

# 9<sup>th</sup> Class

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## Charged Particles in Matter:

### 1. Structure of Atoms :

- Atoms consist of subatomic particles: protons, neutrons, and electrons.
- Protons are positively charged, electrons are negatively charged, and neutrons are neutral.

### 2. Electric Charge:

- Electric charge is a fundamental property of matter.
- Charges exist in two types: positive (+) and negative (-).
- Like charges repel each other, and opposite charges attract.

### 3. Atomic Structure and Charge:

- The nucleus of an atom contains protons and neutrons.
- Electrons orbit the nucleus in electron shells.
- Protons carry a positive charge, electrons carry a negative charge, and neutrons are neutral.

### 4. Ion Formation:

- Ions are charged particles formed when atoms gain or lose electrons.
- Cations are positively charged ions (loss of electrons), and anions are negatively charged ions (gain of electrons).

### 5. Conductors and Insulators:

- Conductors allow the easy flow of electric charge (e.g., metals).
- Insulators resist the flow of electric charge (e.g., rubber, glass).

### 6. Coulomb's Law:

- Coulomb's law describes the force between two charged objects.
- $F = kq_1q_2 / r^2$ , where  $F$  is the force,  $k$  is Coulomb's constant,  $q_1$  and  $q_2$  are the charges, and  $r$  is the separation distance.

### 7. Conservation of Charge:

- The total electric charge in an isolated system is constant.

- Charge cannot be created or destroyed; it can only be transferred.

### 8. Electric Fields:

- Electric fields surround charged objects and exert forces on other charged objects.
- The direction of the electric field is defined as the direction a positive test charge would move.

### 9. Electrostatic Induction:

- The redistribution of charges in an object when a charged object is brought near it.
- Induced charges result in attractive or repulsive forces.

### 10. Elementary Charge:

- The elementary charge ( $e$ ) is the charge of a proton or electron.
- $e \approx 1.602 \times 10^{-19}$  coulombs.

### 11. Quantization of Charge:

- Electric charge is quantized, meaning it exists in discrete units (multiples of the elementary charge).

### 12. Applications:

- **Electrostatic Precipitators:** Used to remove particulate matter from industrial gases.
- **Van de Graaff Generator:** Generates high voltages for experimental purposes.
- **Capacitors:** Devices that store electric charge.

### 13. Electric Potential and Voltage:

- Electric potential (voltage) is the electric potential energy per unit charge.
- Measured in volts (V).

### 14. Electrical Conductivity:

- Materials with high electrical conductivity have a high density of charge carriers (usually electrons).

### 15. Superconductivity:

- Some materials exhibit superconductivity, meaning they can conduct electricity with zero resistance at low temperatures.

**Conclusion:**

Understanding charged particles in matter is crucial for comprehending the behavior of electricity, electric fields, and various applications in technology and industry. This knowledge forms the foundation for the study of electromagnetism and is essential in fields ranging from electronics to power generation.