Source: [[KBPhysicsMasterIndex]]

First, let's begin with…

1 | Electrostatics Cheat Sheet

[[KB20200825215200]]

2 | An atom

We begin by recognizing the fact that **it's the electron that can move around in an atom.**.

For now, materials could be either **Conductors** or **Insulators.**

- **Conductors**
  - e^- move freely
  - Think! Metal
- **Insulators**
  - e^- cannot move freely
  - Think! Wood/Glass/Plastic

Objects have different charge properties [[KBhPHYS201AtomChargeProps]], and they interact with each other in specific ways:

- **Like changes tend to repel**
- **Different changes tend to attract**

[[KBhPHYS201AtomInteractions]]

The Rods and Paper Experiment

Recall the day one at-home experiment [[KBhPHYS201D1AtHomeActivity]]. Let's see how the interactions we saw relates to the physical world:

See [[KBhPHYS201ElectrostaticPolarization]], the analysis of the Rods and Paper Experiment

The Electroscope

See [[KBhPHYS201Electroscope]], the electroscope.

3 | Quantifying electrical force!

See [[KBhPHYS201ColoumbsLaw]], Coulomb's Law

4 | Gravity + Gravitational Fields!

Each object has what's called **gravitational field.** Surrounding each object has what is effectively many tiny vectors getting weaker and weaker as you move away from the Earth. You could calculate the force of gravity just by knowing…

1. The mass of what you are calculating.
2. How far away is the other object's mass.

Then, out pops a value that tells you the magnitude of force that an object would exert on another object w.r.t. their mass that was dropped right where that vector was.

To see how we could do this, and how it relates to electrostatics, see [[KBhPHYS201GravitationalFields]] Newton's Law of Gravitation.

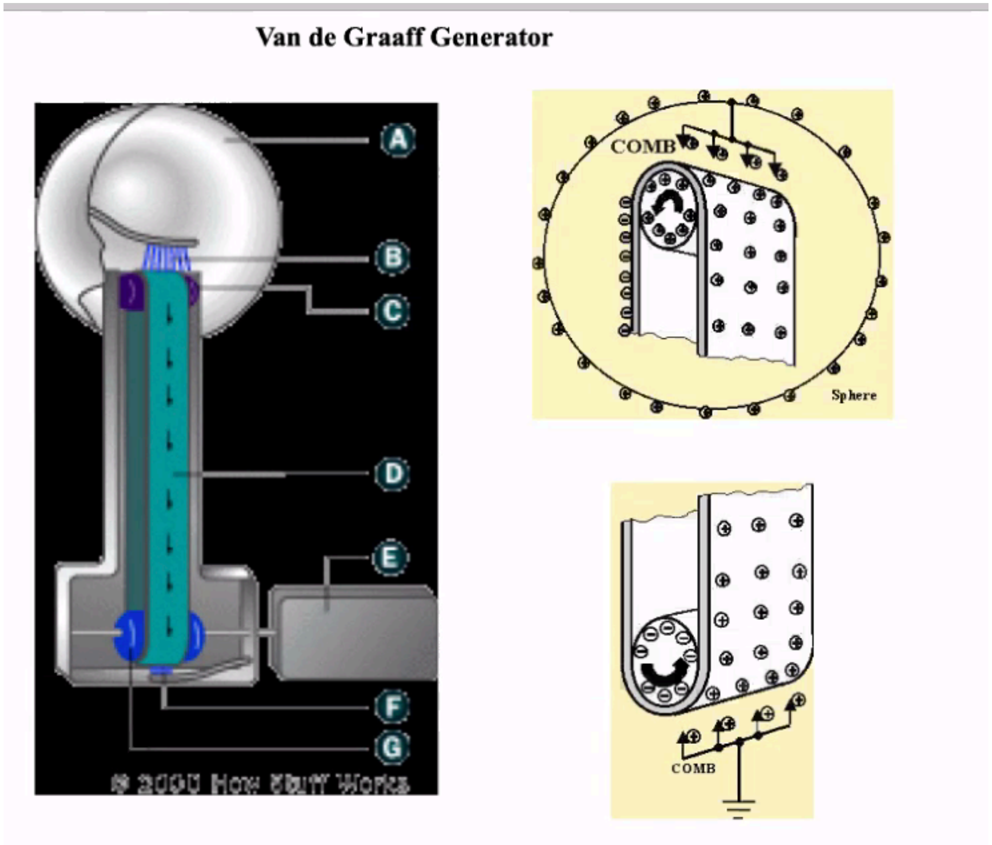
5 | **Electric Fields**

See [[KBhPHYS201ElectricFields]] Electric Fields.

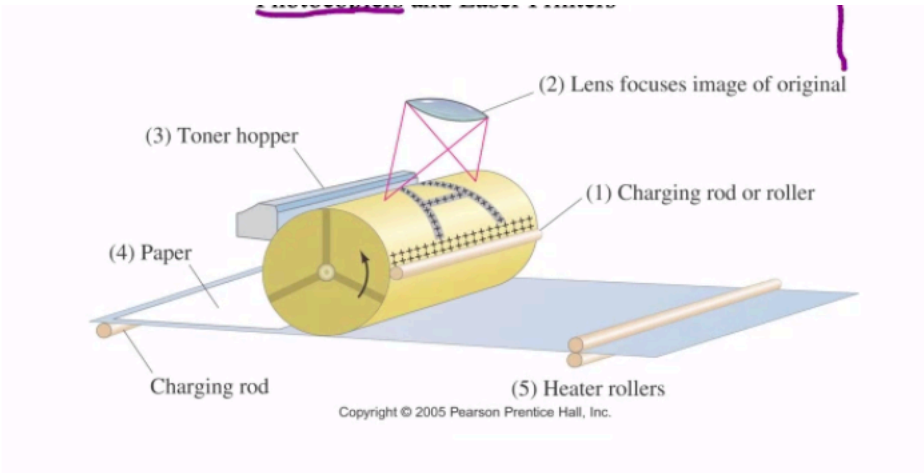
6 | **CN 090902020**

#disorganized

- A van de graff generator!
  - Electrostatics zap happen after crank turned
  - But, how does it work?
    - Cranks connects to a white roller, and next to it some metal teeth
    - Roller connnects to transparent belt, and on the other end, under the globe, there is a similar roller
    - Metal combs next to rollers
  - When cranks are turned, the bottom roller becomes negative, and the top roller becomes positive
  - So, electron flow between handle (connected to bottom) and globe (connected to top)



- Van de graff generator so exciting because, unlike normal statics, charges are added from the inside (see, wire B)
  - When you add additional changes, because conductor wants to stay 0, the additional charges can't do anything but accept it
  - Sphere slightly curved to make up for gaping hole
  - Normal door-handle statics would much rater simply eject the added change as their electric field is pointed at one direction against charge introduction
- Let's talk about the sparks!
  - One dome that's positive, one dome is negative
  - So, what happens when Spark! happens?
    - Enough charge to overcome the electric field resistance of air (like 3.4 million Volts/metre), and **air ionizes** — air atoms becomes so attracted that their electrons ditch their nuclei and air suddenly becomes a conductors
    - Neutral air has high resistance, but when it ionizes, the air looses its resistance (drops) and becomes nicely conductive
    - So then, current (Coulomb/s) that flow in the air suddenly spark up because of sudden loss of resistance, discharging the negative dom
- Photo copiers, too



1. LED light cause original to reflect into mirror 2. Scanning drum (yellow thing) does electrostatics! 3. Drum plated with plastic 4. Positively charged drum gets positively charged by a smaller roller 5. Light reflecting off of the original (the parts of the original without black ink, anyway) disturbs the positively charged roller 6. Plastic becomes conducting where it experiences light 7. Drum under the positive is **grounded** — meaning it could absorb + apply an infinite amount of electrons, so any grounded conductor becomes neutral 8. You could see from the figure above, where you have dark on the original, positive charge contributed by (4) is left on the plastic. Where you have light, the plastic becomes a conductor and the ground draws the electrons away, making light parts neutral 9. Now, the toner powder next to the drum will only stick to the positive parts of the plastic printing drums, which, remember, is where light paper_did not_ affect 10. And then, a copy! 3. Lazer printing 4. Same as above, except plastic becomes conducting where it experiences light from a computer-controlled laser drawing a negative of the print

---

- Use the variable I, a unit Coulombs/Second, to measure current. This also equals $\frac{\Delta V}{Resistance}$. Big resistance, little current.
- So let's figure out resistance
  - V = $\frac{J}{C}$
  - Resistance = Ω = $\frac{\Delta V}{I}$ = $\frac{Js}{C^2}$
- I = $\frac{C}{s}$ = Amps
- Calculating resistance
  - So, let's think. With a wire of length L and with a wire of area A, if we increase L, the resistance in the wire would increase; if we increase area A, the resistance in the the wire would decrease.
  - $Resistance = \frac{L}{A} * ResistivityOfMaterial$ with units $\frac{m}{m^2} * (\Omega * m)$.