Modeling Motion Electrostatics Lab

This lab will not be assessed against any of the assessment criteria

Introduction:

In this lab you will make qualitative investigations of electrostatic phenomena. For each investigation record your observations in your lab hand book and answer any questions.

The Nature of Charge:

When an rubber rod is rubbed with fur it becomes charged. By convention this is referred to as a negative charge. Investigate what happens when two negatively charged rods are brought together. Rub the glass rod with silk and investigate the nature of its interaction with the charged rubber rod. What happens? Is the glass rod negatively charged as well? There are a variety of different materials and rods in the electrostatics kit. Rub the rods with different materials establish which combinations give positive charges on the rods and which negative charges on the rods. Which material are most effective at charging each of the rods?

Pith Balls

Hang a small pith ball which is suspended from some insulating thread near a charged rod and describe what happens? Assuming the pith ball is initially uncharged how can you explain the initial attraction? How can you explain the subsequent repulsion?

The Electroscope:

Investigate the use of the electroscope. Describe what happens when a charged rod is brought close to the cap of the electroscope and then removed without touching it. What happens if the rod touches the cap of the electroscope? Explain what you observe. Can you use the electroscope to determine whether a charge on a rod is positive or negative? Can you use it to determine the relative quantity of charge on a rod?

Charging by Induction:

Hold a rod of known charge close to a metal sphere (but not touching it). Briefly touch the other side of the sphere with your finger and then remove it. This grounds the sphere. Now remove the rod away. Use the electroscope to show that the sphere is now charged? Does it have the same charge or a different charge as the original rod? How can you show this? Draw a picture of what you think is happening.

Transferring Charge:

Charge the black plane by rubbing it and place the proof plane (metal disc with insulating handle) on top of it. Touch the top of the proof plane with your finger. The proof plane should now be charged. Confirm this by bringing it close to the electroscope. Use the proof plane to transfer charge to the large metal sphere. Is there any charge left on the proof plane? Repeat many times to transfer as much charge as possible. How can you confirm that the charge on the sphere is increasing? Is there a limit to how much charge you are able to transfer?

Faraday's Ice Pail:

Faraday investigated the charge distribution on a hollow metal ice pail and made some interesting observations. In this experiment you will use a hollow metal sphere with a hole in it in place of the ice pail. Transfer charge to the sphere with hole in it by touching the proof plane to the outside of the sphere. Does the proof plane still have some charge on it? Transfer more charge to the sphere but this time touch the sphere inside the hole (you may need to use a smaller proof plane). Does the proof plane still have some charge on it? Continue adding charge to the sphere by putting charge on the inside of the sphere. Does the charge on the sphere keep increasing? Compared with charging a sphere on the outside are you able to transfer more charge to the sphere by charging on the inside or less?

Van der Graf Generator:

The Van der Graf generator uses the principle of Faraday's Ice pail to deposit a large amount of charge on the sphere. We do mean a large amount! It is unlikely that anyone will die during this experiment, but if you are not careful you will get a nasty jolt. Please take care not to discharge the sphere through your body. When sufficient charge is on the sphere the electric field around it is sufficient to ionize the air and cause a discharging spark. Bring a variety of objects near the charged Van der Graf (do not include yourself as one of the objects). Which objects are most effective at causing a discharge – large rounded objects, flat objects or small pointy objects?

Mapping Electric Field Lines:

Investigate the field lines due to a charge distribution by painting nickel or silver paint in a distribution of your choice on the conductive paper. You will apply a potential to the painted regions and then use a potentiometer to measure equipotential lines on the conductive paper. The electric field lines are perpendicular to the equipotential lines and are most dense where the equipotential lines are closest.