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Lecture Notes: Introduction to Electric Charges and Common Observations of Electric Discharge

1. Introduction to Electric Charges

Electric charge is a fundamental property of matter that causes it to experience a force when placed in an electric or magnetic field. The study of electric charges and their interactions is known as **electrostatics**.

Charges exist in two types:

- **Positive Charge (+)**
- **Negative Charge (-)**

The presence of electric charge is responsible for several natural and everyday phenomena, such as lightning, electric shocks, and attraction or repulsion between objects.

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2. Common Observations of Electric Discharge

Electric discharge occurs when accumulated static charge is released suddenly. This can be experienced in various common situations:

A. Synthetic Clothing and Static Cling

- When we remove synthetic clothing (e.g., polyester or wool sweaters), we often hear a crackling sound or see tiny sparks in the dark.
- This happens due to the friction between the fabric and our body, which transfers charges and leads to the accumulation of **static electricity**.

B. Lightning During Thunderstorms

- Lightning is a large-scale example of electric discharge.
- During thunderstorms, **friction between clouds and air particles** causes accumulation of charges in the clouds.
- When the difference in charge between clouds and the ground becomes too large, a **sudden discharge** occurs in the form of a lightning bolt.

C. Electric Shock in Vehicles (Car Doors, Bus Handles)

- When getting out of a car or touching a metallic door handle, we sometimes feel a mild shock.
- This happens due to the **accumulation of static charge** on our body or on the vehicle's surface.
- When we touch a conductive surface (like metal), the charge is suddenly discharged through our body, causing a mild electric shock.

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3. Definition: Static Electricity and Electrostatics

Static Electricity

- **Definition:** Static electricity is the accumulation of electric charge on the surface of objects, which remains stationary until it is discharged.
- It is generated by **friction, conduction, or induction**.
- Example: Rubbing a plastic comb on dry hair makes the hair attract towards the comb.

Electrostatics

- **Definition:** Electrostatics is the branch of physics that studies electric charges at rest, their forces, fields, and potentials.
- It explains phenomena like electric attraction, repulsion, and charge distribution on objects.

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4. Summary

- **Electric charge** is a fundamental property of matter with two types: **positive and negative**.
- **Static electricity** is the accumulation of charge, commonly observed in synthetic clothing, lightning, and vehicle shocks.
- **Electrostatics** deals with the study of charges at rest and their interactions.
- **Electric discharge** occurs when stored charge is suddenly released, leading to observable effects like sparks, shocks, or lightning.

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5. Real-Life Applications of Electrostatics

1. **Photocopiers and Printers** – Use static charge to attract toner onto paper.
2. **Air Purifiers** – Remove dust particles using charged plates.
3. **Lightning Rods** – Provide a controlled path for charge discharge during thunderstorms.
