ECE 215 Fall 2025

Objective 1.0:
Course Overview

About Me

Your Turn!

How to contact your instructors

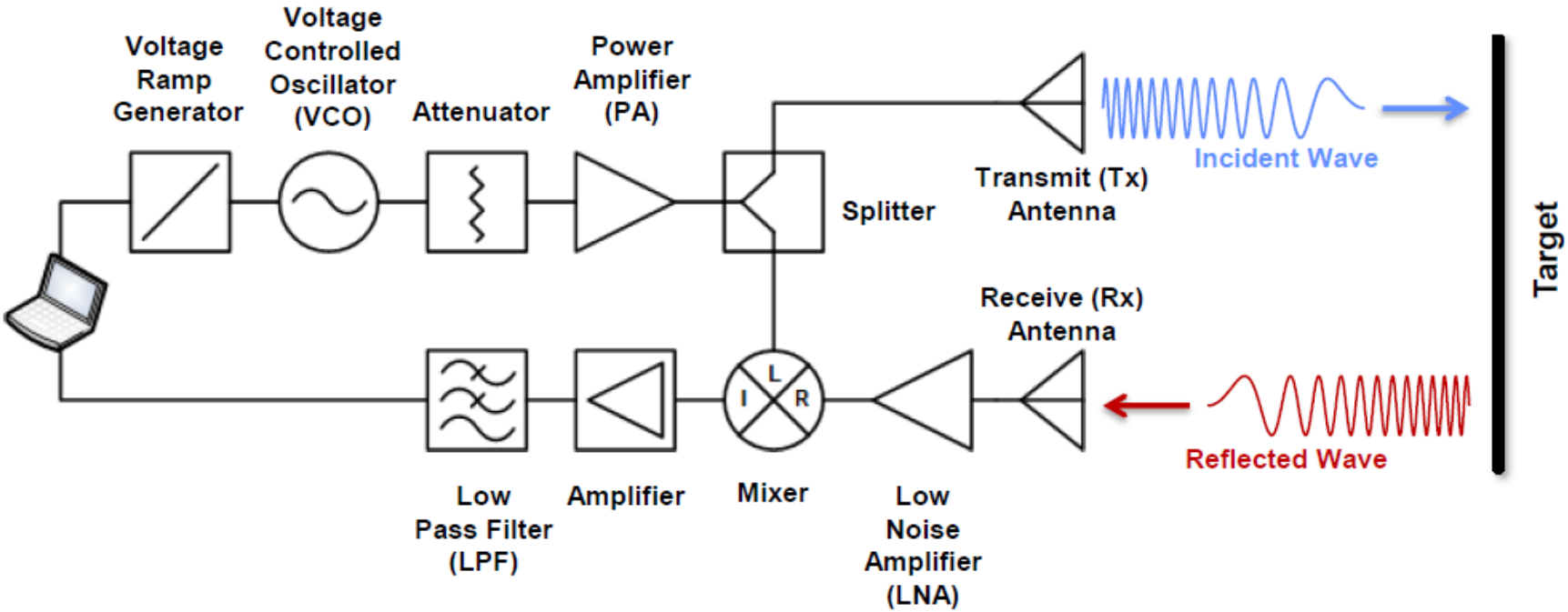
- Offices: 2F4 (Col Jurado), 2E36A (Lt Col Booth)
- Outlook: Official (e.g., bedrest, SCA, etc.)
- Teams: Questions, problems, concerns
- EI (Col Jurado): Use this link to book time on my calendar. Walk-ins are okay if my door is open.
- EI (Lt Col Booth): Prefer Outlook calendar invite (pick any available time) or schedule here - but walk-ins okay, too! (if available)

WHY ARE YOU HERE?

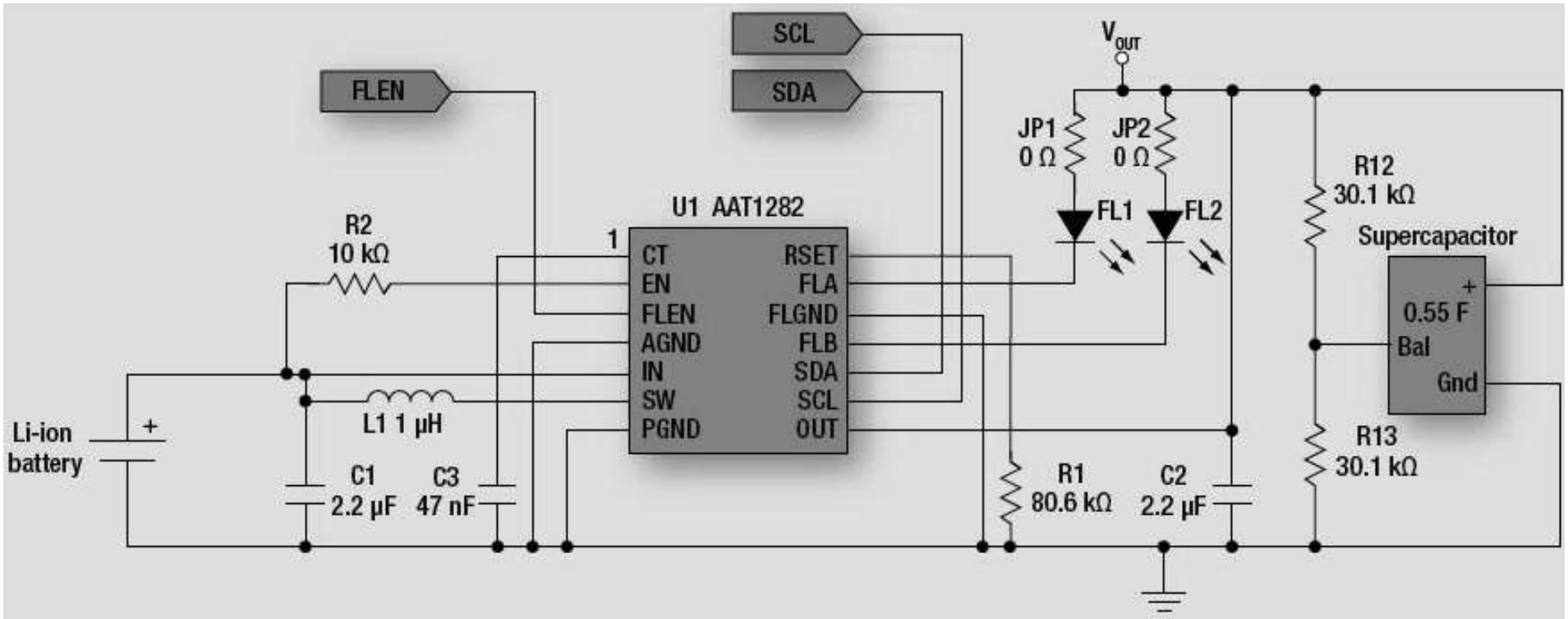
Navy LSRS

Air Force JSTARS

WHY ARE YOU HERE?



WHY DO WE CARE ABOUT ELECTRIC CIRCUITS?

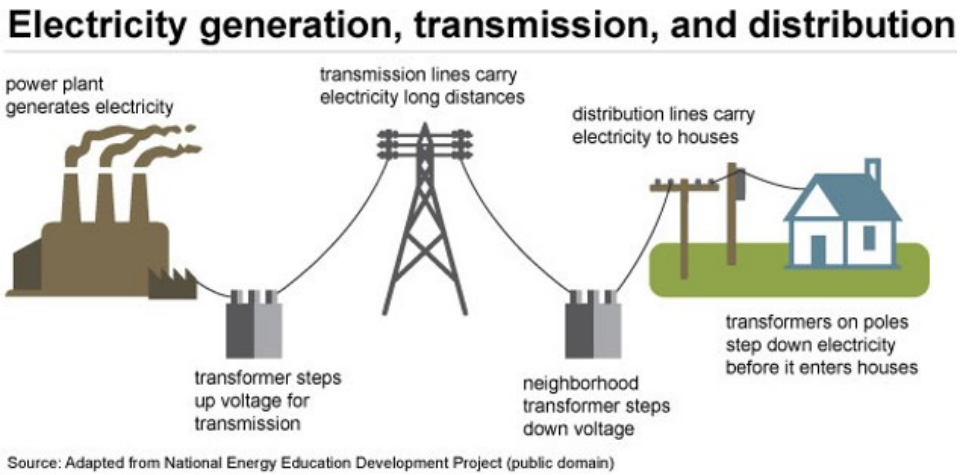


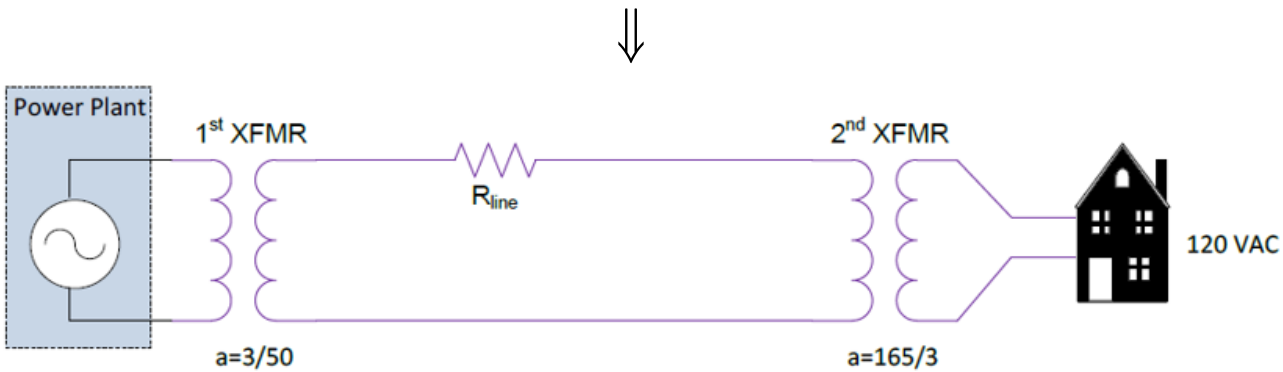
Absolute Maximum Ratings[1]

T_A = 25°C unless otherwise noted.

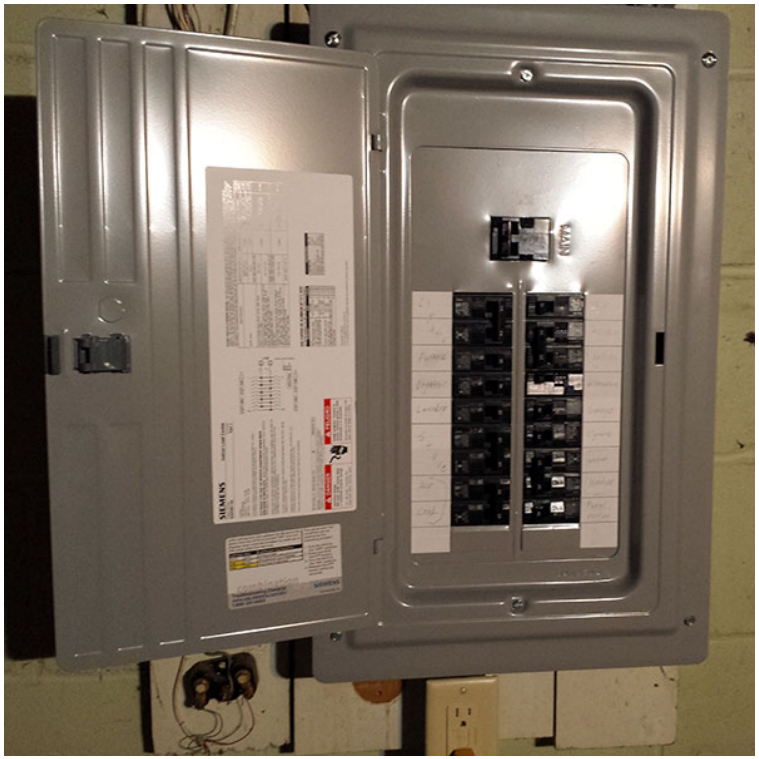
Symbol	Description	Value
V_{IN}, V_{SW}, V_{OUT}	IN, SW, OUT to GND or PGND	-0.3 to 6.0
V_{RSET}, V_{EN}, V_{FLEN}, V_{SCL}, V_{SDA}, V_{CT}, V_{FLOUTA}, V_{FLOUTB}	RSET, EN, FLEN, SCL, SDA, CT, FLOUTA, FLOUTB to GND, PGND, or FLGND	V_{IN} + 0.3
I_{OUT}	FLOUT1 and FLOUT2[2]	2200

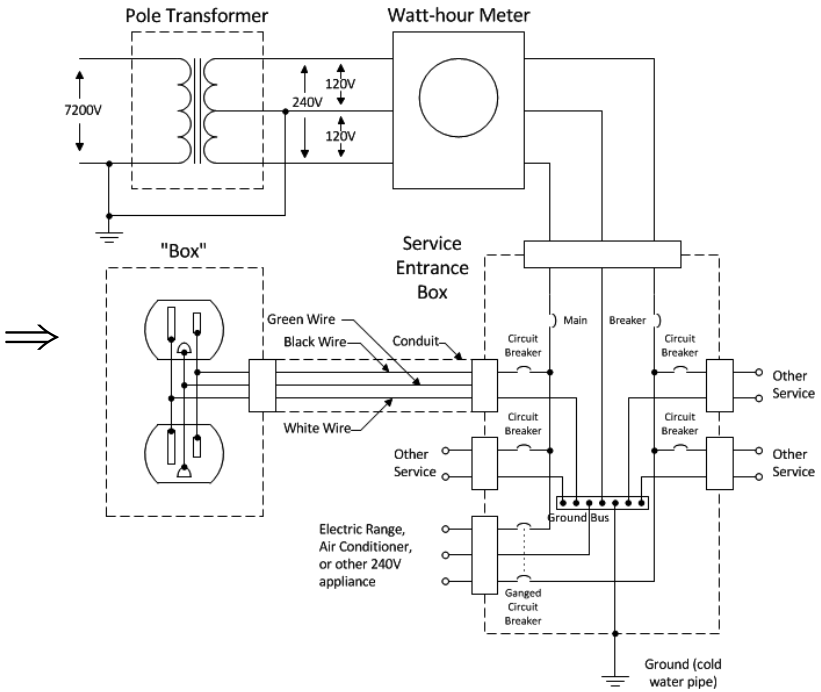
More applications





More applications





Rethinking Learning

- How do you know when you've learned something?
- Has the way we do grading helped you know what you've learned?
- What would help you feel more confident that you've truly learned something?

Course Philosophy

- You should know what you're learning
- Making mistakes is a part of learning
- Revision of work is necessary to learn
- Grading should support learning and partial credit doesn't really tell us anything

Very granular learning objectives that tell you exactly what you will be able to do by the end of the semester

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You shouldn't be punished for committing to the learning process

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- Revision allowed on quiz problems
- One resubmission
- You will practice how resubmissions work on Quiz 0 (comprised of math problems that should be review!)

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- Grading is very clear (1 or 0)
- Instructions are specific (exact specifications provided)
- Focus on mastery through regular quizzes, midterm, and final examinations

Syllabus and Course Content

Let's take a look:
https://usafa-ece.github.io/ece215-book/intro.html

Let's get started!

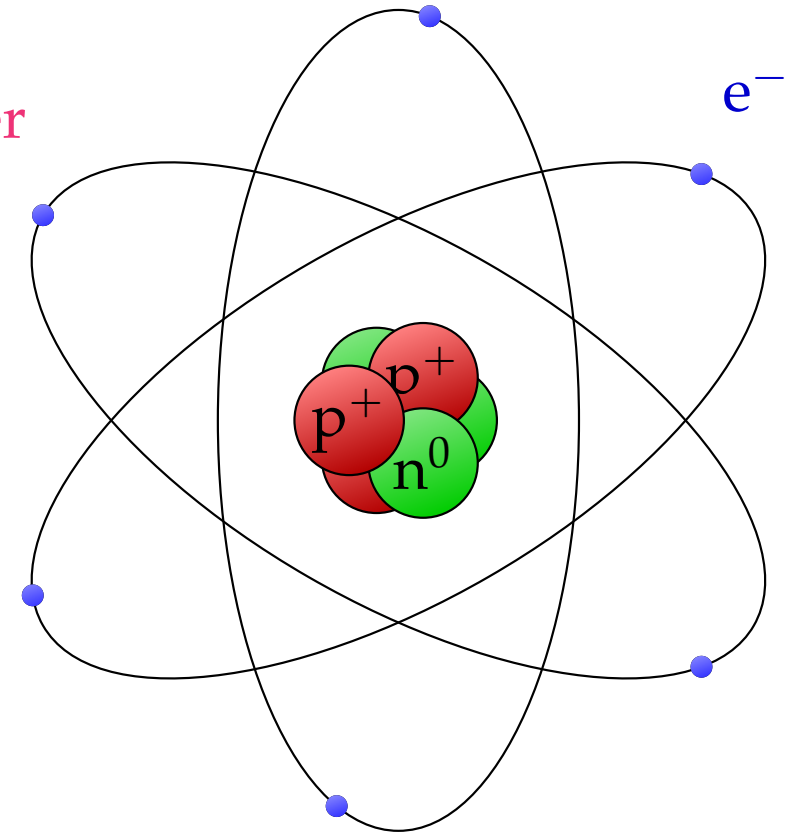
- Objective 1: I can calculate the voltages, currents, and power associated with devices in a simple DC-powered circuit using tools such as KVL, KCL, voltage and current dividers, Ohm's Law, and the power equation.

Charge

- All matter is made up of:
  molecules ← atoms ← particles
- Charge is a physical property of matter that causes it to experience force.
- Charge is quantized

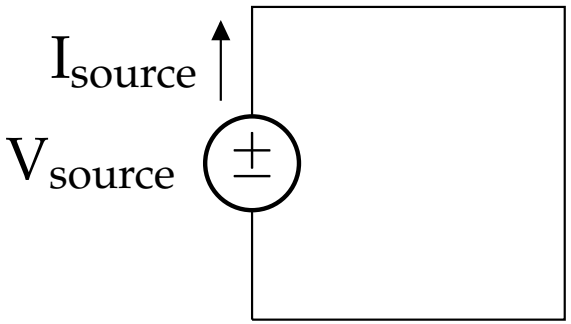
$$q_p = +1.6 \times 10^{-19} \text{ Coulombs}$$
$$q_e = -1.6 \times 10^{-19} \text{ Coulombs}$$

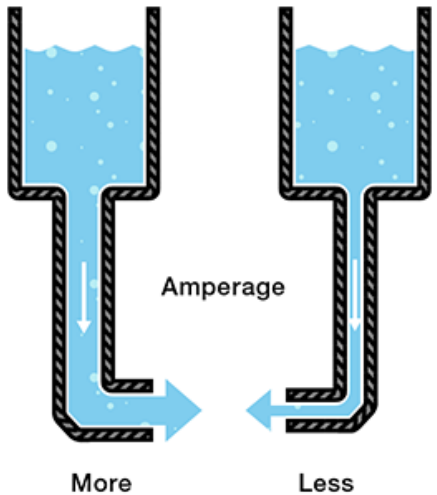
- Like charges repel, opposites attract



Current

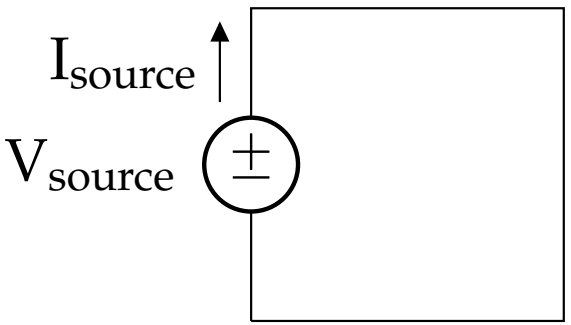
- Current is the strength of the flow of electrons
- Current: $I = \frac{dq}{dt} \rightarrow 1A = \frac{1C}{s}$
- Convention: Current flows from high potential to low potential (+ to -)
- Current is measured through a point
- Current has magnitude and direction

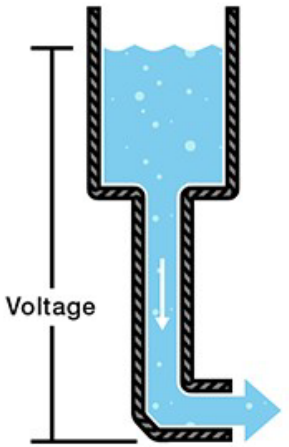




Voltage (Potential)

- Voltage is the potential for electrons to do work
- Energy to move charge
- Voltage: $V = \frac{\Delta E}{dq} \rightarrow 1V = \frac{1J}{C} = \frac{1N * m}{C}$
- Convention: Positive terminal (+) = higher potential
- Potential is measured between 2 points
- Potential exists ALWAYS, even if no current flowing
- Potential has magnitude and polarity





Pause! What about Batteries?

- What do they store?
  - Current?
  - Voltage?
  - Charge?

- Ex: If a battery stores 24A·h , how many does it hold?

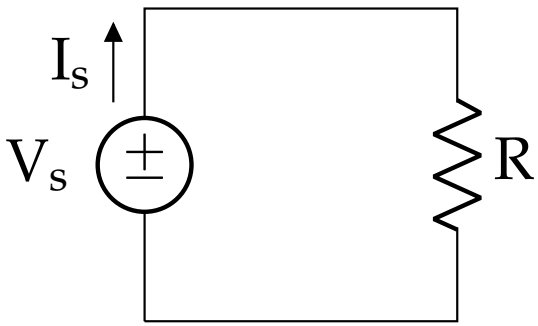
- What about how electric companies bill users? What unit do they use?
  -
  - So what are customers paying for?

Resistance

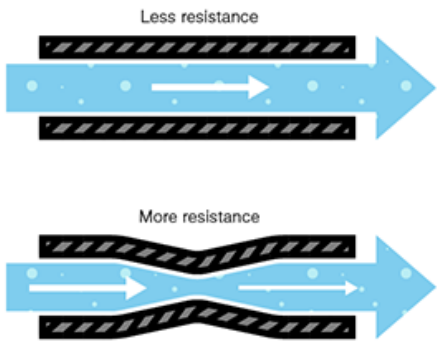
- Resistance is a measure of how much a material resists electron flow
- Resistance "eats up" power
- Measured in Ohms (Ω)
- Resistance is size/shape of pipe
- Describes fundamental physical property
- A material w/ length L and cross-sectional area A will have resistance:

$$R = \frac{\rho L}{A} \qquad \rightarrow \qquad \rho \text{ is resistivity}$$

- Q: Why use gold or aluminum if copper has a lower resistivity?



Resistance



material	$\rho(\Omega \cdot \text{m})$
copper	1.72×10^{-8}
gold	2.45×10^{-8}
aluminum	2.8×10^{-8}