5. **Attraction for light objects:** A charged object attracts an uncharged body which, if sufficiently light, moves towards it. The charged object induces a charge of the opposite type on the adjacent surface of the uncharged one, the unlike charges attract each other and the objects move together.
6. **Electric field:** It is the area around a charged body in which the forces resulting from the charge are apparent. The electric field is most concentrated closed to the charged object, becoming weaker as the distance from it increases.

When one body is placed within the electric field of another, the forces of attraction or repulsion are effective. The forces resulting from the charge act along definite lines known as ***electric lines of force.***

Properties of Electric Lines of Force (7 Marks)

Electric lines of force: The forces resulting from the charge act along definite lines, known as ***electric lines of force***. These are the lines along which a free negative charge would move if placed within the electric field.

Electric field: The electric field is an area around a charged body in which the forces resulting from the charge are apparent.

Properties of electric lines of force

1. The lines of force around an isolated charged body are straight lines radiating outwards and perpendicular to the surface (Fig. 2.6).

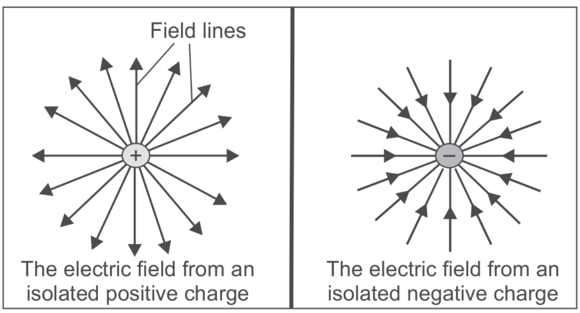

Fig. 2.6: Electric field around an isolated charged body

By applying Ohm's law—the largest resistance carries the smallest current and the smallest resistance carries the largest current.

Condenser in Series (3 Marks)

The combined capacitance (C_{total}) of capacitors connected in parallel is less than that of any one of the capacitors (Fig. 3.5).

$$1/C_{total} = 1/C_1 + 1/C_2 + 1/C_3 + \dots 1/C_n$$

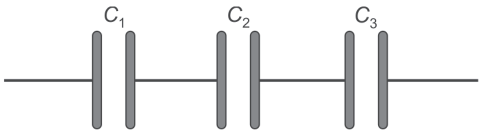

Fig. 3.5: Condenser in series

- Current going through each capacitor is the same and equal ($I_{total} = I_1 = I_2$).
- Voltage drops can be different for each capacitor ($V_{total} = V_1 + V_2$).

Condenser in Parallel (3 Marks)

If condensers are connected in parallel, the total capacitance equals to the sum of individual capacitors (Fig. 3.6).

$$C_{total} = C1 + C_2 + C_3 + \dots C_n$$

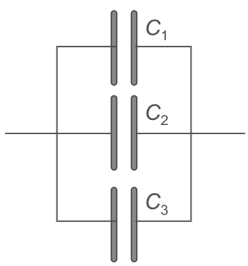

Fig. 3.6: Condenser in series

The amount of impedance from inductive reactance depends on the strength of the self-induced EMF which is determined by:

1. The inductance of the conductor, with which it varies directly.
2. The rate of change in intensity of the current flowing in the conductor. The greater the rate of change the greater is the self-induced EMF.

Note: There is no inductive reactance with a constant DC.

Electromagnetic Induction and its Types (7 Marks)

Electromagnetic induction is the means by which electricity is produced from magnetism (vice versa). It is the result of interaction between a conductor and magnetic lines of force.

An EMF is produced in the conductor by magnetic lines of force surrounding a magnet, without contact with each other, but it is necessary for one to move relative to the other.

Three factors for electromagnetic induction are:

1. A conductor
2. Magnetic lines of force
3. Relative movement of 1 and 2

If the conductor is part of closed circuit, magnetic lines of force produce an EMF which causes movement of the electrons in the conductor. This can be shown by ammeter across the coil of wire.

Types of electromagnetic induction are: Mutual induction and self-induction.

1. ***Mutual induction*:** When an EMF is induced in an adjacent conductor by the magnetic field set up around a coil of wire carrying varying current, the process is known as mutual induction (Fig. 3.7).
2. ***Self-induction:*** When a current flows through a coil of wire, it sets up magnetic lines of force around each turn of wire. If the current varies in intensity these magnetic lines of force cut across turns of wire and induce an EMF in that same conductor, the process is known as self-induction.

Magnet possesses following properties:

1. **Setting in a north-south direction:** As the earth itself is a giant magnet; the earth's magnetic field will influence a suspended magnet. A freely suspended magnet sets itself in the direction of north to south. If displaced from this direction it again returns to its original position.
2. **Like magnetic poles repel one another:** North repels north and south repels south. Unlike magnetic poles attract one another.
3. **Isolation of poles:** Isolated north or south pole is not possible.
4. **Transmission of properties:** A magnet can produce properties of magnetism in suitable materials. As one pole of a bar magnet is stroked along the material, all the opposite poles of the molecular magnets are attracted towards it so that the object is magnetized.

   The end that the magnet leaves will have the pole opposite to that used to induce the effect (Fig. 4.3).

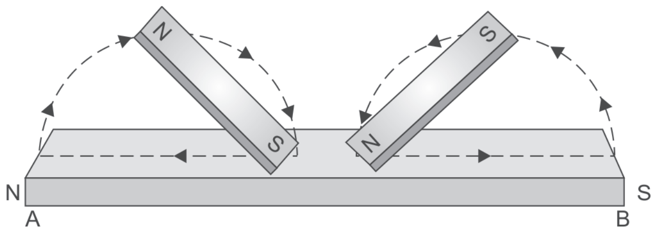

Fig. 4.3: Magnetization by contact

   A magnet may also produce a magnetic effect in an object without contact between them is called ***magnetic induction***, e.g. a piece of soft iron held close to a magnet will attract iron filings. If it is a south magnetic pole that approaches the iron, it attracts the north and repels the south poles of the molecular magnets (Fig. 4.4).

5. **Attraction of suitable materials:** Magnets attract certain materials. This effect is produced by magnetic induction.

Fig. 4.4: Magnetization without contact (magnetic induction)