

Electrical Engineering

Intro

FOUNDATIONS OF ENGINEERING AND TECHNOLOGY

WHEELER HS

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Branches of EE

Electronics - What we're focusing on this week

- **Think circuits, batteries, resistors, lights etc.**

Digital Design/Controls

Computer

Power

Telecommunication

What is Electricity – The Flow of Electricity

Atoms in every material are made up of electrons and protons

Electrons (- charge) are attracted to protons (+ charge)

Some materials have immobile electrons, these are called **insulators**

Some materials have free-to-move electrons, these are called **conductors**

In a conductor, electrons can be made to move, this is called a current of electricity

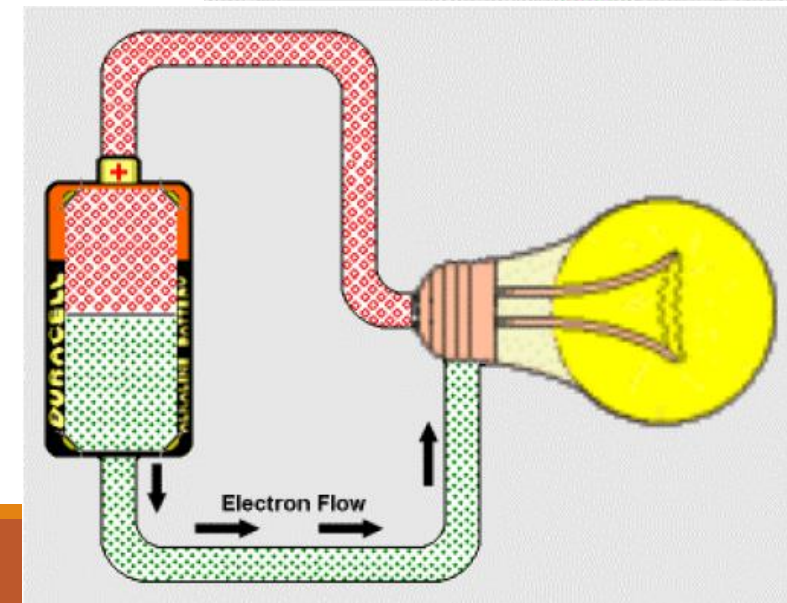
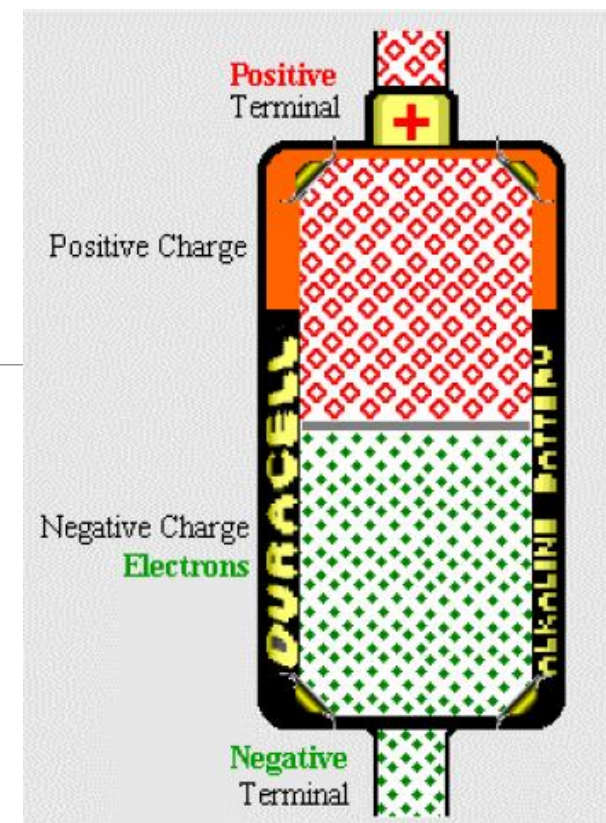
More on Electricity

A surplus of electrons is called a negative charge (-)

A shortage of electrons is called a positive charge (+)

A battery provides a surplus of electrons

- Connecting a conductor from the positive terminal to negative terminal will cause electrons to flow



Key terms

Voltage

Current

Resistance

Video on Electricity

<https://www.youtube.com/watch?v=O5Cpd4U-v80>

Relating voltage, current, resistance to water flow

Current

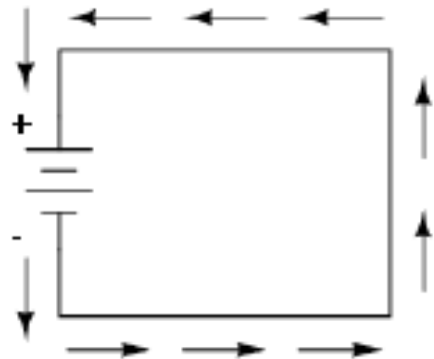


Flow of Water



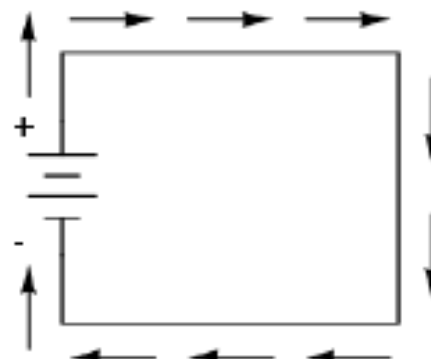
Flow of Charge

Electron flow notation



Electric charge moves from the negative (surplus) side of the battery to the positive (deficiency) side.

Conventional flow notation



Electric charge moves from the positive (surplus) side of the battery to the negative (deficiency) side.

Voltage

A battery has a positive terminal (+) and a negative terminal (-)

The voltage measured between the terminals of a battery is a measure of the ability of the battery to move charge through an external circuit

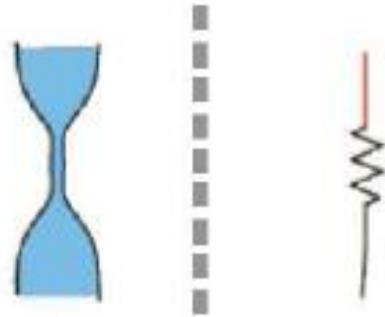
Water Analogy

A battery is analogous to a pump

A **higher voltage** battery is analogous to a **higher pressure** pump

Resistance

Constriction
creates
Resistance to water flow



Resistor creates
Resistance to current
flow



- Used to control current
- The degree of resistance to electrical current flow is measured in Ohms.
- Common example: audio volume control

Ohm's Law

$$V = IR$$

Voltage = Current * Resistance

Basic Parts to make your first circuit

Battery

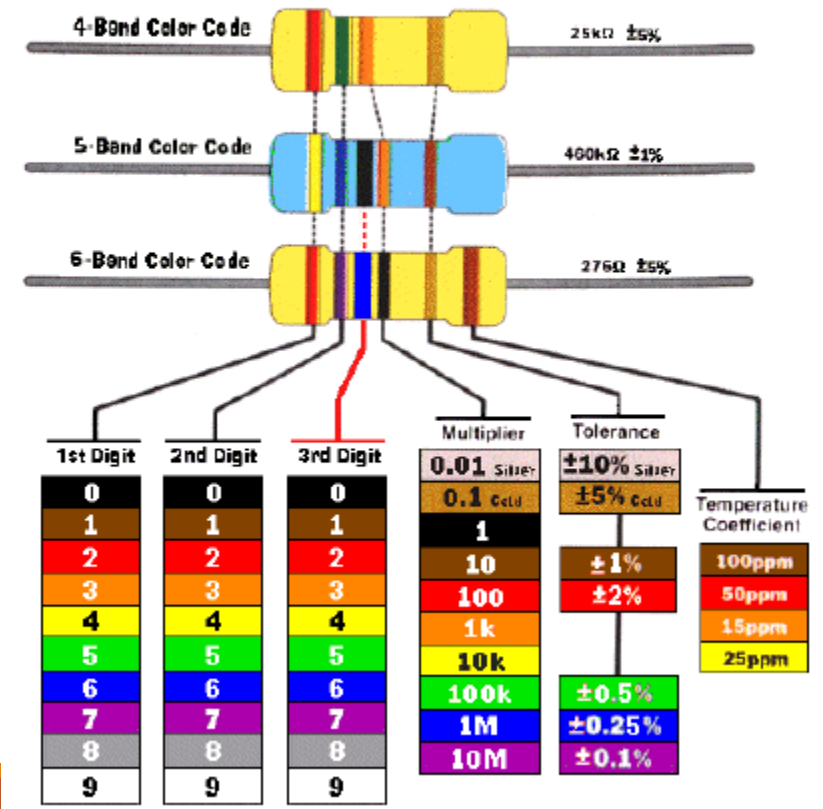
Wire

Resistors

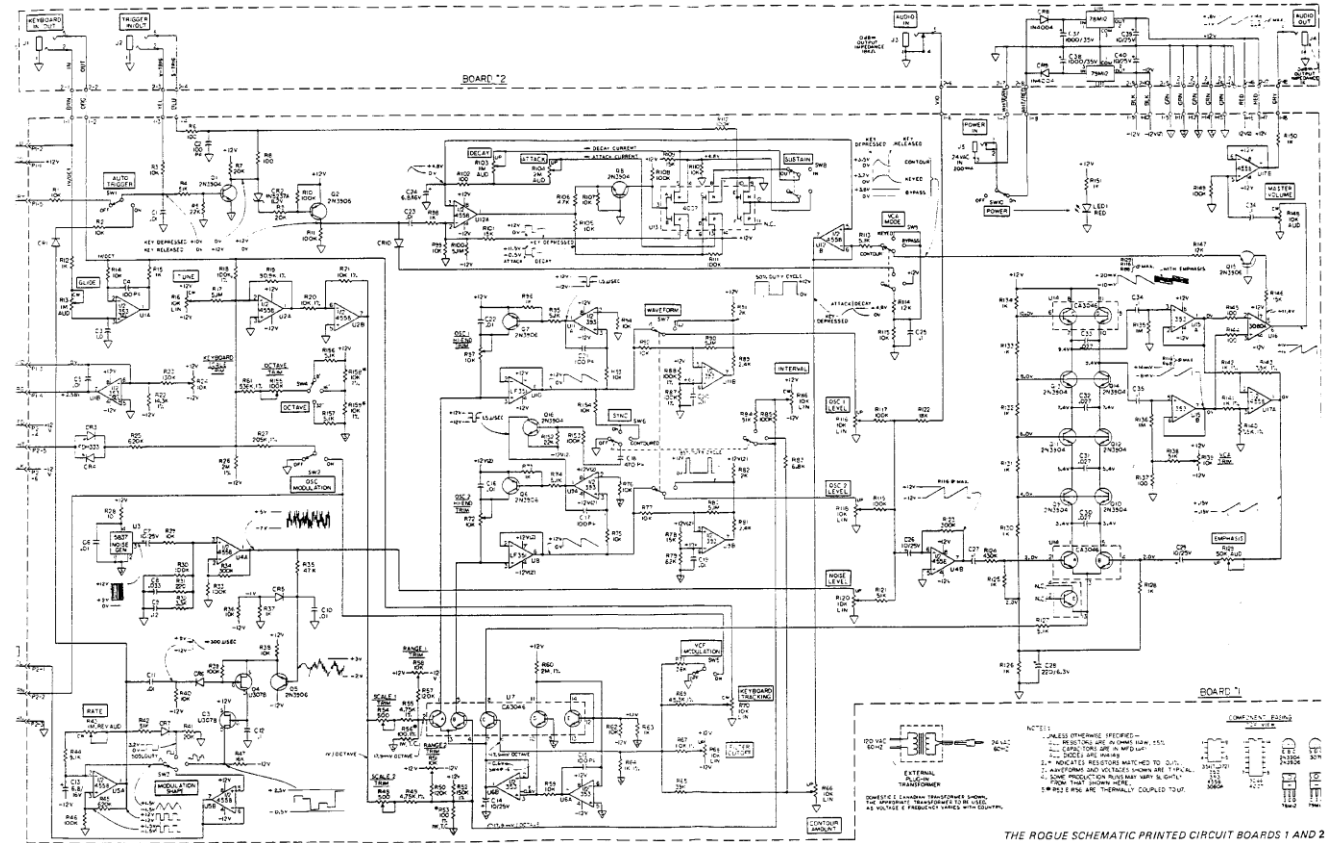
Light

Switch

Resistor Color Code



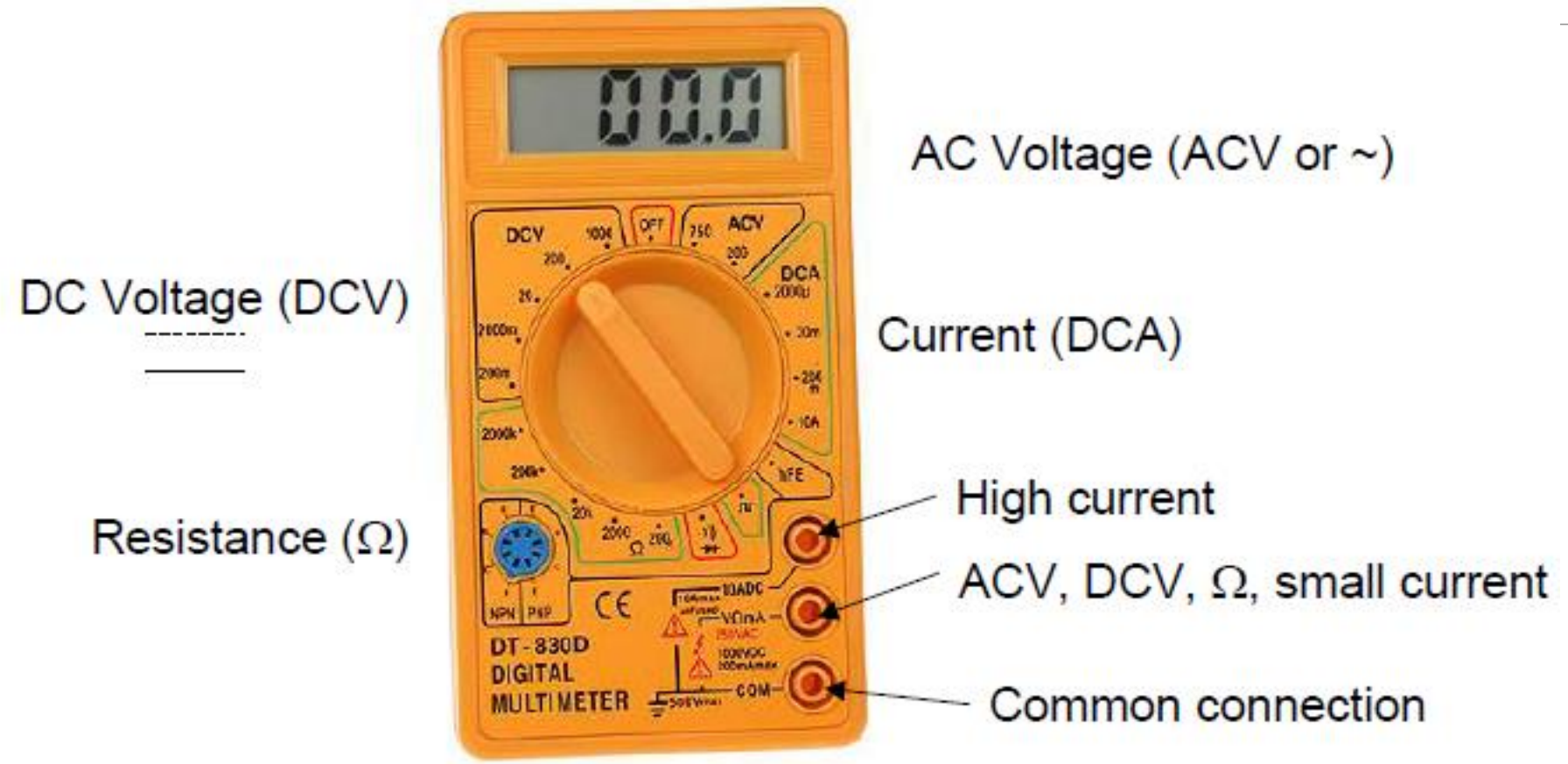
Schematics



First circuits lab!

1. Go to my blog (wheeler-engineering.weebly.com)
2. Download electronicslab1.pdf
3. Go to the google forms link and fill in your answers as you complete the lab
4. You can work in partners or groups of three

Your multimeter!



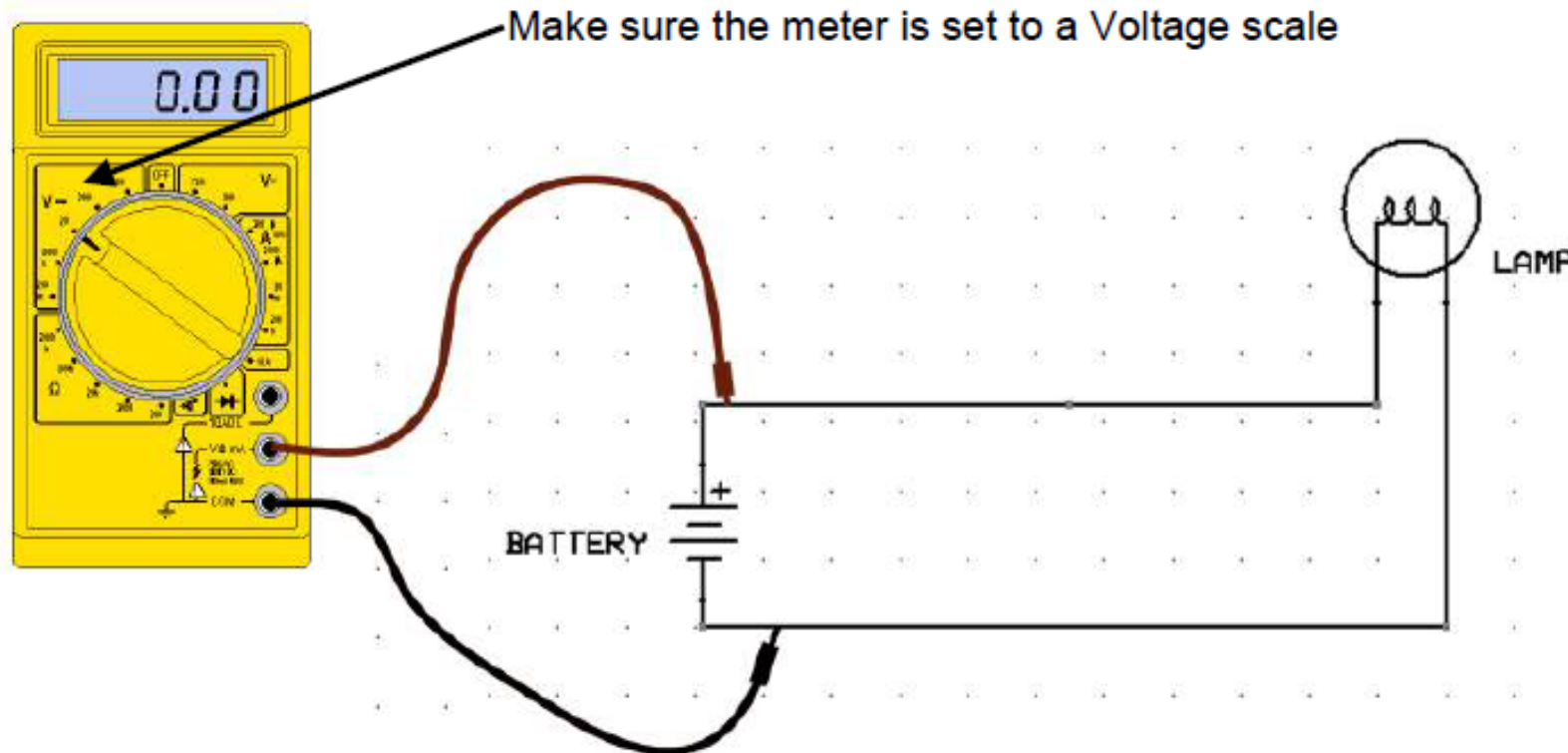
IMPORTANT: when set to any current scale, meter must only be connected in series (like a "smart wire")

Measuring Voltage

- Always measured between two points in a circuit
- Negative (black lead) connects to a reference point (often ground or battery -)
- Positive (red lead) connects to another point in the circuit

What To Do

1. Turn dial to this symbol: \overline{V}
2. Make sure black wire is in "COM" and Red in "V"
3. Test away!

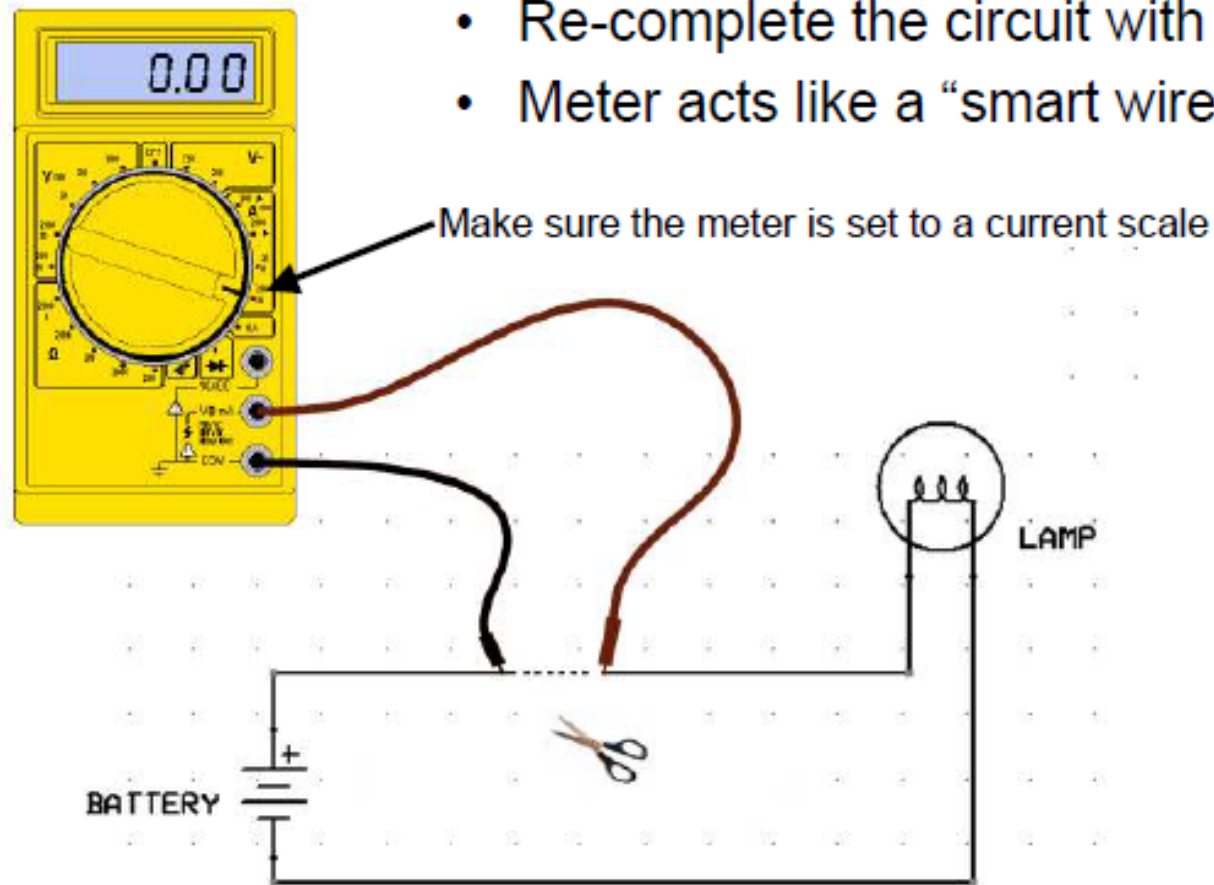


Measuring Current

- Current is measured **through a section** of a circuit
- Meter must be connected in series
- Open a section of the circuit
- Re-complete the circuit with the meter
- Meter acts like a “smart wire”

What To Do

1. Turn dial to this symbol: \overline{A}
2. Make sure black wire is in “COM” and Red in “A”
3. Connect the meter into the circuit
4. Test away!

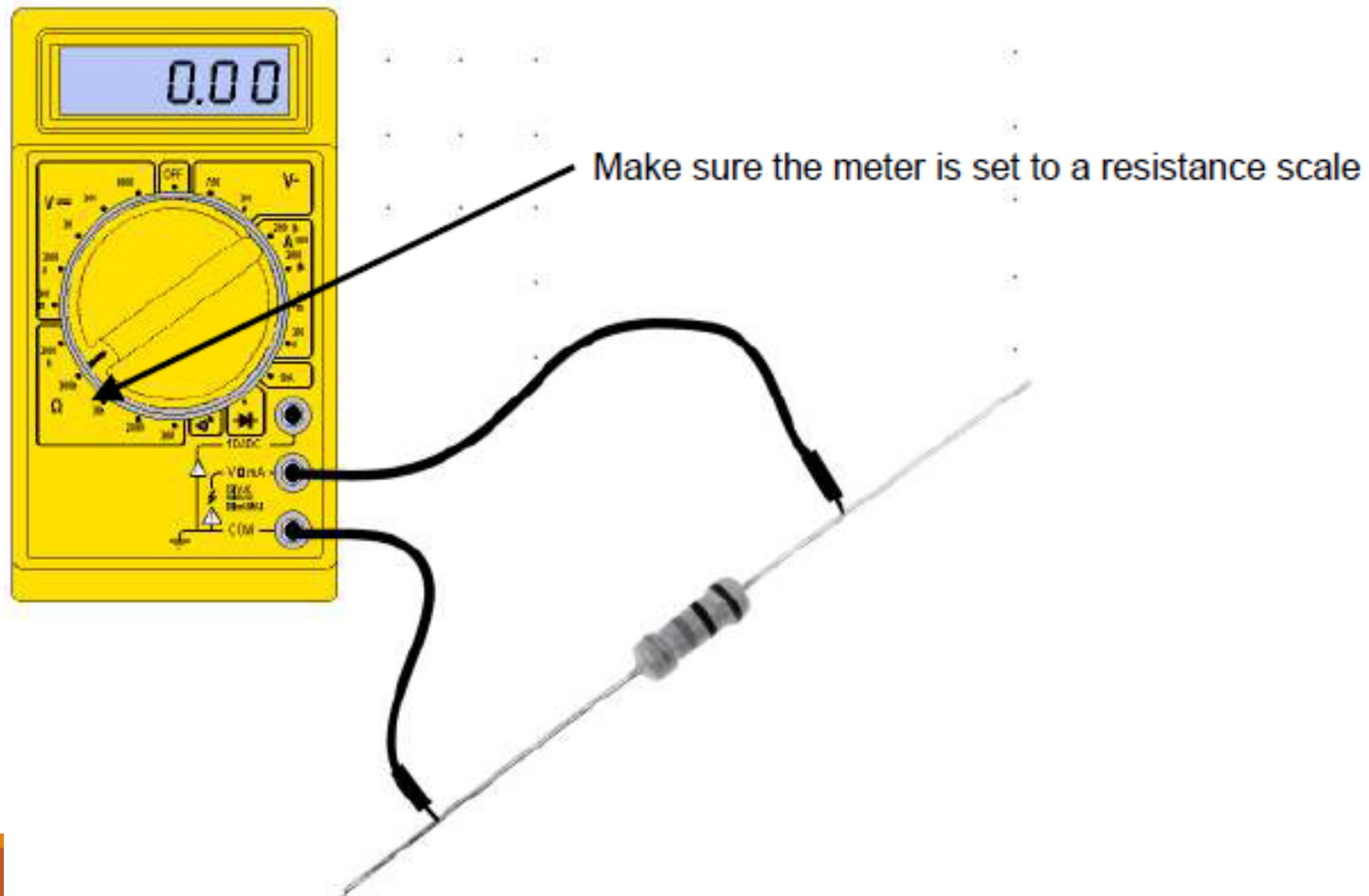


Measuring Resistance

- Measured with resistor (or other device) out of circuit
- Connect one lead to each lead of the component

What To Do

1. Turn dial to this symbol: Ω
2. Make sure black wire is in "COM" and Red in " Ω "
3. Test away!



Other equipment on your desk

Power supply: Provides a constant voltage between 0-15 volts

- Turn on
- Turn knob to change voltage
- DO NOT TOUCH RED/BLACK POWER WIRES DIRECTLY TO EACH OTHER!!! YOU WILL BLOW A FUSE AND I WILL BE SAD

Breadboard/Protoboard

- The lab today doesn't call for you to use these, but feel free to check them out
- We will go over them in more detail tomorrow/Friday

Other supplies you can get from me

- Switches
- Resistors
- LED's
- Alligator clips

Closing
