

**PHYSICS**  
**FORM 5**  
**ELECTROSTATICS**

Objects may be charged or uncharged (neutral) depending upon the ratio of protons and electrons within the object.

Protons are allocated within the nucleus and therefore unable to move. Electrons are extra nuclear (outside the nucleus). Electrons are therefore free to move.

A negatively charged object therefore has a surplus of electrons while a positively charged object has a deficiency of electrons. Movement of electrons from one object to another will result in changes of the charge of the object.

### **Rules of Static Electricity**

1. Only two types of charges exist (positive and negative).
2. Like charges repel each other.
3. Unlike charges attract each other.

### **Charging An Object**

Charging means gaining or losing electrons. When you rub one material on another, they are charged by friction. A material losing electrons is positively charged and a material gaining electrons is negatively charged.

When you rub a glass rod on a silk cloth, the glass will lose electrons and become positively charged and the silk cloth will gain electrons and become negatively charged.

When a polythene rod is rubbed against a cloth duster, this results in negative charges (electrons) moving from the duster moving into the polythene rod. The rod therefore becomes negatively charged.

When a polythene rod is rubbed using cellulose acetate, the polythene rod loses electrons becoming positively charged and the cellulose acetate negatively charged.

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**Charging an Object (Using Earth)**

To charge an object permanently, one would need an earth wire, the method is as follows:

To charge a sphere positively, a negative charged rod is brought adjacent to it (without touching). (If the rod touches the sphere then the sphere will become negatively charged.)

The negative charges on the sphere that is close to the rod are repelled away from the rod. If an earth wire is then attached to the sphere, the negative charges will flow down the earth wire (the earth wire connects an object to the earth which can be considered as a massive collection of both positive and negative charges).

Leaving the negatively charged rod in place, the earth wire is removed. If the rod is moved first, then negative charges from the earth will travel back up into the sphere hence to prevent this, the rod must remain in place while the earth wire is being removed.

After the rod is removed a positively charged sphere results.

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**Charging an Object (Without using Earth)**

Initially the two spheres are neutral and touching. A negatively charged rod is brought near to one sphere. Negative charges from this sphere are repelled and move to the other sphere. Keeping the rod in place the spheres are separated and the result are oppositely charged spheres.

**The Lightning Rod**

This is a metal bar pointed at the top, whose other end is buried firmly in the ground. Its purpose is to discharge thunder clouds safely. Therefore it is fitted at the top of buildings. The idea is that it should get struck first before the building and conduct the surge of charge harmlessly to earth (reservoir of electrons).

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**Electric Field**

This is the region around an electric charge in which a force of electrical origin is exerted.

The direction of an electric field line can be defined as the direction of the force it exerts on a positive charge.

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