/electronics

Code and Space
ARC 593 | DMS 606

Fall 2016

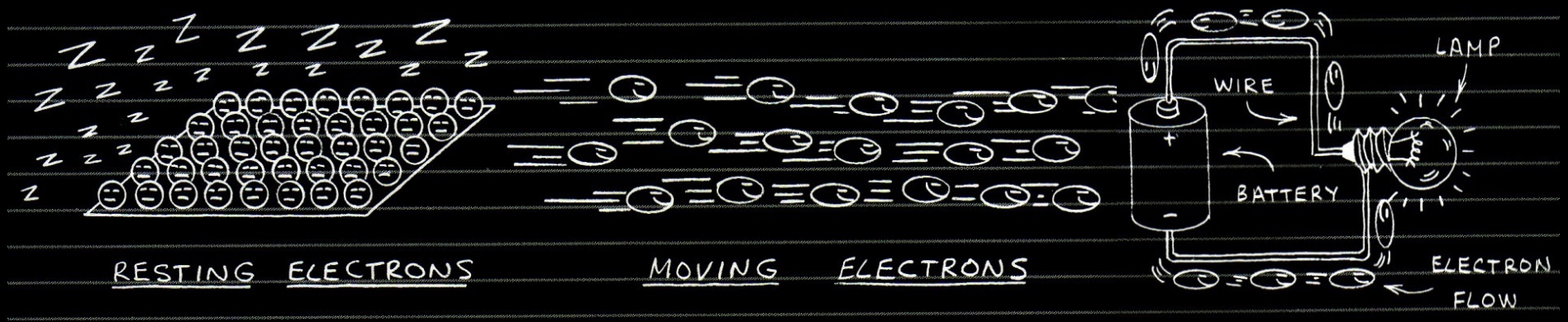
Instructor: Mark Shepard
TA: Leonardo Aranda

electricity

- a fundamental form of energy observable in positive and negative forms that occurs naturally (as in lightning) or is produced (as with a generator) and that is expressed in terms of the movement and interaction of electrons.
- an electron is a subatomic particle with a negative elementary electric charge.

electricity

- electrons are resting until a closed loop is formed between positive and negative: when the loop is closed, electrons start moving.

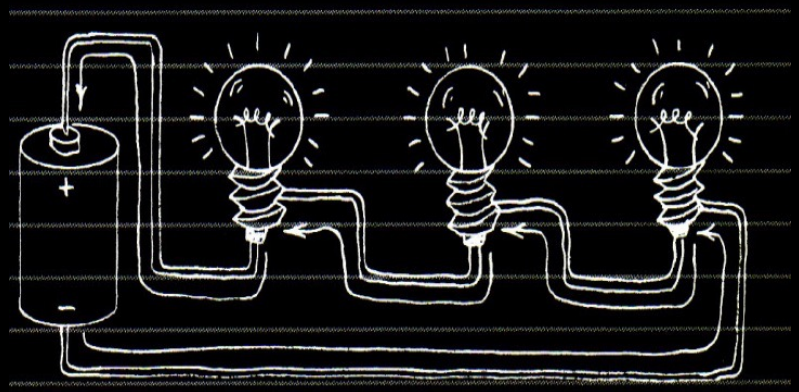


transduction

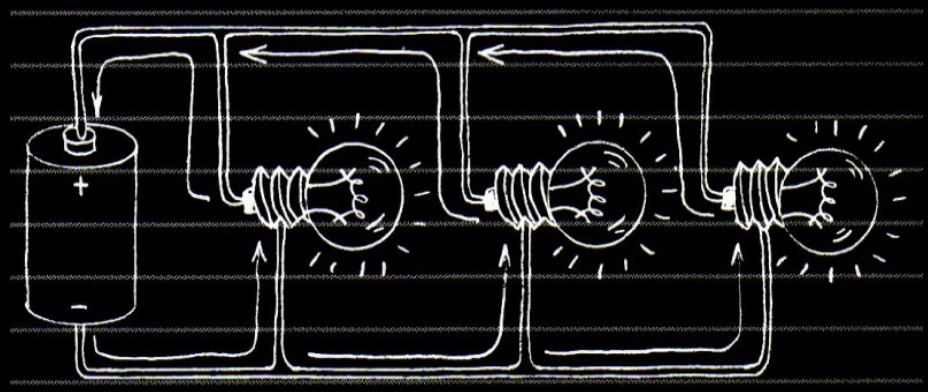
- conversion of one energy type to another energy type
  - electricity > light
  - electricity > heat
  - electricity > movement

circuits

- are devices that work by controlling the flow of electrons through electrical components
- are a closed path formed by interaction of electrical components through which the electric current can flow.



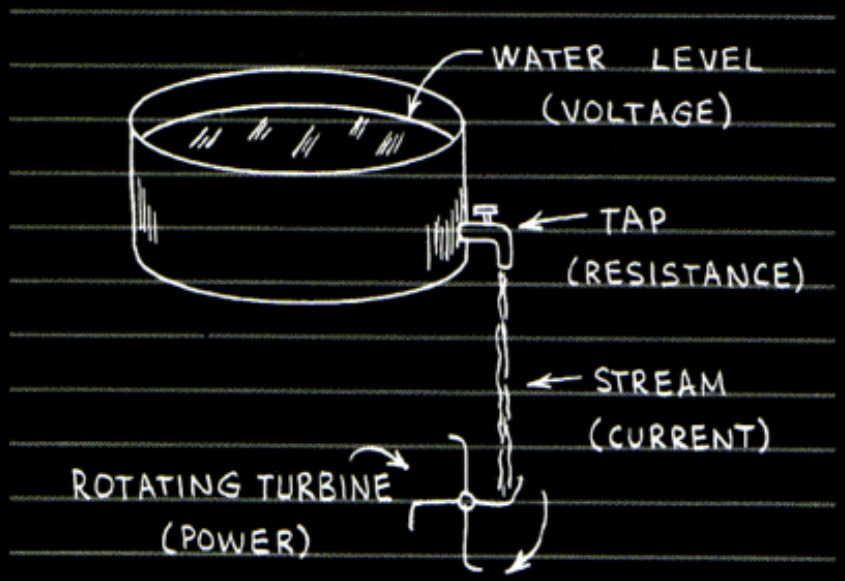
series



parallel

terminology

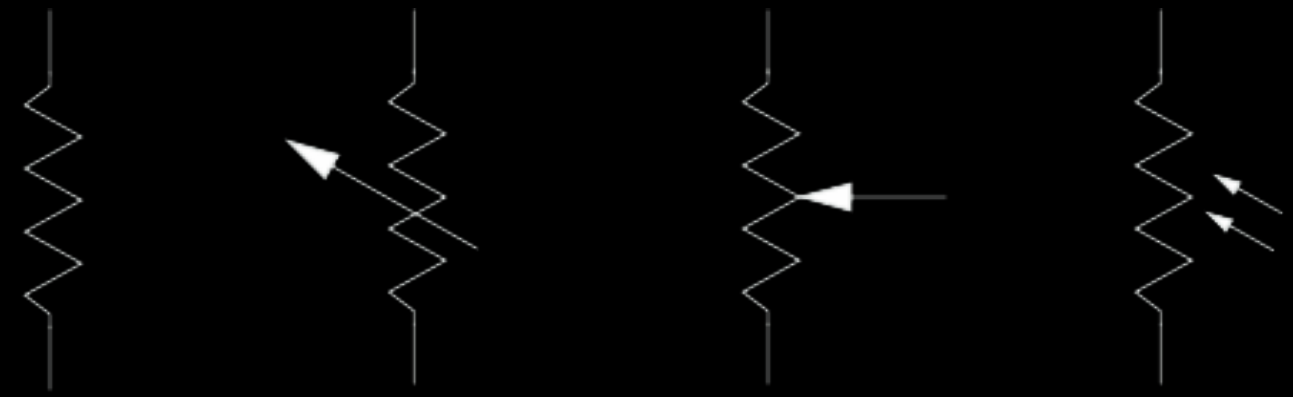
- voltage (V), unit: Volts (V) - potential difference in the circuit
- resistance (R), unit: Ohm (Ω) - a measure of the degree to which an object resists an electrical current through it
- current (I), unit: Ampere (A) - quantity of electrons passing a given point
- power (P), unit: Watt (W) - work done by electrical current



resistors

- Resistors resist, but do not totally block, the flow of electricity.
- They are used to control the flow of current. Current can move either way through a resistor, so it doesn't matter which way they're connected in a circuit.
- Resistors are measured by their resistance in ohms (Ω), often seen in kilohms (kΩ).

resistors



fixed value resistor

variable resistor

potentiometer

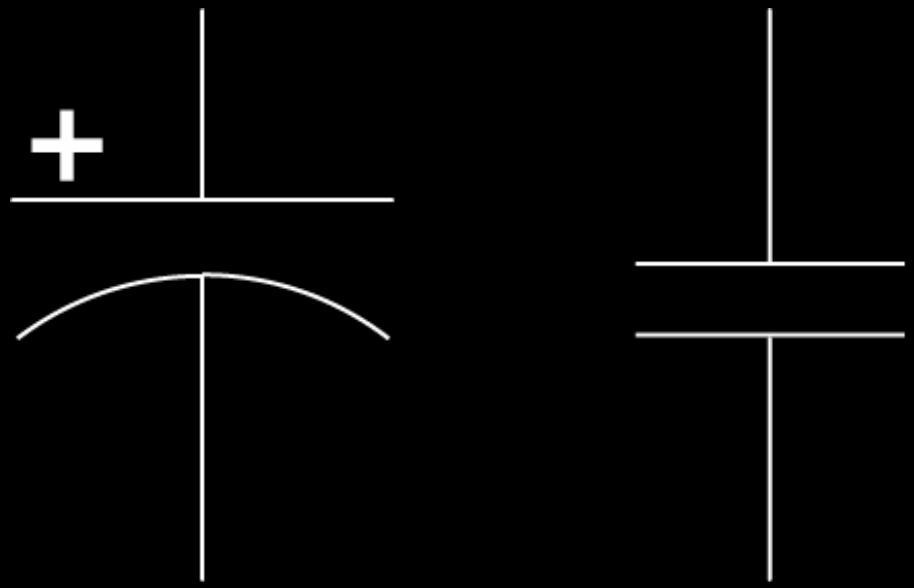
photoresistor or light-dependent resistor

> Resistor Color Code Calculator

capacitors

- Capacitors store up electricity while current is flowing into them, then release the energy when the incoming current is removed.
- Capacitors are measured by their capacitance in farads (F), most commonly seen in microfarads (μF).
- Sometimes they are polarized, meaning current can only flow through them in a specific direction, and sometimes they are not.

capacitors



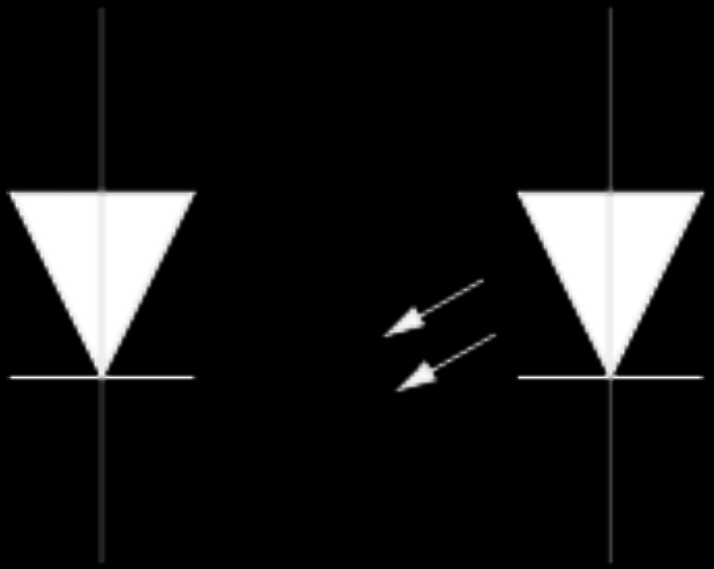
polarized capacitor

non-polarized capacitor

diodes

- diodes permit the flow of electricity in one direction, and block it in the other direction.
- because of this, they can only be placed in a circuit in one direction.
- Light-Emitting Diodes (LED's) are special types of diodes which emit light when current flows through them.

diodes

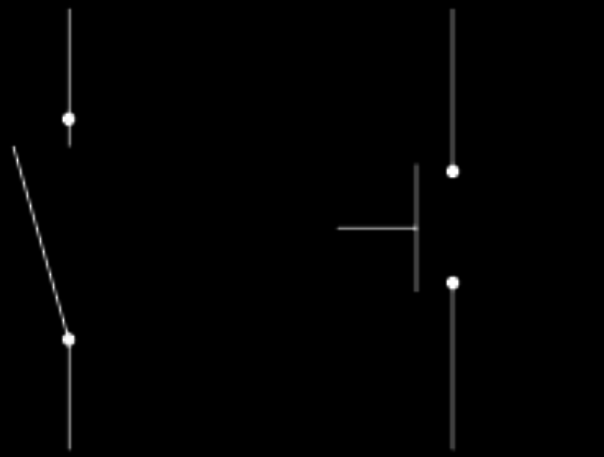


diode

light-emitting diode (LED)

switches

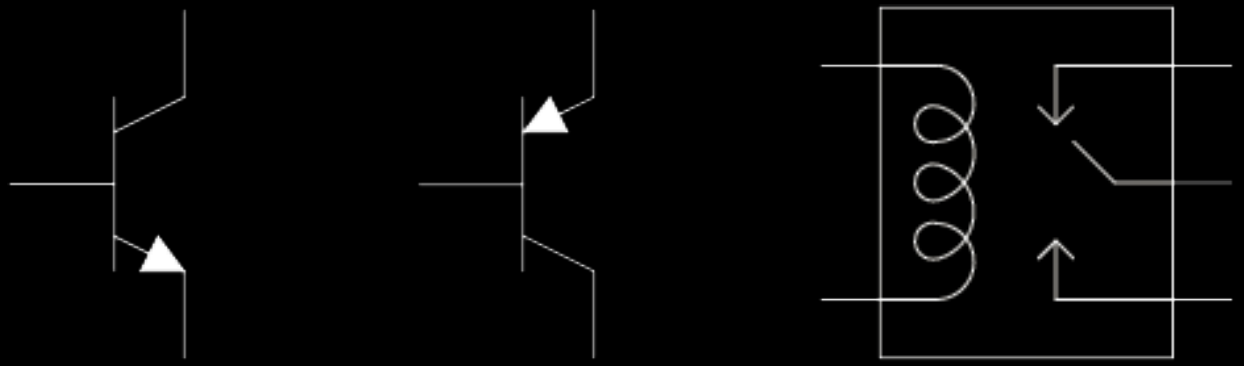
- switches and pushbuttons control the flow of current through a junction in a circuit



switch pushbutton

transistors and relays

- are electrical switching devices



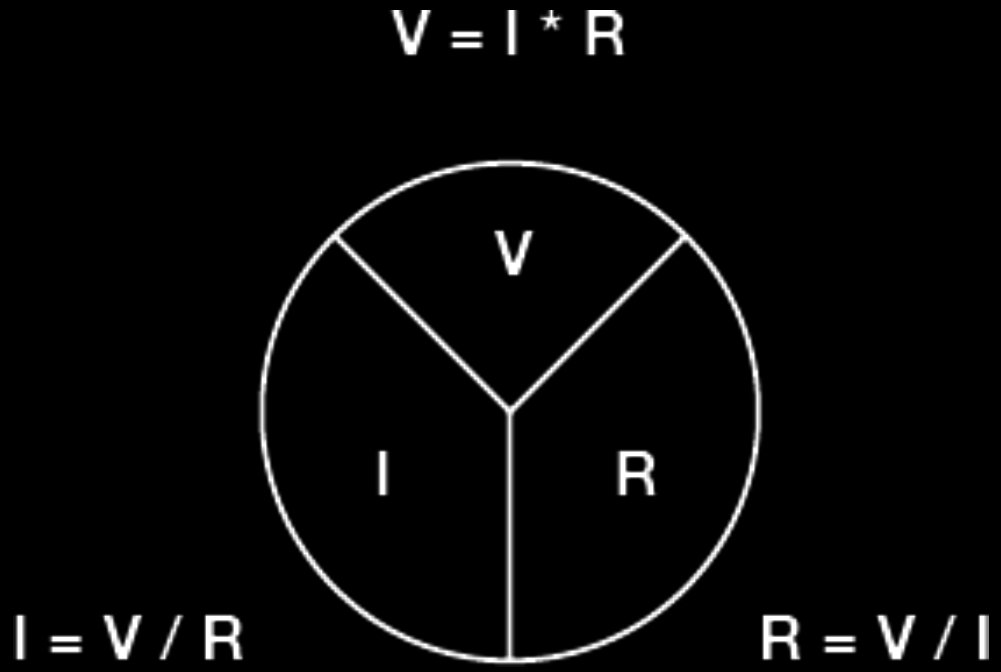
NPN transistor

PNP transistor

relay

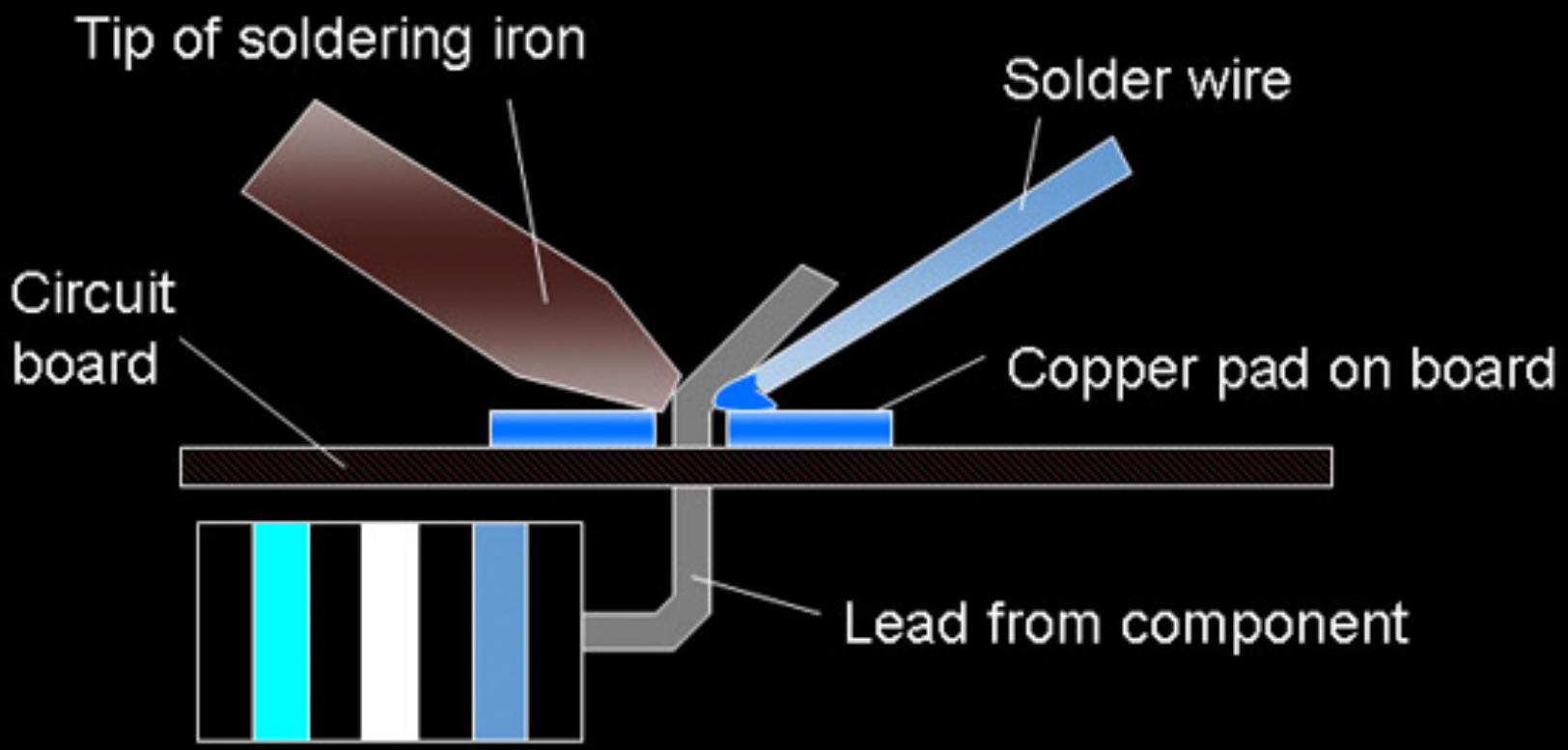
ohm's law

- for a given resistance, voltage across the two points is directly proportional to the current between them



using a multimeter

soldering


Tip of soldering iron
Solder wire
Circuit board
Copper pad on board
Lead from component