Topic tree

Electric Charges and Fields - Topic Tree

1. Introduction
   - Common observations of electric discharge.
   - Examples: Synthetic clothing, lightning, and shocks in vehicles.
   - Definition: Static electricity and electrostatics.
2. Electric Charge
   - Historical perspective: Thales of Miletus and the origin of the term "electricity."
   - Experiments:
     - Glass rods and wool/silk interactions.
     - Plastic rods and fur interactions.
   - Properties of charges:
     - Like charges repel, unlike charges attract.
     - Concept of polarity.
   - Neutralization of charges.
   - Benjamin Franklin’s naming convention: Positive and negative charges.
3. Conductors and Insulators
   - Definition and examples of conductors and insulators.
   - Nature of charge in conductors.
4. Methods of Charging
   - By rubbing (friction).
   - By contact.
   - By induction.

5. Coulomb’s Law

- Force between two point charges.
- Dependence on distance and magnitude.
- Mathematical expression and vector form.

6. Electric Field

- Definition and concept of the field.
- Representation with field lines.
- Properties of electric field lines.
- Electric field due to:
  - Point charges.
  - System of charges.
  - Continuous charge distributions.

7. Electric Dipole

- Definition and examples of dipoles.
- Electric field due to a dipole:
  - On the axial line.
  - On the equatorial line.
- Torque on a dipole in a uniform electric field.
- Potential energy of a dipole.

8. Electric Flux

- Concept and definition.
- Gauss’s Law:
  - Statement and derivation.

- Applications:
  - Uniform spherical charge distributions.
  - Infinite line charge.
  - Infinite plane sheet of charge.

9. Applications of Electrostatics
   - Electrostatic shielding.
   - Capacitors (basic introduction).