Electroscopes Kit

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RECOMMENDATIONS:

1. **The Electroscope Kit should be used during the winter season when there is less humidity in the air, and it is very cold outside. Often this equipment can work in your classroom if it is air-conditioned. The equipment removes excess moisture in the air.**
2. Always clean all aluminum parts as particles on them and moisture can affect your results.
3. All metal parts of the electroscope, rods, and cloths should always be kept in ZIPLOCK bags to keep moisture away from them.
4. No moisture should be around the apparatuses as it conducts electricity.
5. Never use electromagnetic, radio frequency, or radiation equipment in vicinity of the kit.

ASSEMBLING THE ELECTROSCOPE

Materials needed: Plastic forceps and duct tape.

Procedures:

- Tear off a small piece of duct tape. Roll it up sticky side out and use it to attach the bottom of the glass flask to the science table.
- Remove the electrode assembly from its bag and place it on the table.
- Observe the brass hooks at the bottom of the electrode assembly.
- Carefully remove 1 package of aluminum foil leaves from the plastic cylinder.
- Take out 2 leaves very carefully from the package using plastic forceps. Place them on the table.
- Pick up the electrode assembly with one hand. With the forceps in your other hand, pick up 1 aluminum leaf and place rectangular opening on a brass hook. Repeat the same step with the second aluminum leaf.
- Hold the flask with one hand and insert the rubber stopper into the opening of the flask.

CHARGING BY FRICTION

Materials provided: Lucite rod, hard rubber rod, and swatches of silk and cotton.

Procedures:

- Pick up the hard rubber rod. Bring it near the silk swatch. Did anything occur? Record your observations.
- Rub the hard rubber rod with the silk swatch briskly. Lay the silk down. Bring the hard rubber rod towards a corner of the silk. Does anything occur? Record your observations.
- Repeat the previous step using the Lucite rod with the cotton swatch.
- Lay the cotton down . Bring the hard rubber rod towards a corner of the cotton swatch. Does anything occur? Record your observations.

Analysis:

Using your **Electrostatic Series Chart (see page 6)**, locate the hard rubber rod and the silk cloth. Observe that silk is higher on the chart than the hard rubber rod. The rod, which is an insulator, gained electrons to become negatively charged. It acquired electrons from the silk swatch. The silk swatch acquired a positive charge because electrons were transferred. When you brought the rubber rod near the silk, the silk was attracted by the rubber rod. This shows that unlike charges attract. This rubbing of two different materials is called **charging by friction**. What charge did the Lucite rod acquired when rubbed with the cotton swatch?

Critical Thinking:

What does the word "**static**" mean and where is it derived from?

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CHARGING BY INDUCTION

Safety first: Always place duct tape under the flask before using the electroscope for your activity. Do not drop the glass rod. **Wear your goggles** because you are using a glass flask.

Materials provided: Lucite rod, hard rubber rod, swatches of silk and cotton, and electroscope.

Materials to collect: Duct tape, wool and fur swatches, goggles, and glass rod

Procedures:

- Observe the aluminum leaves. If the leaves are not in the discharged position, place your fingers on the aluminum ball to discharge it. Discharge position is when the leaves are hanging down.
- Bring the hard rubber rod close to the round ball of the electroscope. Did anything occur? Record your observations.
- Rub the hard rubber rod with the silk swatch briskly. Bring the rod near the knob. Does anything occur? Record your observations. Do the aluminum leaves move?
- Remove the rod from the aluminum knob. What happens? Record your observations.
- Repeat the previous step using the Lucite rod with the cotton swatch.
- Slowly remove the Lucite rod from the knob. Did you observe anything happening? Record the results.
- Repeat the previous step again using the glass rod with the wool swatch. What did you observe? Record the results.
- Repeat the previous step again using the glass rod with the fur swatch. What did you observe? Record the observations.

Analysis:

Your electroscope has a metal knob (electrode/conductor) and a metal rod (conductor) with 2 aluminum leaves (conductor). The conductor is surrounded by a rubber stopper which is an insulator. The electroscope is neutral when the hanging leaves droop with equal positive and negative charges. The leaves can separate if a charged rod is brought near the knob. Using your **Electrostatic Series Chart**, locate the hard rubber rod and the silk cloth. Observe that the silk cloth is higher on the chart than the hard rubber rod. The hard rubber rod when rubbed with the silk cloth gained electrons to become negatively charged. The hard rubber rod induced a positive charge on the electrode (conductor) and repelled the electrons in the knob to move down the metal (conductor) making the aluminum leaves spread apart. The rubber insulator around the metal rod conductor allowed the electrons to shift towards the aluminum leaves. As long as the negative rubber rod (insulator) remained near the knob the leaves (conductors) remained negative. When the rod was removed, the leaves converged. The electroscope is again neutral.

Charging by induction occurs when a charged hard rubber rod is brought near to, but not touching, the aluminum knob on the electroscope with the leaves diverging. Because no contact is made between the rod and the electroscope, there is no transfer of electrons. The charge on the hard rubber rod was negative and the silk cloth was positive. What charge did the Lucite rod acquire with the cotton swatch? What charge did the glass rod acquire when rubbed with the wool cloth? What charge did the glass rod acquire when rubbed with the fur piece? Use your Electrostatic Series Chart to find out. What charge did one material gain and the other material lose?

Critical Thinking:

What material is used to prevent static charges from building up in clothes being dried in a clothes dryer?

CHARGING BY INDUCTION WITH LEAVING A CHARGE ON THE ELECTROSCOPE

Safety first: Put duct tape under the flask before placing the electroscope on a science table.

Material provided: Hard rubber rod, cotton swatch, and electroscope

Materials to collect: Duct tape, goggles, and glass rod

Procedures:

- **Safety first:** Goggles should be worn as you are using a glass container.
- Always discharge the electroscope prior to