1 | **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

Charge properties

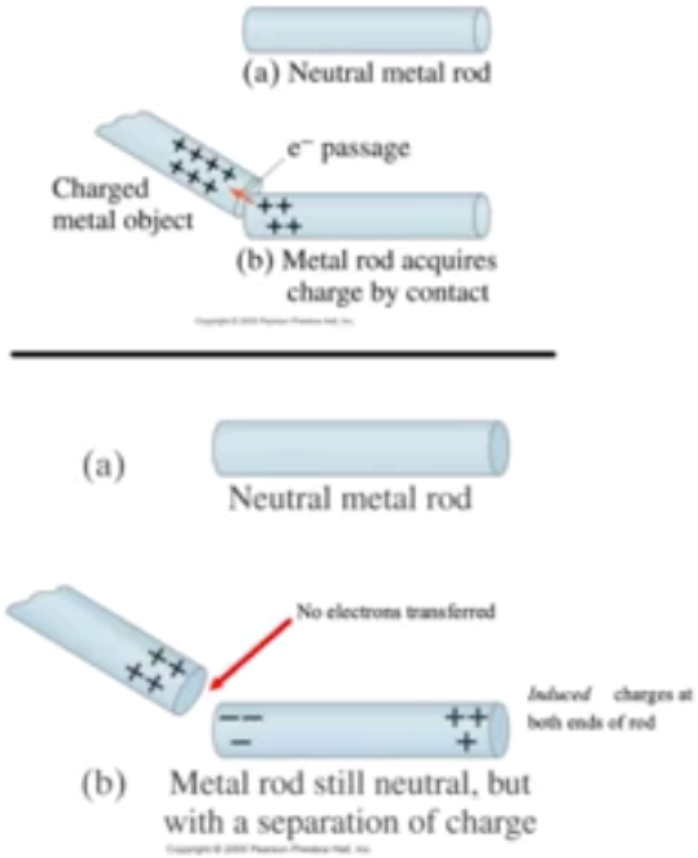
Different materials have tendencies to have a charge when rubbed

- Human hands => very positive when rubbed
- Fur => positive when rubbed
- Steel, Wood, Polyester => meh
- Plastics => negative when rubbed
- Silicon/Teflon => very negative when rubbed

Change Interactions

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

Rods and Paper



Scenario 1

- Taking neutral rod + close, positively charged, rod
  - Electrons will move from the neutral rod to the charged rod
  - Balances the charge out

Scenario 2

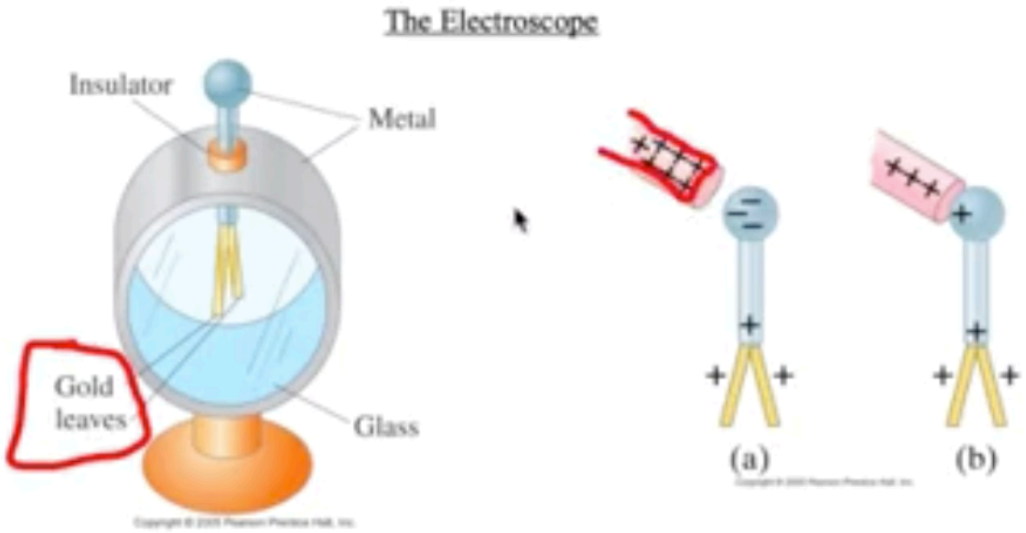
- Taking neutral rod + slightly farther, positively charged, rod
  - The neutral rod “polarizes”, repelling the positively charged protons off to one side while attracting all the electrons towards it
  - There is a net force of attraction to the “left” on the example image — towards the charged rod

Recall that per the physics KB20200824111828 D1 At home Activity, pieces of paper sometime flow towards the charged rod, then back again. Why?

About how that works…

1. The charged rod polarizes the paper
2. The paper’s newfound positive end attract with the plastic rod’s negative end
3. The paper has a net positive force towards the rod, so it accelerates towards it
4. Electrons, once connected, tries to flow back onto the paper
5. The paper neutralizes, then falls to the ground
6. Repeat from (1)

The Electroscope



About how this works…

1. Bring in some external charge near the electromitor (the ball-y part)
2. The rod becomes polarized, pushing the $+$ protons down towards the "gold leaves"
    - If the rod is not close enough to cause electron flow but is close enough to polarize…
        - Gold leaves temporarily push apart because positive repels positives
        - When charged rod removed, leaves come back
    - If the rod is close enough to cause e^- to flow out of the electromitor, making the whole rod more positive instead of a temporary polarization…
        - Gold leaves permanently (until somebody/the air discharges it, anyways) separated
        - When charged rod removed, leaves stay put

2 | **Quantifying electrical force!**

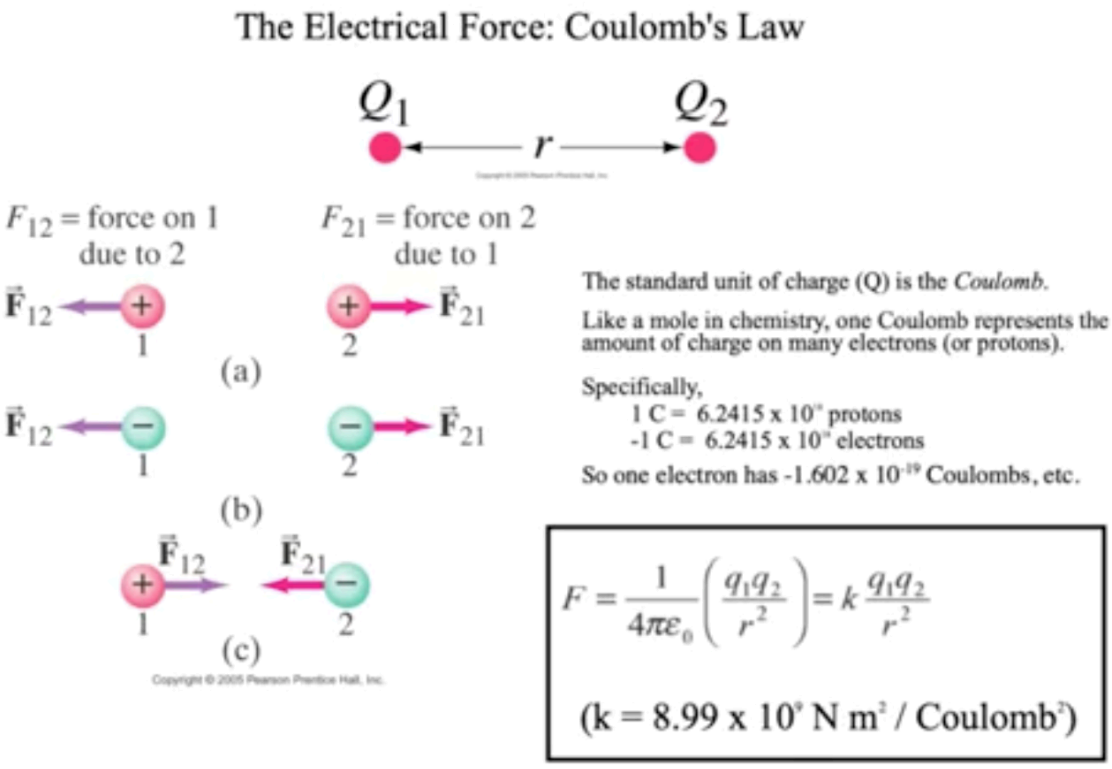


Figure 1: Screen Shot 2020-08-24 at 7.40.48 PM.png

- Electrical forces gets stronger as charge increases
- Electrical forces gets weaker as charge decreases

The magnitude of force between two charges is given by the Columb's Law

Definition 1 · **Coulumb's Law** $k\frac{q_1 q_2}{r^2}$

where k, a constant for change, q_1, change of first particle, q_2, change of second partical, r^2, distance squared

Note! The Standard Unit of Charge (Q) is the Coulomb — a representation for change for many electrons or many protons

Remember this!

Definition 2 · **Charge of an Electron** $-1.602 \times 10^{-19} Q$

Definition 3 · **k** $8.99 \times 10^9 \frac{Nm^2}{Q^2}$