ELECTRIC CHARGES AND FIELDS

Electric Charges, Conductors, Insulators,Induction

Electrostatics deals with the study of **forces**, **fields** and **potentials** arising from **static charges** .

If two glass rods rubbed with **wool** or **silk** cloth are brought close to each other, they **repel** each other

The two strands of **wool** or two pieces of **silk** cloth, with which the rods were rubbed, also **repel** each other.

However, the glass rod and wool **attracted** each other. Similarly, two plastic rods rubbed with cat's fur **repelled** each other but **attracted** the fur.

There are two kinds of electrification and we find that

(i) **like** charges repel and

(ii) **unlike** charges attract each other.

The property which differentiates the two kinds of charges is called the **polarity** of charge.

The charges were named as **positive** and **negative** by the American scientist Benjamin Franklin [Go to the Image Website]

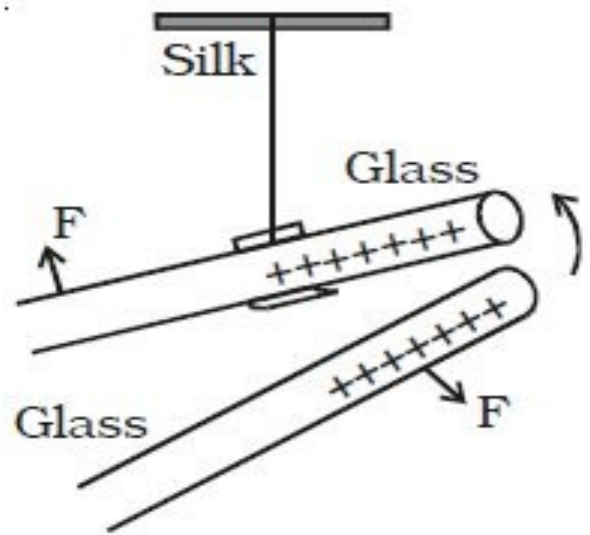


Fig. 1.1 Two charged rods of same sign

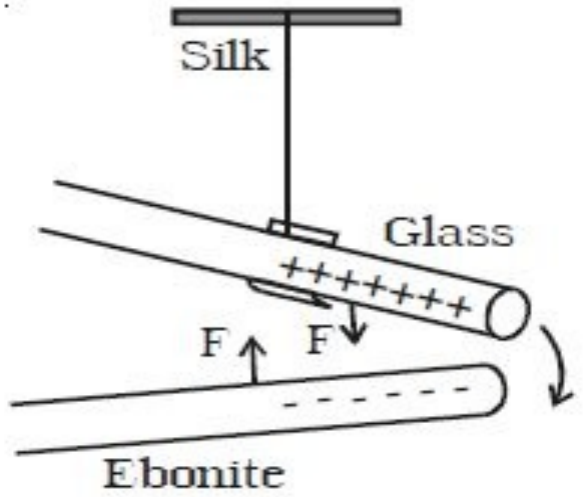
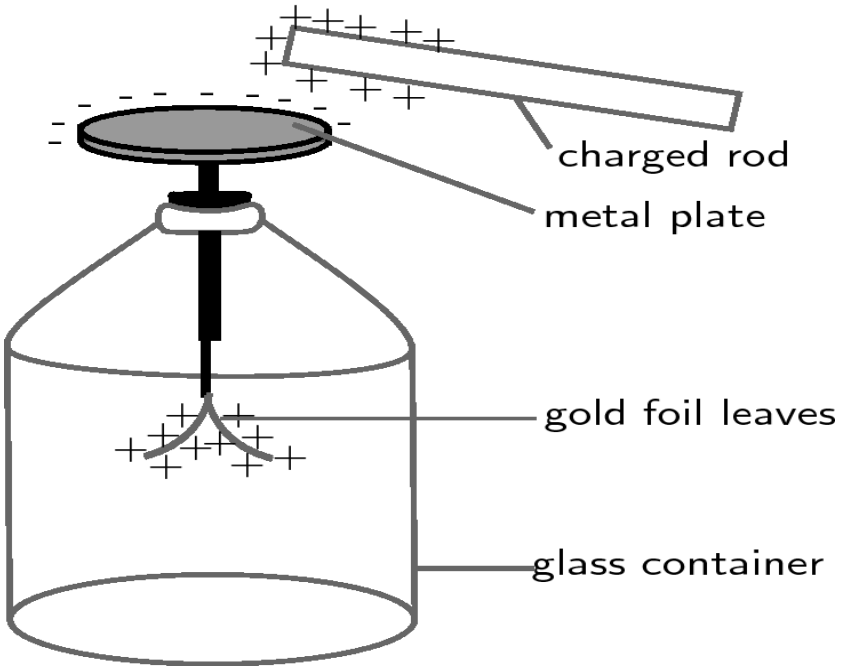


Fig 1.2 Two charged rods of opposite sign

Gold-leaf electroscope [Go to Image website]



When a charged object touches the metal knob at the top of the rod, charge flows on to the leaves and they diverge. The degree of divergence is an indicator of the amount of charge.

Conductors and Insulators

When some charge is transferred to a **conductor**, it readily gets distributed over the entire surface of the conductor. In contrast, if some charge is put on an **insulator**, it stays at the same place.

When we bring a charged body in contact with the earth, all the excess charge on the body disappears by causing a momentary current to pass to the ground through the connecting conductor. This process of sharing the charges with the earth is called **grounding** or **earthing**.

A body can thus be charged **positively** by **losing** some of its **electrons**.

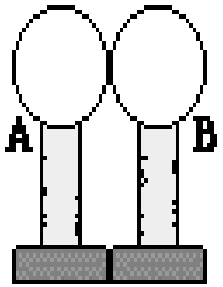
Similarly, a body can be charged **negatively** by **gaining electrons**. When we rub a glass rod with silk, some of the **electrons** from the rod are **transferred** to the silk cloth.

Thus the rod gets **positively** charged and the **silk** gets negatively charged. **No new charge** is created in the process of rubbing.

CHARGING BY INDUCTION

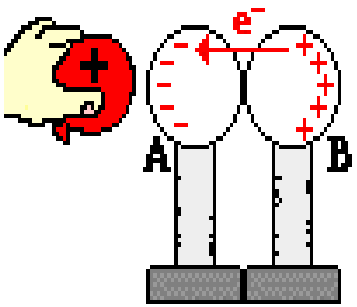
Charging by Induction

Diagram i.



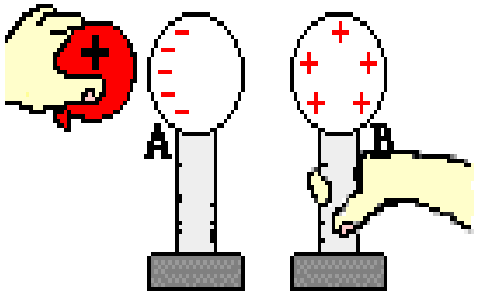
Two metal spheres are mounted on insulating stands.

Diagram ii.



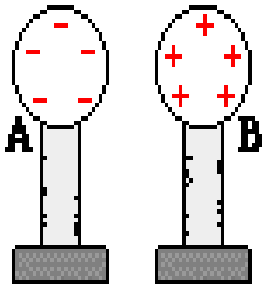
The presence of a + charge induces e⁻ to move from spheres B to A. The two-sphere system is polarized.

Diagram iii.



Sphere B is separated from sphere A using the insulating stand. The two spheres have opposite charges.

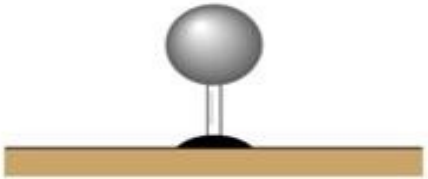
Diagram iv.



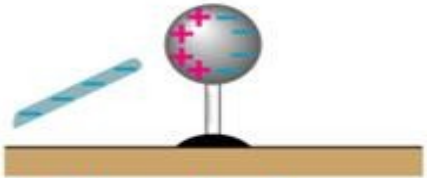
The excess charge distributes itself uniformly over the surface of the spheres.

Go to Image website

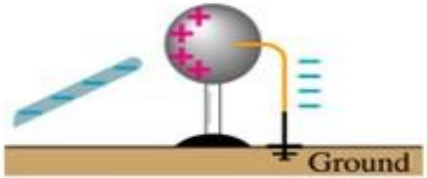
Go to the website of the image



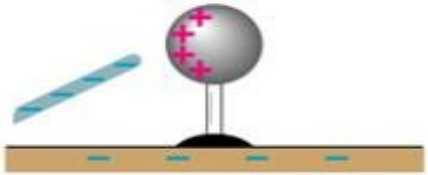
a. Neutral Sphere



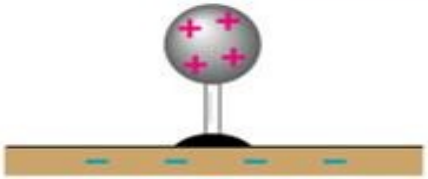
b. Negatively charged rod, charged the sphere



c. Electrons leave the sphere through the conducting wire



d. Negatively charged rod is removed



e. Sphere becomes & remains positively charged