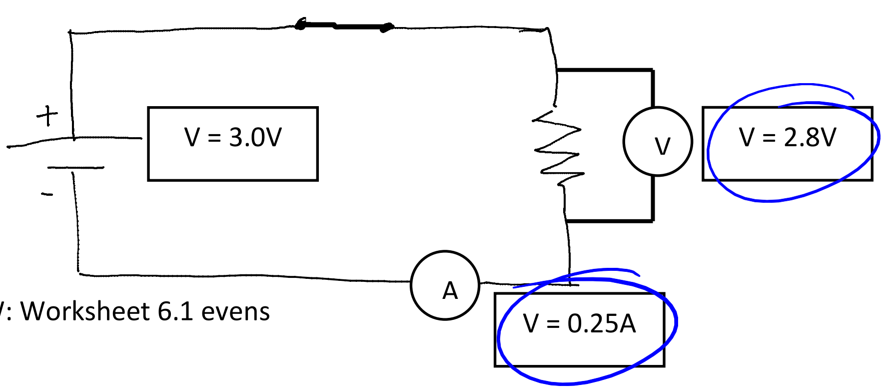
b) The power consumed by the light bulb. (ANS: 0.70W)

a) $V = IR$, $R = \frac{V}{I} = \frac{2.8V}{0.25A}$

$= 11\Omega$

b) $P = VI = 2.8(0.25A)$

$= 0.70W$



HW: Worksheet 6.1 evens