**Electric Charge and Fields**

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**Introduction**

In 600 B.C., *Thales of Miletus*, one of the founders of Greek science, first noticed that if a piece of amber is rubbed with a woolen cloth, it then acquires the property of attracting light feathers, dust, lint, pieces of leaves, etc.

In 1600 A.D., *William Gilbert*, the personal doctor to *Queen Elizabeth*- I of England, made a systematic study of the substance that behaves like amber. In his book*De Magnete* (on the magnet), he introduces the name*electrica* for such substance. In fact, the Greek name for amber is an electron, which is the origin of all such words: electricity, electric force, electric charge, and electron.

**Fractional electricity:-** If a glass rod is rubbed with a silk cloth or a fountain-pen with a coat- sleeve, it is able to attract small pieces of paper, straw, lint, light feathers, etc. Similarly, a plastic comb passed through dry hair can attract such light objects. In all these examples, we can say that the rubbed substance has become *electrified or electrically charged*. It is because of friction that the substance gets charged on rubbing.

The property of rubbed substance due to which they attract the light object is called electricity. The electricity developed by rubbing or friction is called frictional or static electricity. The rubbed substance which shows this property of attraction are said to have become electrified or electrically charged

**Electrostatic:-**The branch of physics which deals with the study of electric force electric field, Electric potential, and electric energy due to charge are at rest is known as electrostatic. It is also known as static electricity.

**Application of Electrostatic**

In electrostatic loudspeaker.

In electrostatic spraying of paints and powder coating.

In fly ash collection in chimneys.

In a photocopy machine.

Electric capacitor or condensers.

In the design of a cathode-ray tube used in television and radar.

Natural phenomenon like lightning and thundering.etc

***Electric charges***

**Electric** **charge**: - Electric charge is a physics property of matter that causes it to experience a force when placed in electromagnetic fields. Electric charge is a physical quantity which causes electric force in a matter.

It is a scalar quantity. Its SI unit is the coulomb(C). It's dimensional formula [AT-1] or [ M0 L0T-1 A1]. A proton has a positive charge (+e) and an electron has a negative charge (-e), where

                                  [e= 1.6 × 10-19coulomb]

**Two kinds of electric charges:-** About 100 years ago, Charles Du fay of France showed that electric charges on various objects are of only two kinds. The following simple experiments prove this fact.

**Experiment 1**

(1) Rub a glass rod with silk and suspend it from rigid support by means of a silk thread. Bring another similarly charged rod near it. The two rods repel each other.

(2) Bring a plastic rod rubbed with wool near the charged glass rod. The two rods attract each other.

(3) Now rub a plastic rod with wool and suspend it from a rigid support. Bring another similarly charged plastic rod near it. there will be repulsion between the two rods.

**Experiment 2**

If a glass rod, rubbed with silk, is made to touch two small pith balls( or polystyrene balls) which are suspended by silk threads, then the two balls repel each other.

(a) Similarly two pith balls touched with a plastic rod rubbed with fur are found to repel each other.

(b) But it is seen that a pith ball touched with a glass rod attracts another pith ball touched with a plastic rod.

(c) From the above experiment, we note that the charge produced on a glass rod is different from the charge produced on a plastic rod. Also, the charge produced on a pith ball touched with a glass rod is different from the charge produced on a pith ball touched with a plastic rod. We can conclude that:

1. there are only two kinds of electric charges- positive and negative.

2.like charges repel and unlike charges attract each other. This is also known as the fundamental law of electrostatic.

From this, we can say that pith balls have been electrified or charged by contact. This property which distinguishes the two kinds of charges is called the polarity of charge.

**Vitreous and resinous charges**:- *Charles Du Fay*used the term vitreous and resinous for the two kinds of charges.

1.The charges developed on the glass rod when rubbed with silk was called*vitreous charges* (Latin virtum*=glass*)

2. The charges developed on amber when rubbed with wool was called *resinous charge*(amber is a resin).

Butlater on, these terms were found to be misleading, for example, a ground glass rod develops resinous electricity while a highly polished ebonite rod develops vitreous electricity.