# 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 $F$ \[

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

\]
  - 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