Charging by Induction - Negative and Positive Charges, Charging by Friction

Charging by Induction - Negative and Positive Charges

- Charging by induction using a negatively charged object Charging by induction using a positively charged object Charging of Electroscope by Induction
- Most objects are electrically neutral which means that they have an equal number of positive and negative charges.
- In order to charge an object, one has to alter the charge balance of positive and negative charges.
- There are three ways to do it:
  - **Friction**
  - **Conduction**
  - **Induction**

Charging by Friction

- The charging by friction process involves rubbing of one particle on the other resulting in electrons moving from one surface to another.
- This method is useful for charging insulators.

Charging by Conduction

- This process involves touching of a charged particle to a conductive material.
- In This way the charges are transferred from the charged material to the conductor.
- Charging by conduction method is useful for charging conductors.

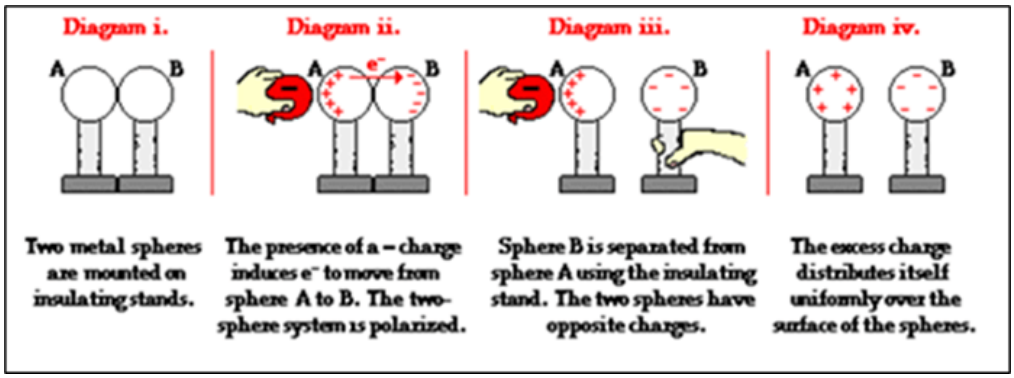
Charging by Induction

- The induction charging is a charging method that charges an object without touching the object to any another charged object.
- This process is where the charged particle is held near an uncharged conductive material that is grounded on a neutrally charged material.
- The charge flows between two objects and the uncharged conductive material develop a charge with opposite polarity.

Charging by Induction Using a Negatively Charged Object

- The metal spheres are supported by insulating stands so that any charge acquired by the spheres cannot travel to the *ground*.
- The spheres are placed side by side to form a two-sphere system. Being made of metal (a conductor) , electrons are free to move between the spheres - from sphere A to sphere B

Charging by Induction

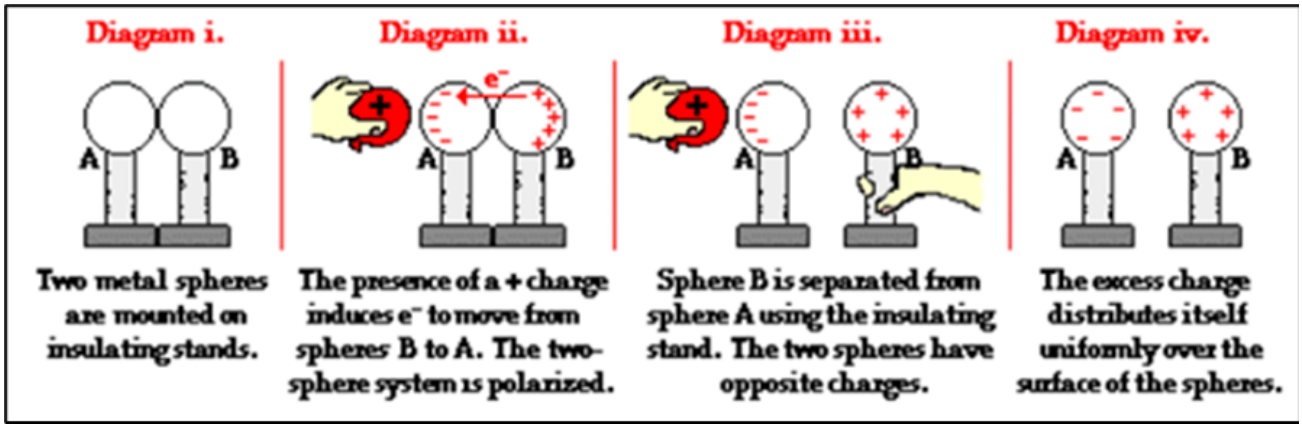


- If a balloon of rubber material is charged negatively (perhaps by rubbing it with animal fur) and brought near the spheres, electrons within the two-sphere system will be induced to move away from the balloon.
- Simply the principle that like charges repel.
- Being charged negatively, the electrons are repelled by the negatively charged balloon and being present in a conductor, they are free to move about the surface of the conductor.
- There is a *mass migration* of electrons from sphere A to sphere B. This electron migration causes the two-sphere system to be polarized
- Overall, the two-sphere system is electrically neutral. Yet the movement of electrons out of sphere A and into sphere B separates the negative charge from the positive charge.
- Once the two-sphere system is polarized, sphere B is physically separated from sphere A using the insulating stand. Having been pulled further from the balloon, the negative charge likely redistributes itself uniformly about sphere B.
- Also, the excess positive charge on sphere A remains located near the negatively charged balloon, consistent with the principle that opposite charges attract.
- As the balloon is pulled away, there is a uniform distribution of charge about the surface of both spheres.

Charge Transfer by Induction Using a Positively Charged Object

Consider the Graphic below in Which a Positively Charged Balloon is Brought Near Sphere a.

Charging by Induction



- The Presence of the Positive Charge Induces a Mass Migration of Electrons from Sphere B Towards (and into) Sphere a.
- So, this Movement is Induced by this Simple Principle That Opposites Attracts. Negatively Charged Electrons Throughout the Two-Sphere System Are Attracted to the Positively Charged Balloon.
- This Movement of Electrons from Spheres B to Sphere a Leaves Sphere B with an Overall Positive Charge and Sphere a with an Overall Negative Charge. the Two-Sphere System Has Been Polarized.
- With the Positively Charged Balloon Still Held Nearby, Sphere B is Physically Separated from Sphere a.
- The Excess Positive Charge is Equally Distributed Across the Surface of Sphere B.
- The Excess Negative Charge on Sphere a Remains Towards the Left Side of the Sphere, Positioning Itself Close to the Balloon.
- Finally, sphere a Becomes Charged Negatively and Sphere B Becomes Charged Positively.