1 | Experiments

Basically, we just rubbed a bunch of things on each other and checked the resulting charge with an electrometer.

1.1 | Interesting results

- Combs are great for static electricity
- Rubbing some objects on others caused similar charges, while other object caused different charges
- These notes are in hindsight so I legit don't remember too much

2 | Explanation

- Opposite charges attract; similar charges repel
- When charged object is brought close to a conductor, electrons in the conductor will flow and polarize the conductor
- When charged object is brought close to an insulator, atoms inside the insulator will be polarized. With small objects, this can make the whole object be basically polarized.
- When a charged object makes contact with a conductor, the electrons will be shared between objects.

3 | Homework

3.1 | Lecture Notes

Might not be complete.

3.1.1 | Electrostatics Basics

- There are Insulators and Conductors
  - Insulators: Don't share electrons
  - Conductors: Share electrons
  - Learn why this is in solid state physics
- List of charges when rubbed
  - Plastics usually become negative
  - Fur, elastics usually become positive
- Electrons can be shared between materials
- Electrons can move somewhat freely (depending on the material) within an object
  - Especially when close to another charged object!
- Even in materials where electrons can't move freely (e.g. paper, other insulators), polarization can cause a "chain reaction" and "polarize" the object as a whole

3.1.2 | Quantification

- Coulomb's Law
  - Given two point charges, Q1 and Q2, and a distance r
  - $F = k\frac{q_1 q_2}{r^2}$
    - ⋆ k is $8.99 \times 10^9 Nm^2C^{-2}$
    - ⋆ r is in meters
    - ⋆ q_1, q_2 in Coulombs (C)
    - ⋆ if $F > 0$, then force is repulsion
    - ⋆ if $F < 0$, then force is attraction
  - Sample Problem: Find distance (r) given q_1, q_2, and F \[

$$\begin{aligned} q_1 &= 50uC \\ q_2 &= 1uC \\ F_{12} &= 2N \\ k &= 8.99 \times 10^9 Nm^2C^{-2} \\ F &= k\frac{q_1 q_2}{r^2} \\ r^2 &= k\frac{q_1 q_2}{F} \qquad = 8.99 \times 10^9 Nm^2C^{-2} \cdot 50 \times \\ &= 224.75 \times 10^{-3} m \\ r &= \sqrt{224.75 \times 10^{-3}} m \\ &= 474 \times 10^{-3} m \end{aligned}$$

  \]
  - In more complicated setups, certain things such as acceleration won't be constant because it is determinant on force, which is determined by distance from other charges.
    - ⋆ This complicates things so don't expect it to be simple.

3.1.3 | Vector Fields

- Fields of vectors
  - Vector magnitude is in NC^{-1} (Newtons per Coulomb)
  - Behave in interesting ways i guess i dunno
  - Calculate using a hypothetical proton