

Static Electricity

Purpose: To study aspects of static electricity including positive and negative charges, electrical forces and charging by induction.

Equipment: Electroscope, lucite rod, flannel cloth, two pith balls with string, support stand.

Introduction: As you know, there are two types of electrical charges-positive and negative. In this experiment you will investigate some aspects of the behavior of these charges. After completing each instruction given below, write down your observations carefully of what happened and give an explanation for why it happened. You will find it very helpful to make a simple diagram for most of the experiments showing location of positive and negative charge, etc.

Procedure:

Part I

1. Suspend a pith ball from a support stand being careful not to touch the string with your fingers except at the top. Why? Charge the lucite rod by rubbing it with the flannel cloth. Bring it into contact with the suspended pith ball. Describe what happens and explain.
2. What can you conclude about the effect that the distance between the rod and pith ball has on the size of the electric force exerted? Why?
3. Charge the pith ball with the rod again and position the rod at about the equilibrium position of the suspended ball. Note roughly how far the pith ball is repelled away from the rod. Now bring up a second uncharged pith ball into contact with charged pith ball #1 so that some of the charge from ball #1 is transferred to ball #2. Now note how far ball #1 is repelled by the rod. Remove the charge from ball #2 by touching it and repeat. Conclusion?

Part II

1. The electroscope is a convenient tool for comparing relative amounts of electric charge and determining whether it is positive or negative. Examine the various parts of the electroscope carefully and see if you can explain how it works. Hold a negatively charged lucite rod near the top plate of the electroscope and observe what happens.
2. Transfer some charge onto the electroscope by rubbing the charged rod on the top of the electroscope. Results? Explain.

Part III

1. Hold a charged lucite rod about a centimeter away from the top of the uncharged electroscope so that an easily observed deflection takes place. With the rod still in position, ground the plate by touching a finger to it. What happens? Remove your finger and then the rod. Results? Explain.
2. While the electroscope is still charged in the above manner slowly bring the rod back to within a centimeter of the plate. Now bring the rod even closer (without touching) to the plate. Record the result and explain.

Part IV

Faraday Ice Pail

Ideally, we would like to investigate a completely closed conductor, but we need to get inside also! Faraday's Ice Pail is a compromise. It is a closed conductor with a hole in it. Charge the pail with the Van De Graaf generator. Touch the uncharged test ball to the inside of the pail and test the ball for a charge with the electroscope. Now touch the uncharged ball to the outside of the pail and test the ball for a charge. What can you conclude about the location of charge on the pail?

By means of a wire connect the pail to the electroscope. Charge the metal test ball on the electrostatic generator and lower it into the pail without making contact. Result? Now ground the pail with your finger and then break the ground. Record the result. Finally, allow the test ball to touch the pail and then remove the test ball. With the aid of sketches, carefully explain each of the results you just obtained. What can you conclude about the size of the charge induced on the pail and scope (when you grounded them) compared to the size of the charge that was originally on the ball?