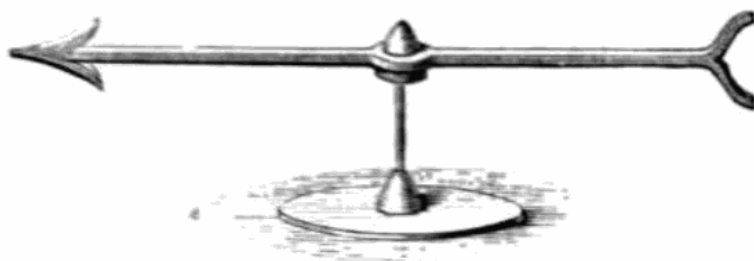


Electroscope

An **electroscope** is an early scientific instrument that is used to detect the presence of electric charge on an object. It was the first electrical measuring instrument ever created.

The first electroscope was a pivoted needle called the versorium. It was invented by William Gilbert around 1600 AD.



The pith-ball electroscope and the gold-leaf electroscope are two classical types of electroscopes that are still used in modern classrooms to demonstrate the principles of static electricity.

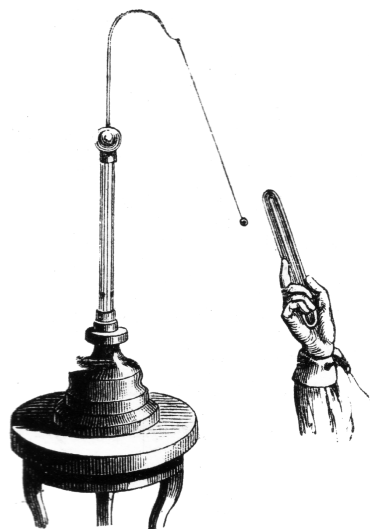
Pith-ball Electroscope

The pith-ball electroscope was invented by John Canton in 1754. It consists of a small ball of some lightweight nonconductive substance, originally pith (tissue from the stems of some plants), suspended by a silk thread from the hook of an insulated stand.

In order to test an object for charge, the object is brought close to the uncharged pith ball. If the object is charged, the pith ball will be attracted to it.

The attraction occurs because of induced polarization of the charges inside the pith ball. For example, if a positively charged object is brought near the ball, the negative electrons in the ball will move closer to the object. Thus, the side of the ball closest to the object will be more negative, while the side farthest from the object will be more positive. Since the negative side of the ball is closer to the object than the positive side, there will be an overall attraction of the ball to the object.

The pith ball can be charged by touching it to a charged object. When charged in such a way, the ball acquires the same charge as the object that is used to charge it.



Gold-leaf Electroscope

The gold-leaf electroscope was created by Abraham Bennet in 1787, as a more sensitive instrument than the pith-ball electroscopes then in use.

A gold-leaf electroscope consists of a vertical metal rod, from the end of which hang two parallel strips of thin, flexible gold leaf. A metal disk or ball terminal is attached to the top of the rod, where the charge to be tested is applied.

To protect the gold leaves from drafts of air, they are typically enclosed in a glass bottle.

When the metal terminal is touched with a charged object, the gold leaves spread apart in a V. This is because some of the charge on the object is conducted through the terminal and metal rod to the leaves. Since both leaves receive the same type of charge (positive or negative), they repel each other and spread apart. If the terminal is grounded, by touching it with a finger, the charge is transferred through the body to the ground, and the leaves close.

The electroscope can also be charged without touching it to a charged object, by induction.

If a positively charged object is brought near the terminal, as shown to the right, the negative charges in the electroscope will be attracted towards it and move to the top. This will result in a positive charge on both leaves. Since they have the same charge, the leaves will repel each other and spread out.

If the electroscope is grounded while the charged object is nearby, negative charges from the ground will move into the electroscope. This will give the electroscope an overall negative charge.

