

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, Q_1 and Q_2 , and a distance r
 - $F = k \frac{q_1 q_2}{r^2}$
 - * k is $8.99 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$
 - * 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

$$q_1 = 50 \mu\text{C}$$

$$q_2 = 1 \mu\text{C}$$

$$F_{12} = 2 \text{ N}$$

$$k = 8.99 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$$

- Sample Problem: Find distance (r) given q_1, q_2 , and F \[

$$F = k \frac{q_1 q_2}{r^2}$$

$$r^2 = k \frac{q_1 q_2}{F} = 8.99 \times 10^9 \text{ Nm}^2 \text{ C}^{-2} \cdot 50 \times 10^{-6} \text{ C} \cdot 1 \times 10^{-6} \text{ C} / 2 \text{ N}$$

$$= 224.75 \times 10^{-3} \text{ m}$$

$$r = \sqrt{224.75 \times 10^{-3} \text{ m}}$$

$$= 474 \times 10^{-3} \text{ m}$$

\]

- 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