Lecture Notes: Methods of Charging

1. Introduction to Charging

Electric charge is a fundamental property of matter. An object can acquire electric charge through different methods, leading to either **positive or negative charge**. The three main methods of charging are:

1. **Charging by Rubbing (Friction)**
2. **Charging by Contact**
3. **Charging by Induction**

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2. Methods of Charging

A. Charging by Rubbing (Friction)

- **Definition:** When two objects are rubbed together, **electrons are transferred** from one to the other, causing one object to become **positively charged** and the other **negatively charged**.
- This happens because different materials have different abilities to **gain or lose electrons**.
- The object that **loses electrons** becomes **positively charged**, while the object that **gains electrons** becomes **negatively charged**.

Examples:

1. **Rubbing a plastic comb on dry hair** – The comb gains electrons and becomes negatively charged, while the hair becomes positively charged.
2. **Rubbing a glass rod with silk** – The glass rod **loses electrons** (becomes positively charged), and the silk gains electrons (becomes negatively charged).
3. **Rubbing a balloon on wool** – The balloon becomes negatively charged and sticks to a wall.

🔹 **Key Point: Frictional charging only works with insulators** because conductors allow charges to move freely.

B. Charging by Contact

- **Definition:** When a charged object touches a **neutral conductor**, **some of the charge is transferred** to the conductor.
- The conductor **acquires the same type of charge** as the original charged object.

Examples:

1. **Touching a charged metal sphere with a neutral metal sphere** – The neutral sphere acquires the same charge.
2. **Touching a charged rubber rod to an electroscope** – The electroscope's metal leaves spread apart, showing that charge has been transferred.

🔹 **Key Point: Contact charging works best with conductors** since charges can easily flow.

C. Charging by Induction

- **Definition:** A **charged object is brought close** to a neutral conductor, causing charges in the conductor to **redistribute** without direct contact.
- The object being charged **develops the opposite charge** of the charged object.

Process:

1. A negatively charged rod is **brought near** a neutral metal sphere.
2. The electrons in the sphere are repelled, leaving one side positively charged.
3. If the sphere is then grounded (connected to Earth), electrons leave, and it remains **positively charged** when the rod is removed.

Examples:

1. **Inducing charge in a metal ball** by bringing a charged rod near it.
2. **Clouds inducing charge on the ground before lightning strikes.**

🔹 **Key Point: Induction charging does not require physical contact** and results in **opposite charge formation**.

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3. Summary

Method	Process	Charge Acquired	Examples
Friction	Rubbing two objects together	Opposite charges	Rubbing a balloon on wool
Contact	Touching a charged object to a neutral one	Same charge as original object	Touching a charged rod to an electroscope
Induction	Bringing a charged object near a neutral conductor	Opposite charge	Charging a metal sphere without contact

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4. Applications of Charging Methods

- **Frictional Charging:** Used in **plastic wrap** sticking to objects.
- **Contact Charging:** Used in **capacitors** to store charge in electronics.
- **Induction Charging:** Used in **wireless charging** of mobile phones.

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