# **Electric Power**

* Almost always requires a resistor
* Electrons collide with crystal structure and lose energy: emit heat and light
* (in watts): combine this with ohm’s law:
* As resistance goes *up*, power consumed goes *down* (so high-power lightbulbs have low resistance)
* Total power is larger in parallel than in series
* Power Strip: cable dissipates a lot of heat if there’s too much power after daisy chaining... (a lot in parallel going through same wire!)
* Alternating/Direct Current
  + Alternating current oscillates in voltage and in current (but lightbulbs stay hot/bright!)
    - LED’s flash though
    - frequency is 60Hz (US)
* Batteries
  + Slow-producing, but make a lot of charge
  + chemical reactions
  + Internal resistor inside battery: maximum voltage
    - high voltage = high resistance (more expensive battery)
    - where is the internal resistance
    - If no internal resistance, , so (short circuit!)
  + 2 lemons in series: double voltage; lemons in parallel: same voltage, less resistance
  + The voltage a battery provides is called an “electromotive force” (E)

## **Ammeter/Voltmeter**

* Goal: measure without changing the circuit
* Base device: galvonometer (measures indirectly with electromagnet)
  + has an internal resistor: “shunt”; this makes the right *portion* of the current flow through the galvonometer
* **Ammeter** (measures current): want shunt to have small resistance [big resistor with small resistance] in PARALLEL
* **Voltmeter** (measures voltage): want shunt to have very high resistance so no current escapes in SERIES
* Keep in mind: the galvonometer itself has resistance, so the total resistance must be calculated in parallel/series

## **RC-Circuits**

* Solve for each resistor/capacitor individually OR
* Use Kirchkoff’s Rules
  + **Loop Rule:** All the voltages in a loop must add up to 0
  + **Junction Rule:** All the currents in/out of a junction must add up to 0
* Capacitors in series with a resistor charge/discharge exponentially.
  + This is described by the time constant
  + . When this much time passes, current or charge is of a distance to the final charge/current
  + The smaller time time constant, the faster t charges!
* The charge on a capacitor at any one point in time is:
* Capacitors in time:
  + at , all capacitors are uncharged, so all current passes through (pretend they’re not there)
  + at , *no* current passes through the capacitors, so pretend like they are a break in the circuit!