

2 Secondary Physics

Definition of Electricity:

- Electricity is the flow of electrical charges (electrons or ions).

Types of Electric Charges:

- Positive charge (+)**
 - Negative charge (-)**
 - Like charges repel, unlike charges attract.
 - Electric charge is measured in **coulombs (C)**.
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Materials Based on Charge Conductivity:

Type	Definition
Conductors	Materials that allow charge to move freely (e.g., copper).
Insulators	Materials that restrict charge movement (e.g., plastic).

Coulomb's Law (Force Between Charges):

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

- F= Electric force (Newtons)
 - K= Coulomb's constant $9 \times 10^9 \text{ N.m}^2/\text{C}^2$
 - q_1, q_2 = Magnitude of charges (Coulombs)
 - r= Distance between charges (meters)
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Dangers of Static Electricity:

Lightning	Caused by charge buildup in clouds, potentially damaging buildings or harming people.
Damage to electronic devices	Static charges can destroy sensitive components (ex: computer parts).
Flammable gas ignition	Sparks from static electricity can ignite gasoline vapors at fuel stations.
Attracting dust and germs	May cause contamination of medical equipment.

Uses of Static Electricity:

- **Laser printing:** Uses electrostatic attraction to apply toner.
 - **Electrostatic precipitators:** Remove pollutants from the air.
 - **Spray painting:** Ensures even distribution of paint on surfaces.
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Coulomb's Law

- The force (F) between two charges:
 - **Inversely proportional** to the square of the distance:
 - **Directly proportional** to the product of the charges:
 - **Formula :**

$$F = K \frac{q_1 q_2}{d^2}$$

Electric Field (E)

- Space around a charge where forces are felt.
 - **SI unit:** Newton per Coulomb (N/C).
 - **Direction:** Away from **positive** charges, toward **negative** charges.
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Applications:

1. **Photocopiers & Printers** – Use electrostatic charges to transfer ink.
 2. **Pollution Control** – Electrostatic precipitators remove pollutants.
 3. **Spray Painting** – Charged droplets ensure even coating.
 4. **Lightning Rods** – Safely discharge static electricity.
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Types of Electric Charge:

- **Negative charge:** Found on a plastic rod rubbed with fur.
 - **Positive charge:** Found on a glass rod rubbed with silk.
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Electric Attraction & Repulsion:

- **Like charges repel** (both positive or both negative).
 - **Opposite charges attract** (one positive, one negative).
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Definition of Electric Fields:

- An **electric field** is the area around a charge where its effect can be felt.
 - It is a **vector quantity** (has both magnitude and direction)
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Electric Field Generation:

1. **By a stationary charge:**
 - **Positive charge:** Field lines point **outward**.
 - **Negative charge:** Field lines point **inward**.
 2. **By a changing magnetic field.**
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Electric Field Lines:

- **Like charges repel** (field lines push away).
- **Opposite charges attract** (field lines pull together).

Formula for Electric Field Intensity (E):

$$E = \frac{F}{q} = K \frac{q}{d^2}$$

- E = Electric field intensity (N/C)
 - F = Force (N)
 - q= Charge (C)
 - d = Distance from the charge (m)
 - K = Coulomb's constant
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- Measured using an **Electrometer**.
 - The field strength **decreases with distance** (inverse square law).
 - **Force in an electric field** depends on charge amount and distance.

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