

Electricity

- Chapter 16

Electric Potential Energy

- Potential Energy is stored energy.
- Electric Potential Energy is energy that is stored.
- Capacitors are the most common ways to store energy.

Electrical Potential Energy

- $PE_{\text{electric}} = - (\text{charge} \times \text{electric field strength} \times \text{displacement})$
- $PE_{\text{electric}} = - (qEd)$

As a particle moves 10 m along an electric field with a strength of 75 N/C, its electrical potential energy decreases by 2.8×10^{-16} . What is the charge?

Potential Difference

- Also known as Voltage
- Units are Volts
- Potential Difference = change in Electrical Potential Energy / electric charge
- $V = \Delta PE_{\text{electric}} / q$

As a particle moves 5 m along an electric field with a strength of 20 N/C, its electrical potential energy decreases by 5×10^{-10} . First find the charge then the potential difference.

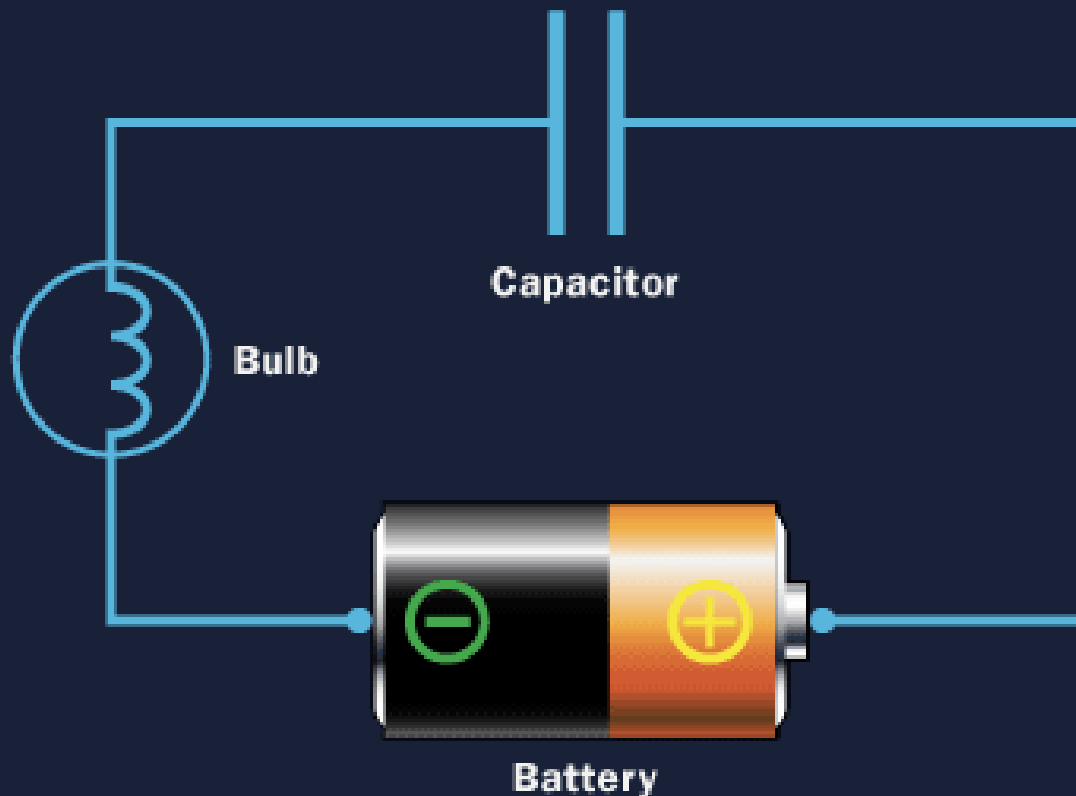
Capacitance

- A conductor can store energy by storing charges on separate plates
- The ability of a conductor to store energy is measured by the capacitance.
- The more electricity something can hold, the higher the capacitance.
- Capacitance has units of the Farad (F) which is equivalent to a coulomb/volt.

- Capacitance = Net Charge on each plate / potential Difference
- $C = Q / V$

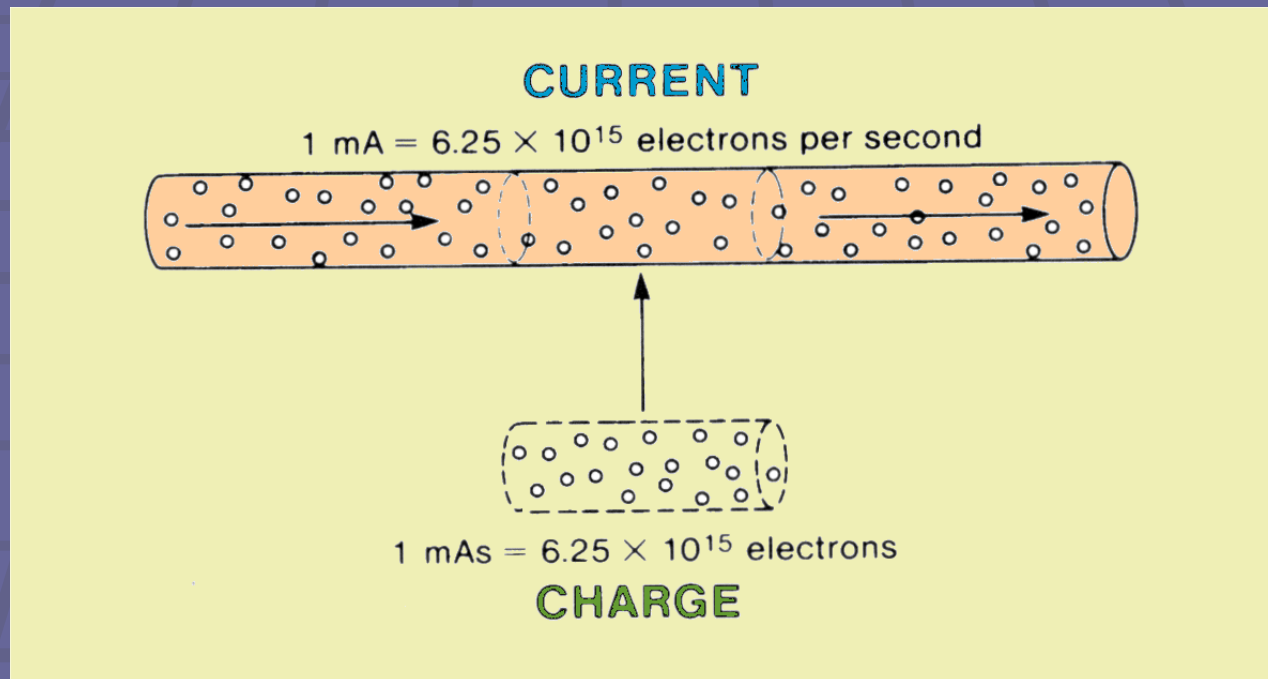
Demo Camera Capacitor

How Capacitors Work Basic Configuration



Current

- How fast charges move is called Current.
- Current is measured in Amps (A).

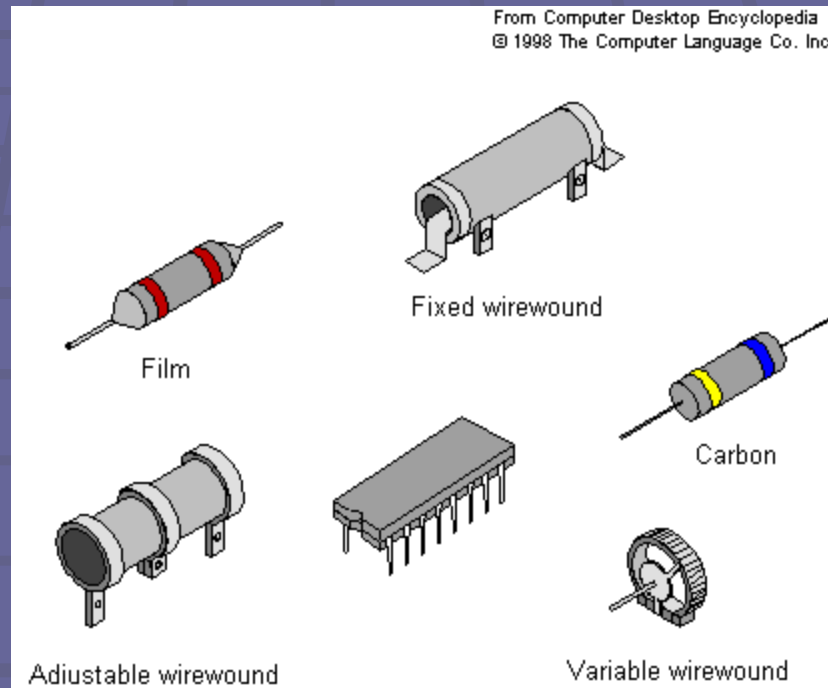


- Electric Current = Charge / Time

- $I = Q / t$

Resistance

- The opposition to the flow of charges (current) is called resistance.
- Resistance is measured in Ohms (Ω)



Ohm's Law

- Resistance = Potential Difference / Current
- $R = V / I$
- Ohm's Law is not true for all materials. However, most common materials do follow Ohm's Law so when working problems we assume the materials follow this law.

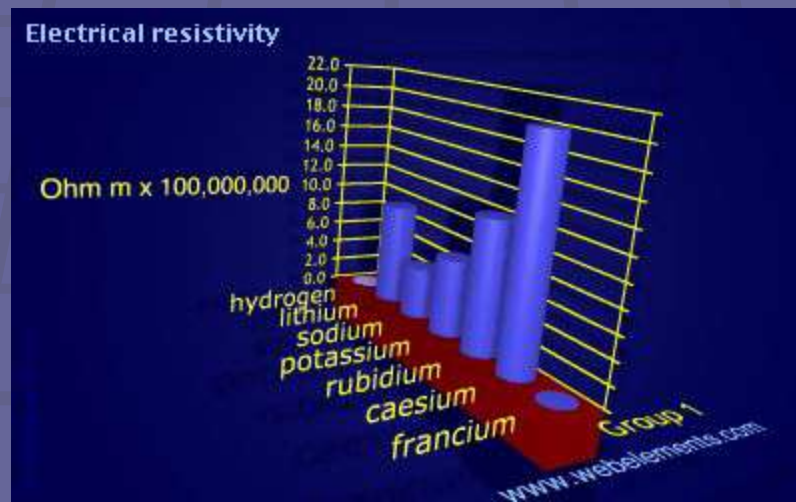
Resistance

- Resistance depends on length, area, material, and temperature.
- Longer wires have more resistance.
- Thinner (less radius) wires have more resistance.



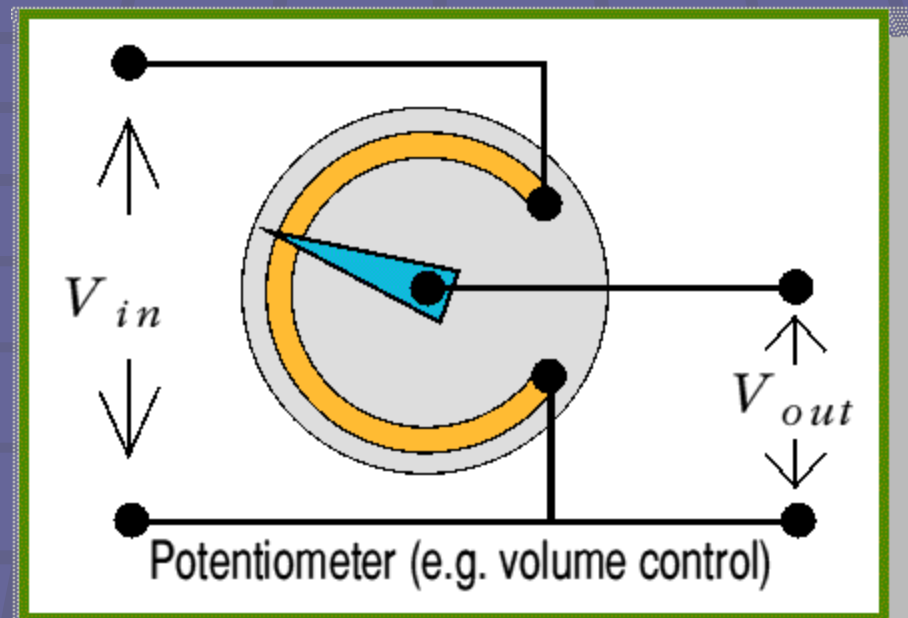
Resistance

- Certain materials, such as gold, have less resistance than others. This depends on the structure of the atom.
- As temperature increases, for most materials the resistance increases. When a material is hot, it's atoms vibrate faster and interfere with the flow of electrons.



Variable Resistors

- Resistors that can change their resistance are called Potentiometers.
- They have one fixed end and the other end slides to change the resistance.



Power

- Earlier, in this class, we learned that Power is the how fast something does work.
- Electrical power is how fast a charges do work.
- Electrical Power has Watts as units.

- Electric Power =
Current x potential
difference
- $P = I \times V$