

Welcome to ENGR 40M!

Please take a seat and fill out a namecard with the name you prefer to be called by.

ENGR 40M, Lecture 1:

Welcome and electricity basics

Steven Bell

26 June 2016

Stanford University

What is "Making"?







VATTENFALL





"Any sufficiently advanced technology is
indistinguishable from magic."

Arthur Clarke, 1973

Our goal is for you to
become the magician
(and not part of the audience)

You'll have to take things apart,
literally and figuratively.

This takes **patience** and **practice**

Remember:

someone put it together,
and they weren't smarter than you.



About us

Instructors

Steven Bell

Chuan-Zheng Lee

Course Assistants

Cheng Chen

Jugal Gala

Siavash Kananian

Nathan Staffa

Helen Xiong

About you: name game

Learning philosophy

- ▶ We're a **community**.
- ▶ Your **brain** is like a **muscle**.
- ▶ There are lots of **stereotypes** about who succeeds in EE - but they're false.

About the course

This is a challenging course, and we've compressed it down to 8 weeks for summer.

Expect to work **125%**.

But I think it will be worth it!

And **we're here to help** - we've got a great student/staff ratio and **we want you to succeed**.

Class logistics

We have lecture MWF 1:30-2:50pm

You'll have lab once a week

Prelab will be due 24 hours before lab

3-hour lab section (times to be assigned)

Report due by lab time the following week

Homework

Homework will go out on Friday, and be due the following Friday at the beginning of class.

The homework shouldn't take more than 2-3 hours/week. If you're struggling, talk to us.

Technology

Stanford Honor Code

The Honor Code is an undertaking of the students, individually and collectively:

- 1) that they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
- 2) that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.

The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.

Resources

All slides and resources will be at
engr40m.stanford.edu

Join ENGR 40M on **Piazza** for **Q&A**

Assignments submitted online via **Gradescope**.

Objectives

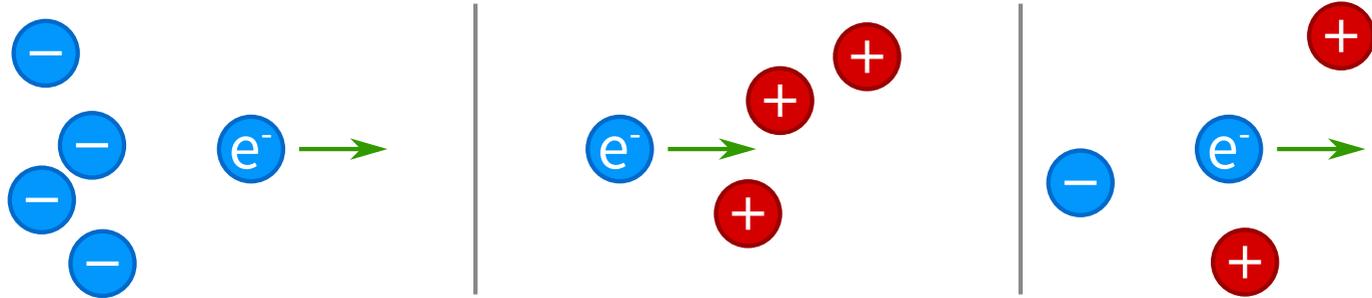
By the end of class, you should be able to:

Explain what voltage and current are, and how they are different.

Identify schematic elements and connections.

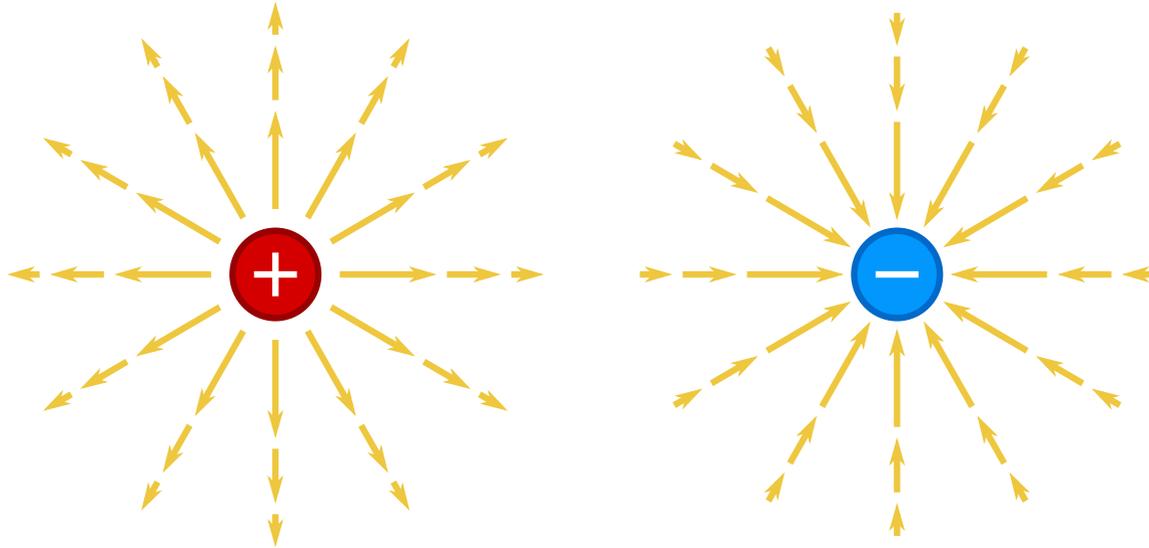
Identify congruent circuits.

Opposites attract



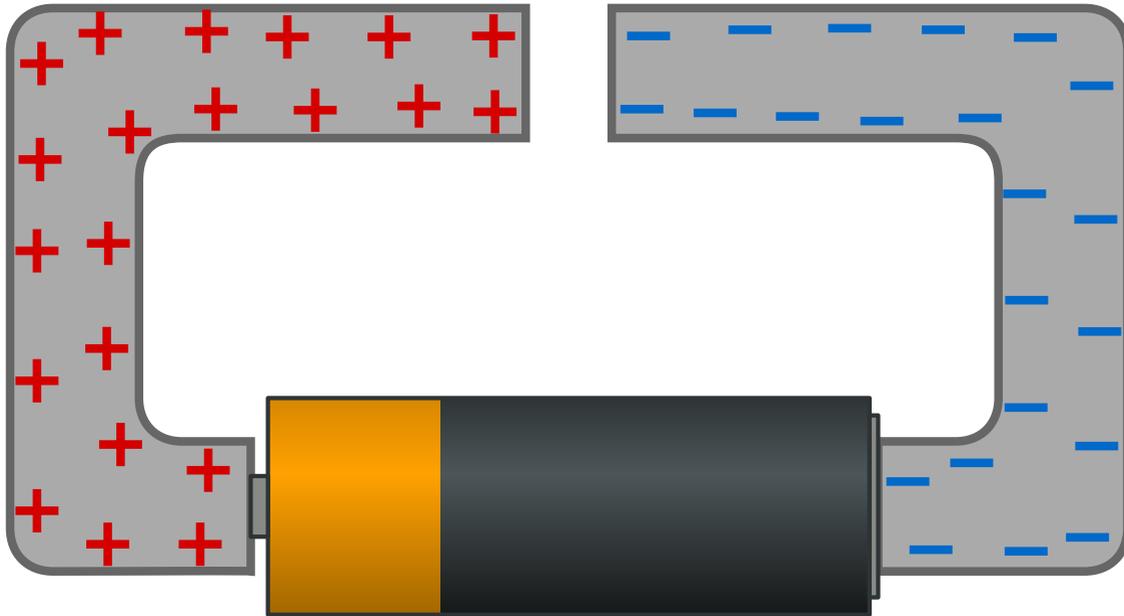
Electric field

What force would a positive charge feel?



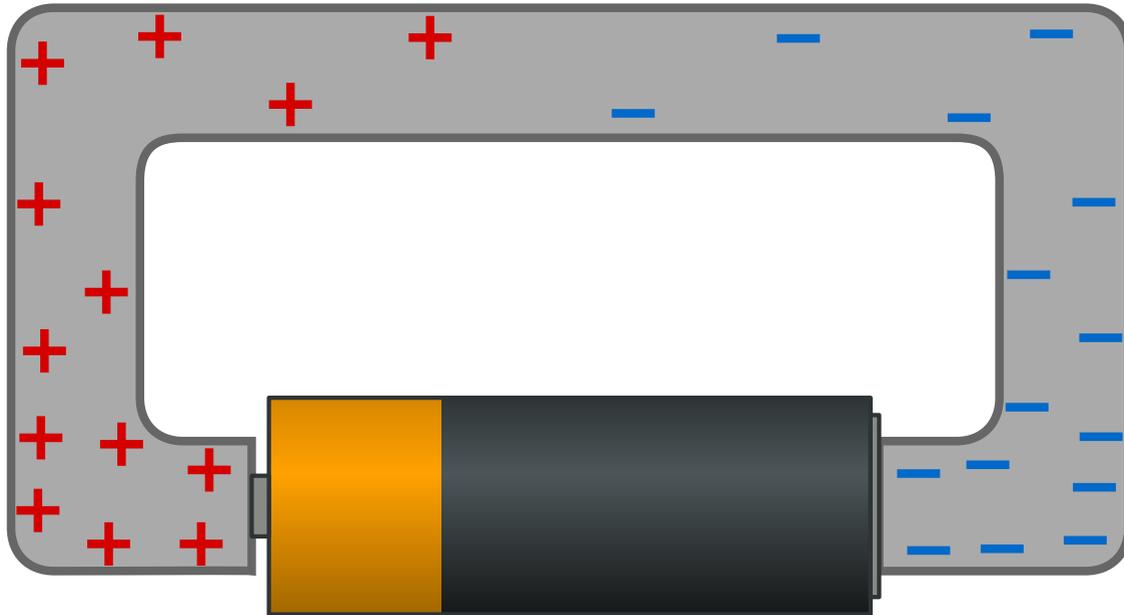
Batteries and wire

A chemical reaction produces charges, until it reaches equilibrium.



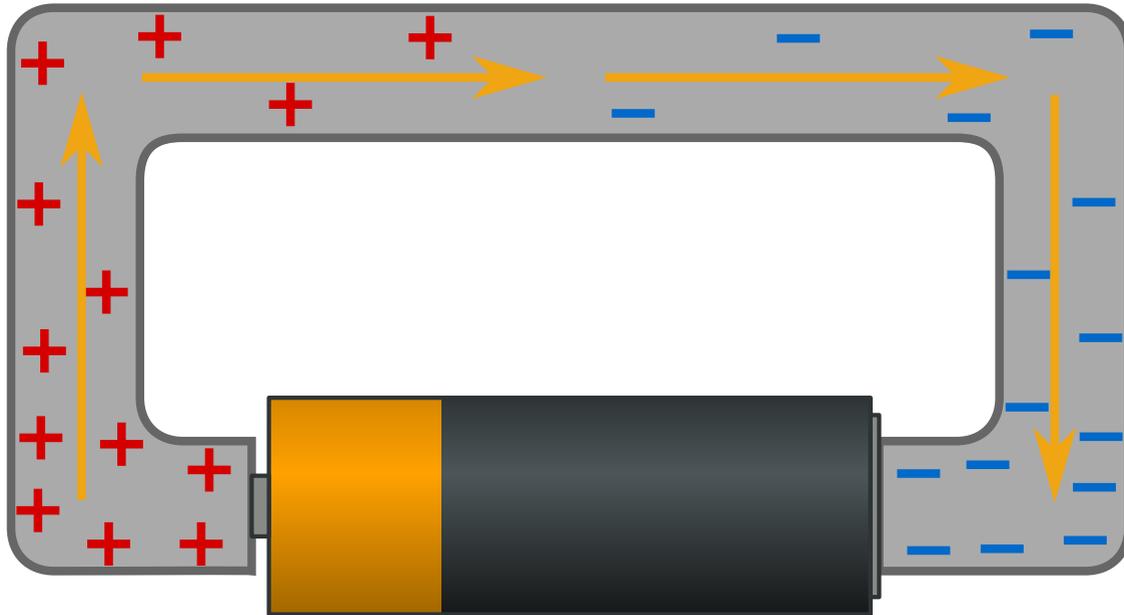
Connecting the wire

Charges cancel, but the battery produces more, setting up a new equilibrium.



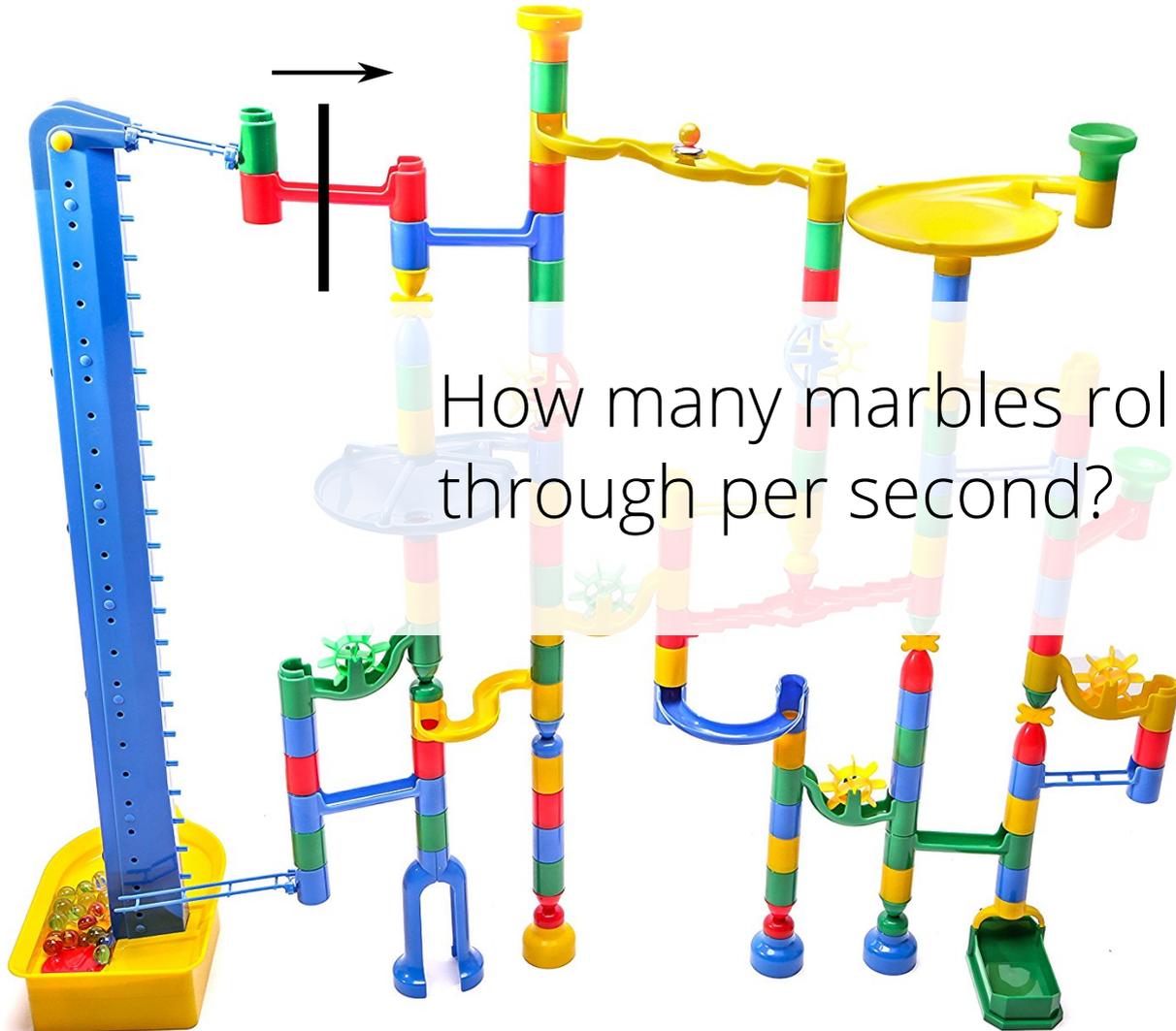
A field in the wire

The charge gradient produces an electric field, which pushes current down the wire!

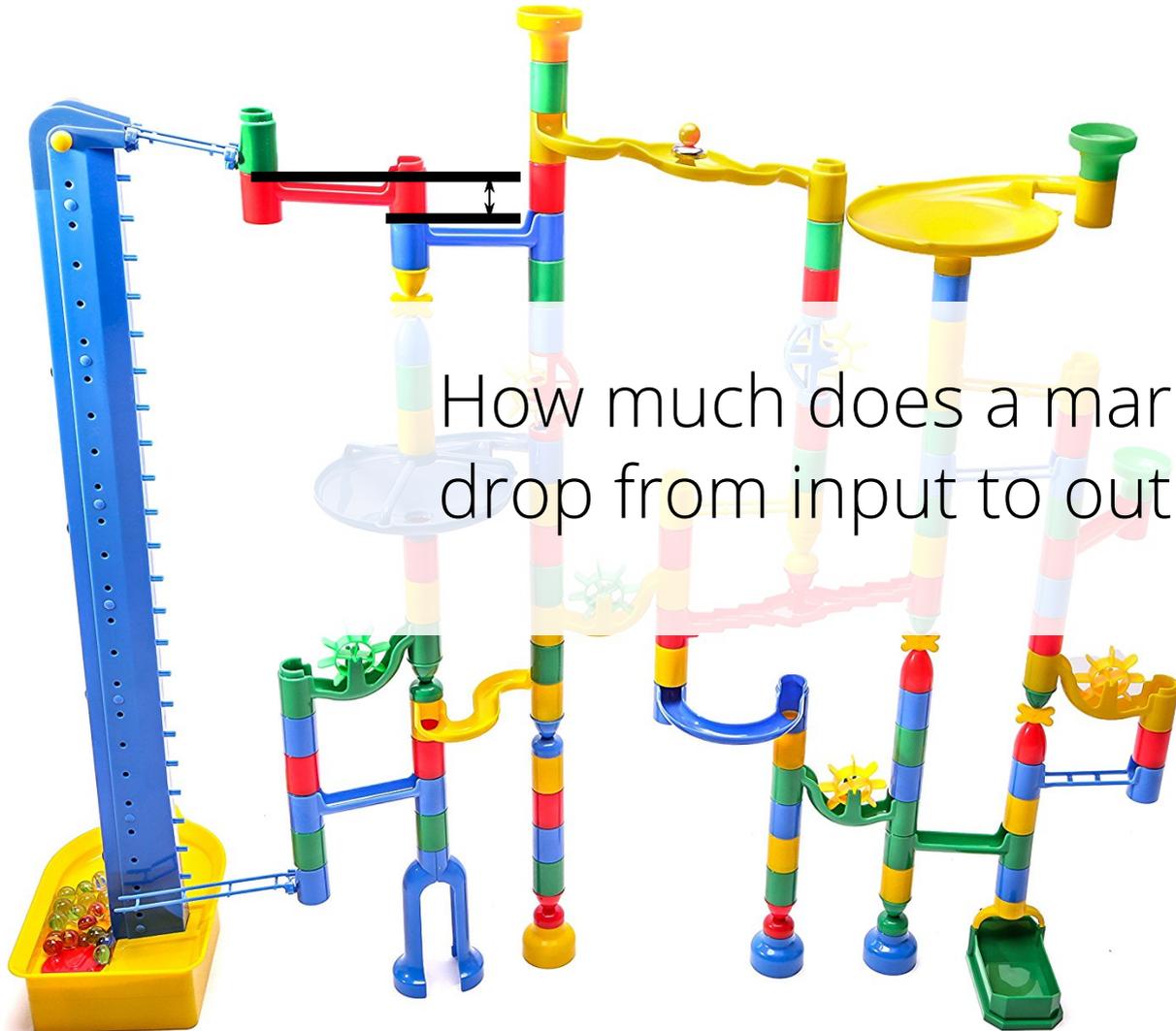


One way to think about a circuit:





How many marbles roll through per second?

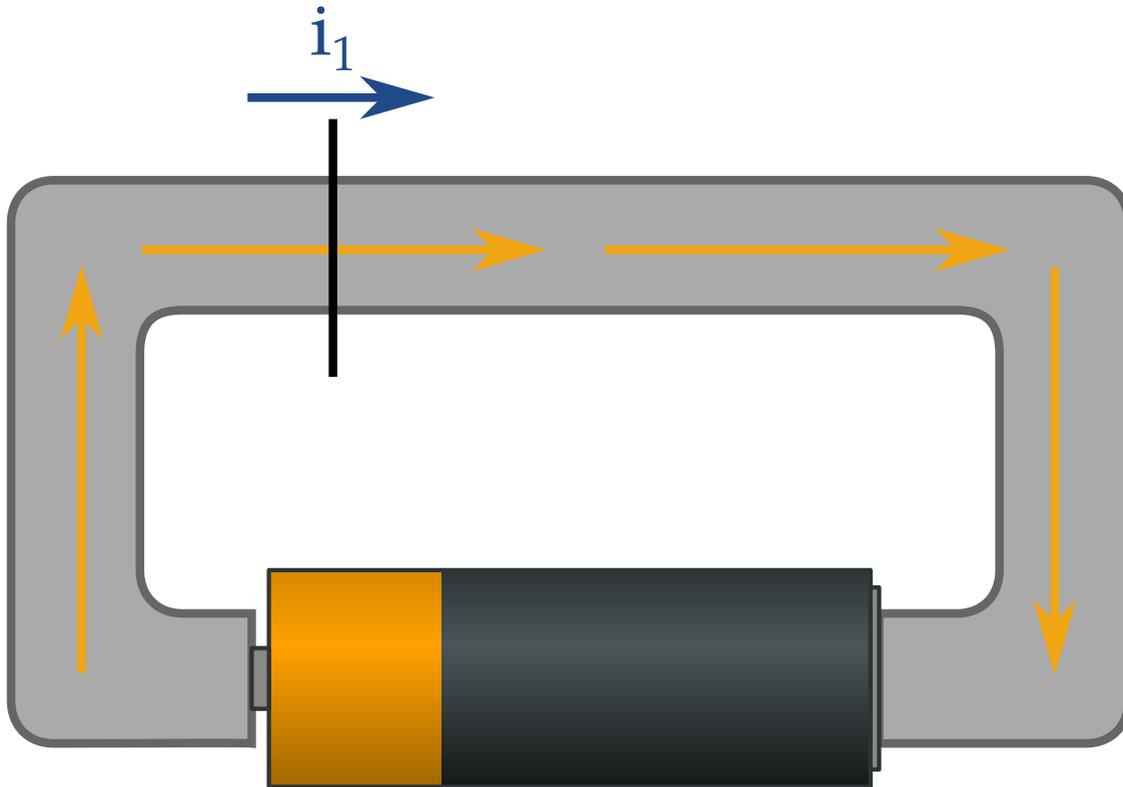


How much does a marble drop from input to output?

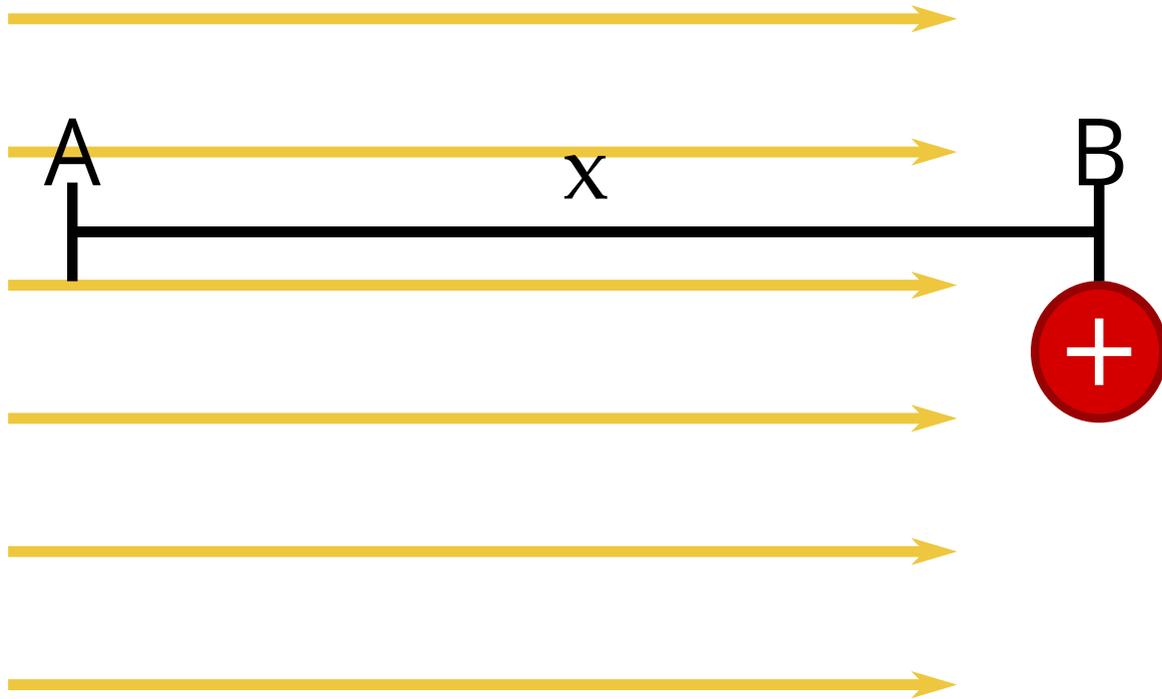
Current

Current is charge per second past a point

Measured in Coloumbs /second = **Amps**



Work in an electric field

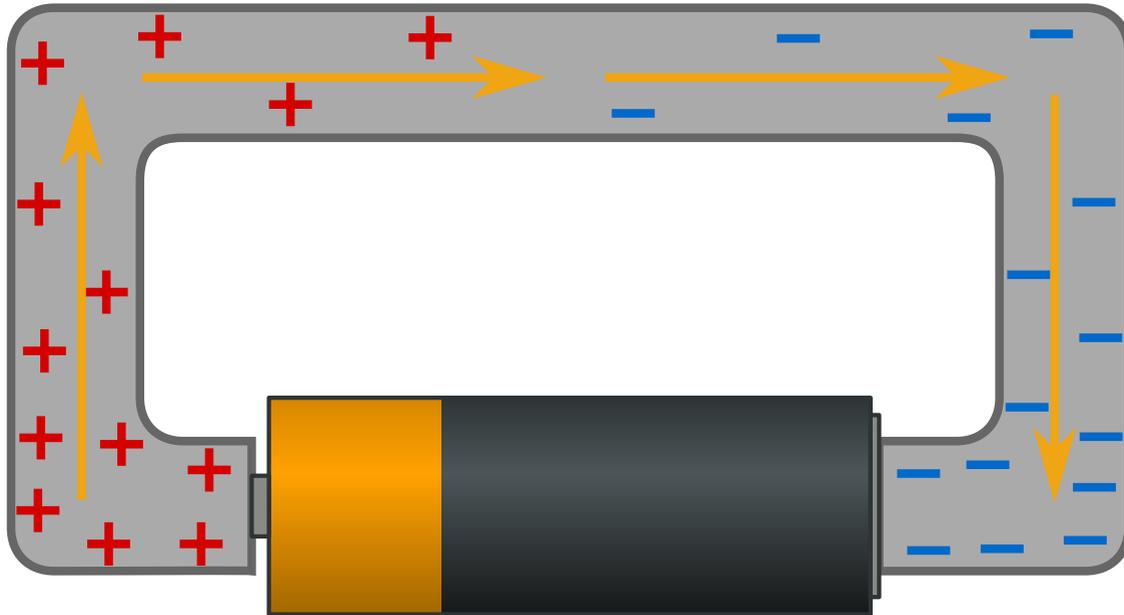


We say that A has **higher potential** than B.

Work in a wire

Voltage is difference in electrical potential

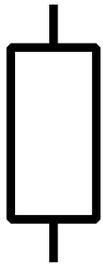
Measured in Joules/Coulomb = **Volts**



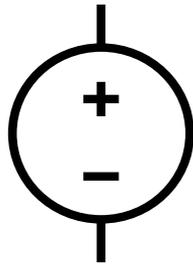
Circuit schematics

A schematic is an abstraction for describing a circuit.

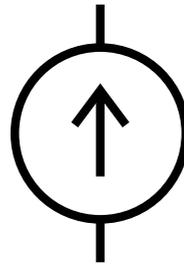
Some elements you should know:



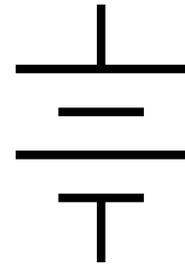
Block
element



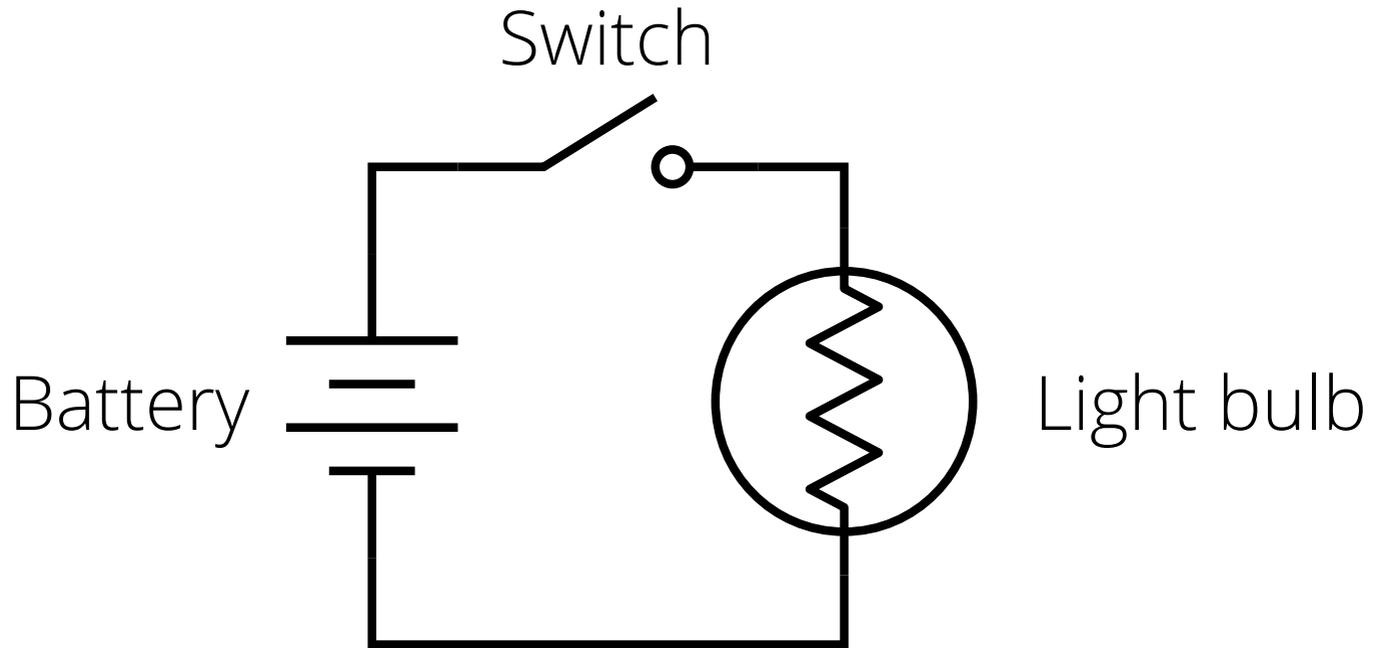
Voltage
source



Current
source

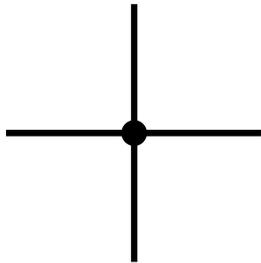


Battery

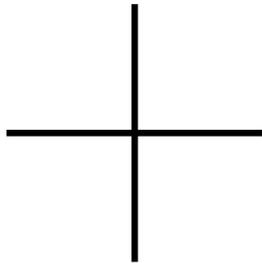


Circuit schematics

It's important to be clear about what's connected and what is not:



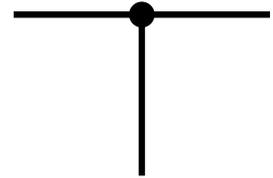
connected



not connected



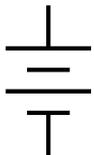
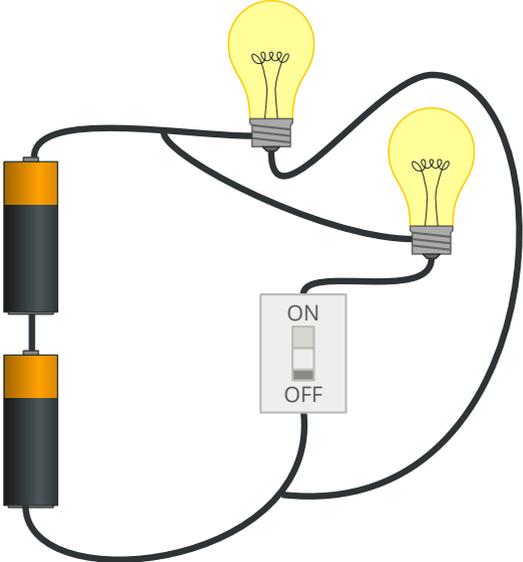
connected



connected
(dot is only for clarity)

A connected region is called a "node".

Draw a schematic for this circuit:



Battery



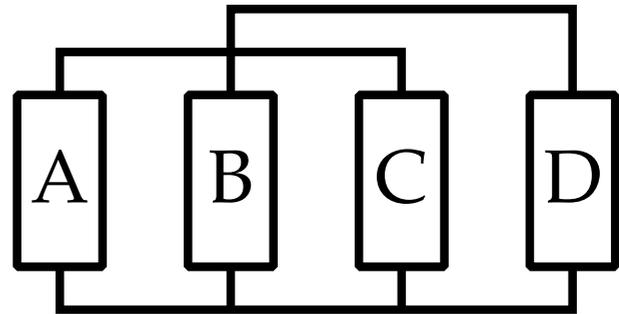
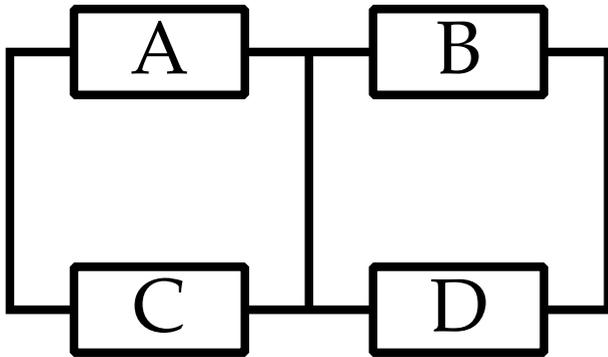
Light bulb

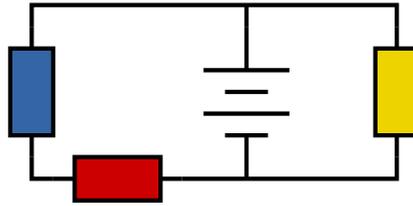


Switch

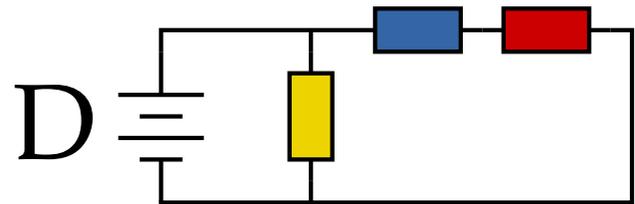
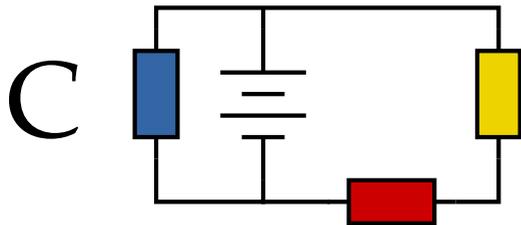
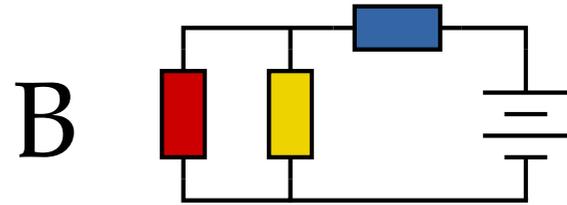
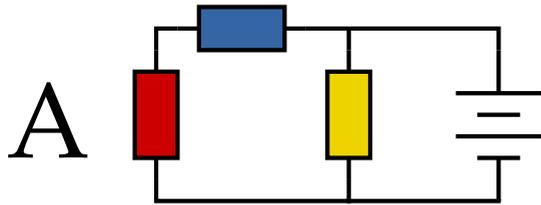
Congruent schematics

There are many ways to draw the same circuit. Don't be fooled just because they appear different - check what connects to what!





Which of the circuits below are congruent with the circuit above?



Go to **menti.com** and use code **11 69 95**

What is one question you
have after today's class?

Go to **menti.com** and use code **11 69 95**