

Electricity and Magnetism

Nahed jabber
General physics
1st stage

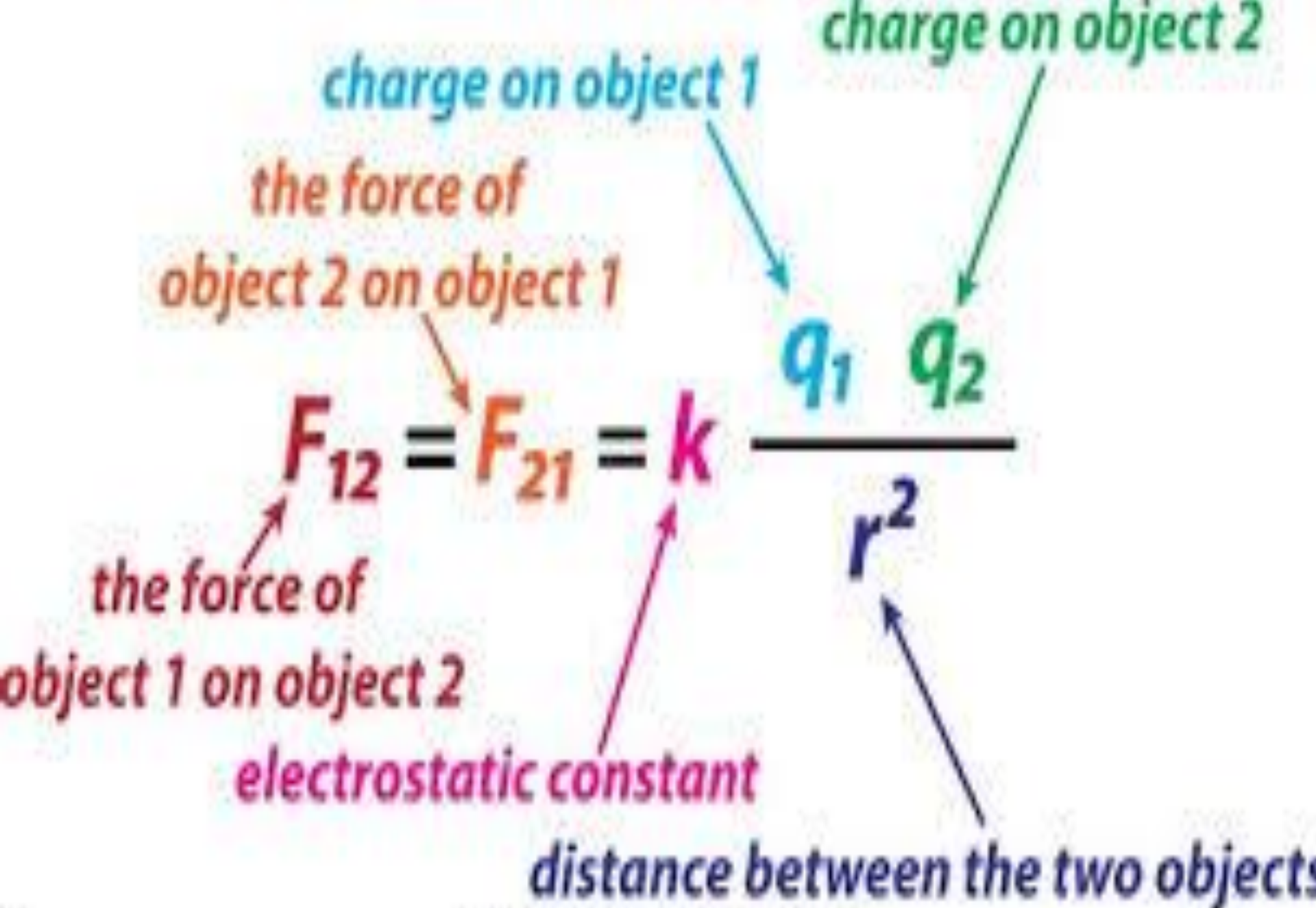
Electrostatics

- **Is the study of forces between charges, as described by Coulomb's Law.** We develop the concept of an electric field surrounding charges.
- Is a branch of physics that deals with the study of stationary electric charges.

Electrostatics law

- **Coulomb' law**

'The magnitude of the electrostatic force of attraction or repulsion between two point charges is directly proportional to the product of the magnitudes of charges and inversely proportional to the square of the distance between them.



$$F_e = k_e \frac{q_1 q_2}{r^2}$$

where

- F_e is the force
- k_e is the Coulomb's constant ($8.987 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$)
- q_1 and q_2 are the signed magnitudes of the charges
- r is the distance between the charges

• **ELECTRIC CHARGE**

- The term electric is derived from the Greek word electron.
- There are two types of charges, (i) positive charge and (ii) negative charge.
- The unit of charge is coulomb.
- The amount of charge in an electron is equal to 1.6021×10^{-19} coulombs.

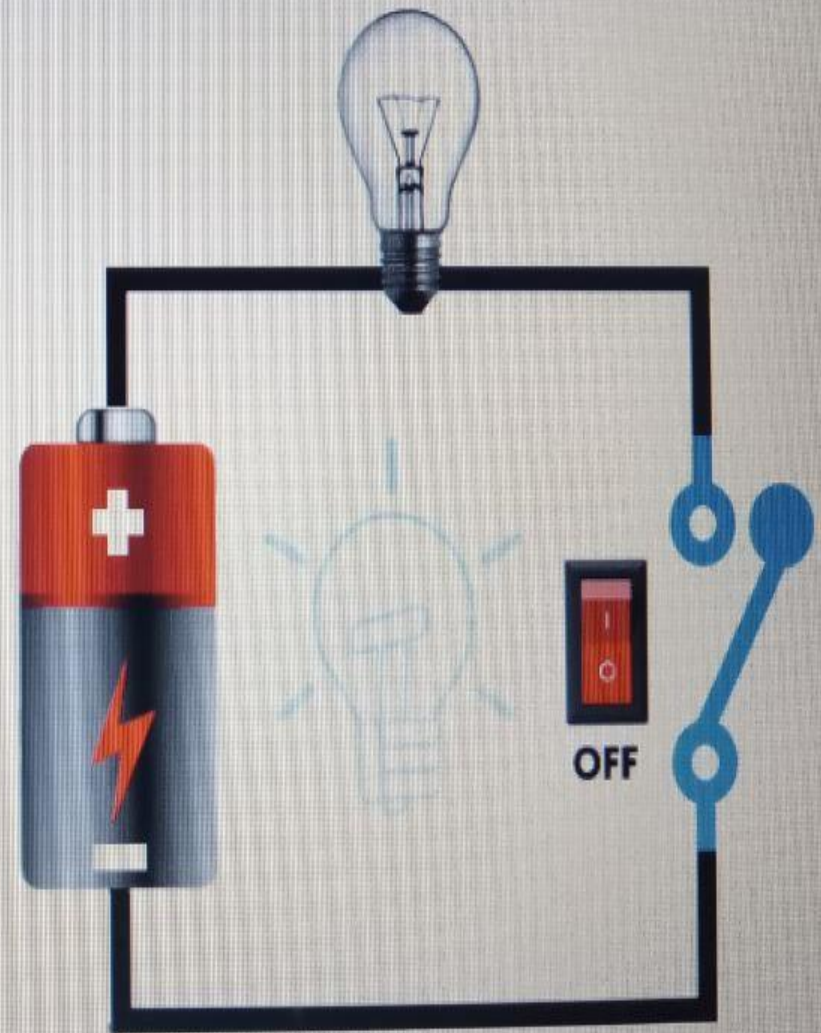
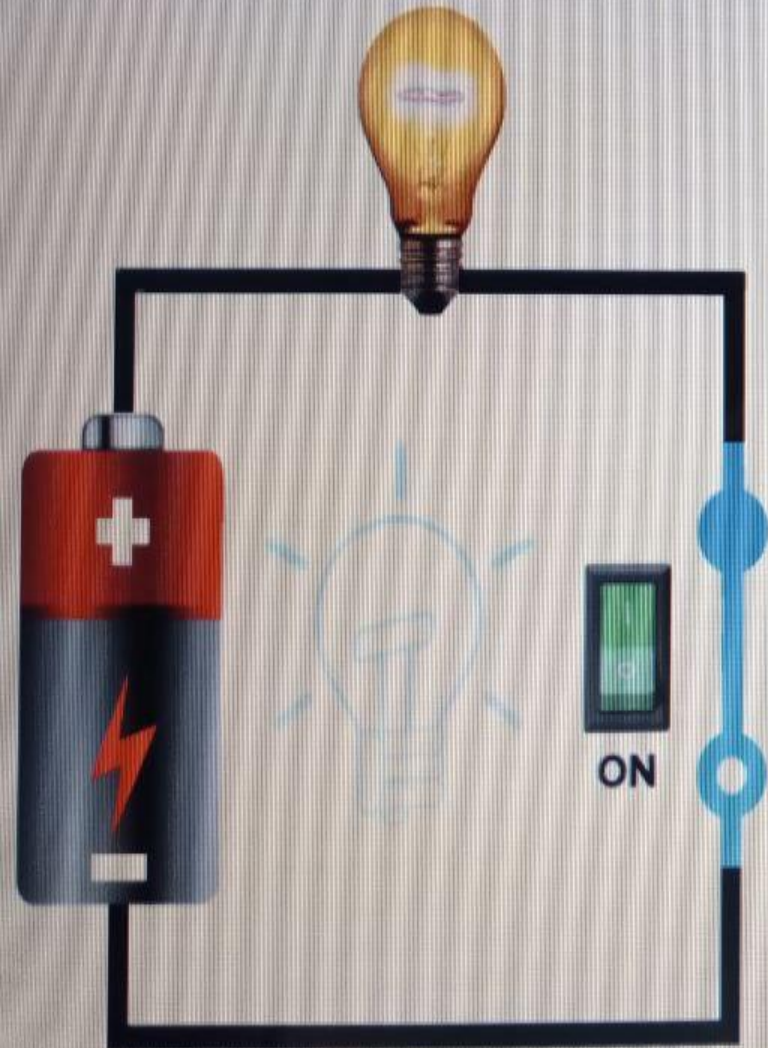
ELECTRICAL POTENTIAL

- The electric potential (V) at a point in an electric field is the work done (W) in taking a unit positive charge (q) from infinity to that point, i.e.
- $V = W/q$
- Positive charges flow from a point of higher potential to point of
- lower potential and negative charges flow in the reverse direction.
- The unit of potential is volt and one volt is equal to 1 joule per coulomb.
- The potential is a scalar quantity and the potential of earth is taken
- as zero. In practice, kilovolt (kV) and megavolt (MV) are used as units, 1 kV = 1000 volts and 1 MV = 10⁶ volts.

Electric Circuit

- An **electric circuit** is a closed loop network which provides a return path for the flow of current. Or a closed conducting path in which current can flow is called a circuit. An electric circuit is also known as **electrical network** or **electrical circuit**.

What is an Electric Circuit?



ELECTRICAL POWER

- The electrical power (P) is the rate at which energy is expended and it is equal to the product of potential difference (V) and current (I)
- in a circuit, i.e. $P = VI$.
- The unit of electrical power is watt, which is equal to one joule per second (Js^{-1}).
- In practice, kilowatt and kilowatt hour (kWh) are used as units of electrical power and one kilowatt hour is equal to $3.6 \times 10^6 \text{ J}$.

MAGNETISM

- Magnetism is a fundamental property of a matter and it is produced by motion of electrical charges.

MAGNETIC INDUCTION

- If a material is placed in a magnetic field, magnetism may be induced in that material by the magnetizing force.
- The atoms of the material tend to align with the direction of magnetizing force and induce a magnetic flux within the material.
- If H is the magnetizing force that induces a magnetic flux B in the material, then,
- $B = \mu H$
- where, μ is the permeability of the medium $= \mu_r \times \mu_0$, where μ_r is the relative permeability and μ_0 is the permeability in vacuum.

Transformer

- A transformer is an electrical device that uses the principle of electromagnetic induction to transfer energy from one electric circuit to another. It is designed to either increase or decrease AC voltage between the circuits while maintaining the frequency of the current.

Thank

you

