Welcome back!

Please fill out a name tent with whatever you want us to call you.

EN 1-24: Engineering in the Kitchen

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14 September 2020

Tufts UNIVERSITY

Quick review of last time

Is it possible to have a voltage without a current?

Respond at **pollev.com/stevenbell**

Quick review of last time

Is it possible to have a voltage without a current?

Is it possible to have a current without a voltage?

Respond at **pollev.com/stevenbell**

By the end of class today, you should be able to:

- Explain what resistance is
- Use Ohm's law to calculate V/I/R
- Explain what power is, and how it's different from energy
- Use Watt's law to calculate power

Marble-track resistor

From the fantastic engineering/woodworking site woodgears.ca

Ohm's Law

For a resistor (and only a resistor):

$$I = \frac{V}{R}$$

R is the resistance, measured in Ohms

Represented with the schematic symbol:

WARNING WARNING WARNING!

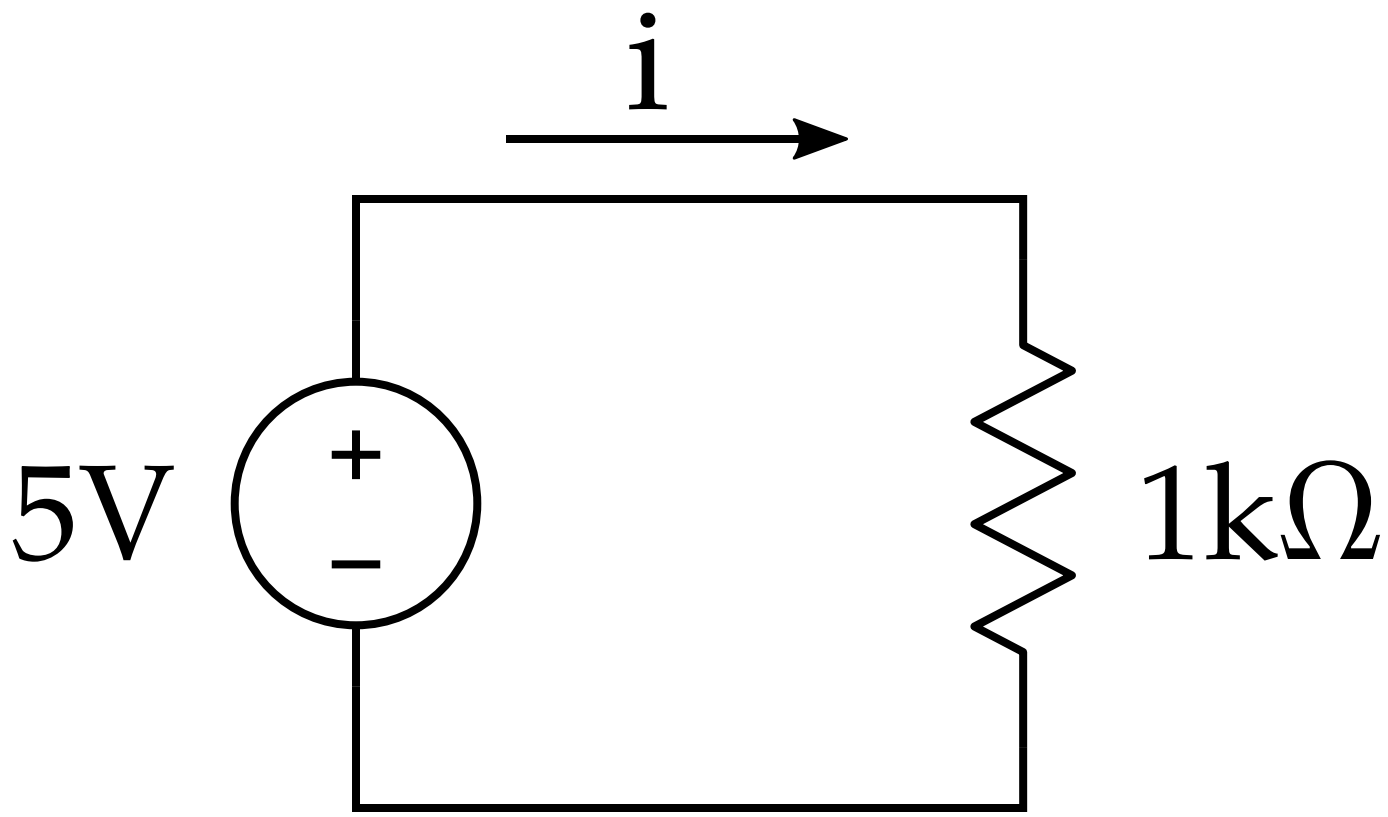
Not everything behaves like a resistor.

For example:

- Diodes (and light-emitting diodes, LEDs)
- Capacitors and inductors, which store energy
- Batteries

Don't just blindly apply Ohm's law!

What is the current i?

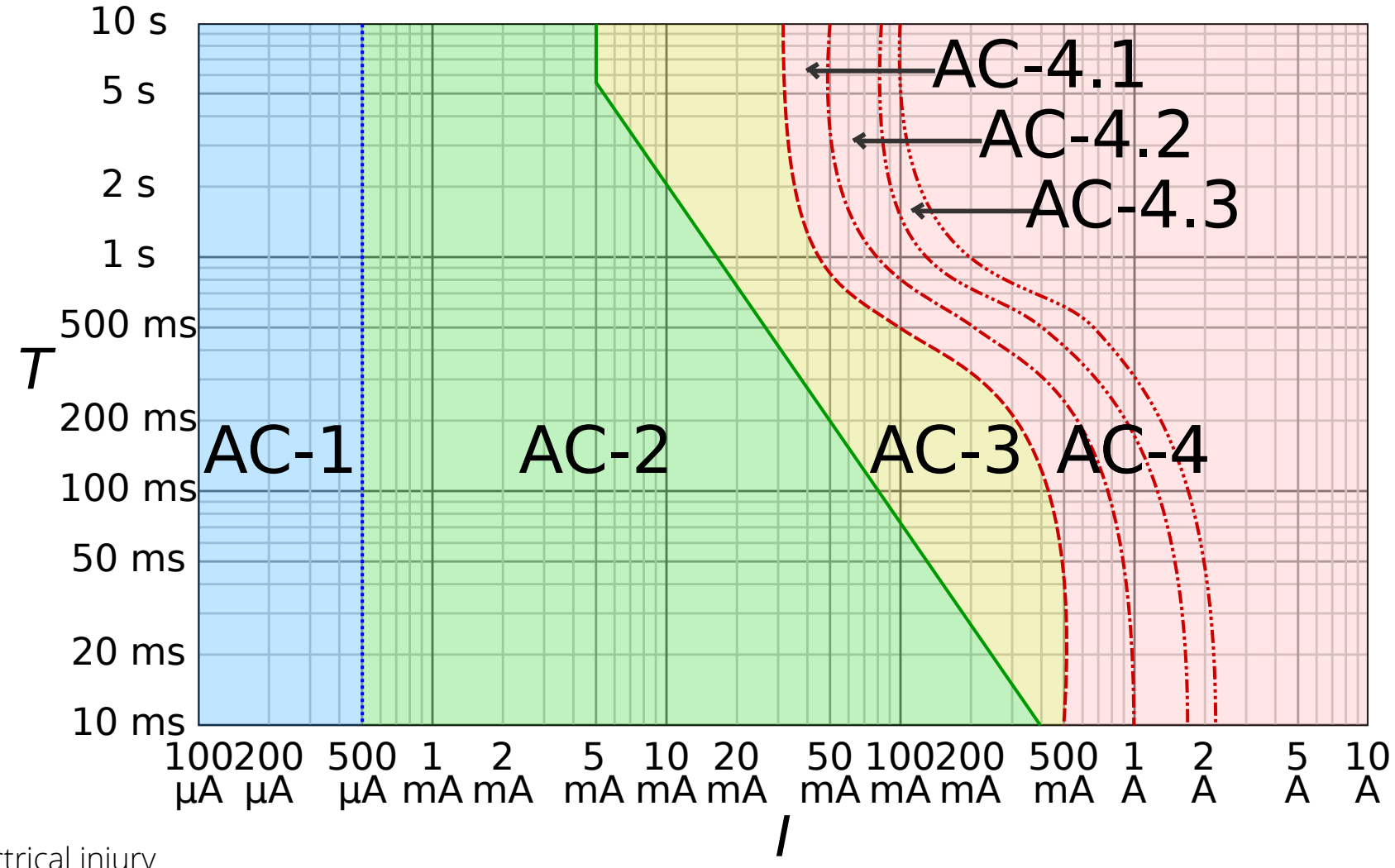


Let's measure some more interesting things.

Let's talk about safety

Electricity can kill you.[*citation needed*]

But how? And is it the voltage or current that's dangerous?



Wikipedia - Electrical injury

Ok, so what *voltage* is dangerous?

A phone charges at 1A or more, so why isn't that dangerous? (Or is it?)

Intermission: Interview your partner

I'll be coming around to take pictures

Intermission: Interview your partner

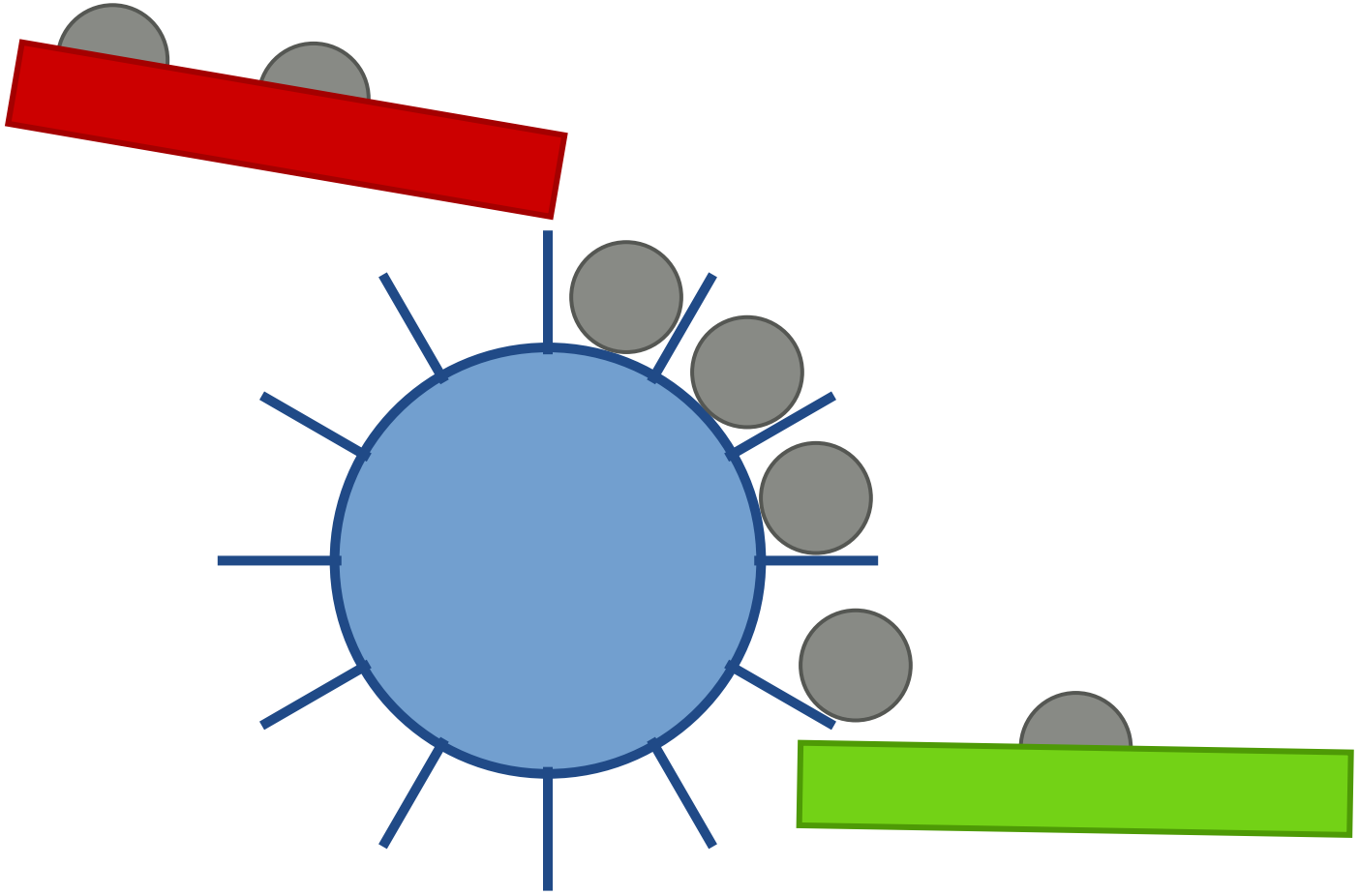
Who is from the furthest away?

Who has the largest / most interesting pet?

Who has the most siblings?

Who has an interesting hobby?

Collecting energy from marbles



What determines how much energy I get?

$$V = \frac{\text{Joules}}{\text{Coloumb}} \qquad I = \frac{\text{Coloumbs}}{\text{second}}$$

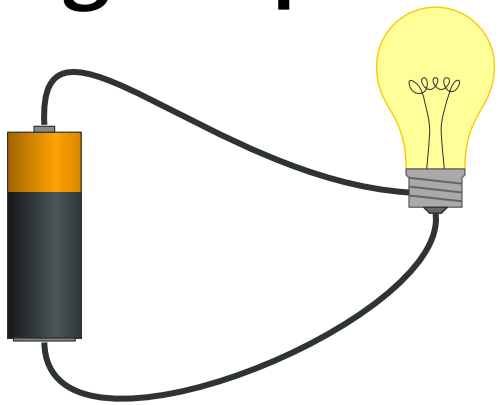
$$V \cdot I = \frac{\text{Joules}}{\text{Coloumb}} \; \frac{\text{Coloumbs}}{\text{second}} = \frac{\text{Joules}}{\text{second}}$$

Joules/sec is called a **Watt**, abbreviated **W**.

How much power does a light bulb use, if it is connected to 120V and draws 0.5 A?

A more exciting example

Why does the light bulb light up?



The filament gets hot and glows because:

A) the current is used up in the light bulb, becoming heat.
B) the voltage accelerates electrons and they collide with the metal, losing their energy as heat.
C) charges pile up inside the filament, and the repulsion of their electric fields creates heat.
D) this is a trick question; the light bulb doesn't light up.

Bonus material: Alternating current

Wrapping up

PollEverywhere: what is one question you have after today's class?