**Static Electricity**

**Purpose:** To investigate the nature of static electricity

**Required Equipment:** 3/4" tape, Scotch Magic Tape

 fresh balloons

**Discussion:** When discussing static electricity, many people focus on the need to rub materials together in order to generate separations of charge. Some state that friction creates the separation of charge. Is this statement always true—or only some of the time? What is the nature of electrocharge?

Consider two objects simply touched together. Their surfaces adhere slightly. Chemical bonds form at the regions of contact between the molecules of both surfaces. If the surfaces are not of the same material, the bonds will probably be polarized, with the shared bonding electrons staying with one surface more than with the other. When the two objects are pulled apart again, the bonds rupture and one surface may end up with electrons from the other surface. Now the surfaces are no longer neutral. One surface has extra electrons (electron surplus) while the other surface has fewer electrons (electron deficient) compared to the number of protons in each substance. These charges are then separated as the surfaces are pulled apart. As the objects are separated, the charges move with them. If the surfaces involved are rough or fibrous, friction does play a part in surface charging.

If you touch a balloon to someone’s hair, the hair really only touches the balloon in tiny spots, and the total area of contact is extremely small. However, if the balloon is dragged across the hair, then the successive areas of contact add up. Rubbing a balloon on your head increases the total area of contact, so it increases the amount of charge that is separated. However, the friction does not cause the charging. You can rub two balloons together as much as you like, and you will never create any “static electricity.” Contact between dissimilar materials is required.

**Procedure**

Step 1: Pull a couple of strips of plastic adhesive tape from a roll. Each one should be about 12–20 cm long. Hold them up by their ends, then slowly bring them side by side. What happens? Notice that they repel each other. If you try to get the dangling lengths of tape to touch each other, the tape will swerve and gyrate to frustrate your efforts. Obviously the tape has become electrically charged. *But how?* No friction was involved.

Step 2: One at a time, pass each of the strips of tape lightly between your fingers so as to discharge or neutralize them, then hold the two strips near each other again. *Now how do the strips behave?* If discharged, they will not repel each other. You've managed to discharge the strips by touching them.

Step 3: Fold over a couple of centimeters of the end of each strip. This gives you a non-sticky handle to work with. Carefully stick the two strips to each other so the sticky side of one strip adheres to the “dry” side of the other. You should end up with a double-thick layer of tape which is sticky on one side, and which has two tabs at the end. Now grasp the tabs and rapidly peel the strips apart. Keep them distantly separated, then slowly bring them together again. *How do the strips behave this time?*

Step 4: Blow-up two fresh balloons. Do not rub them against your hair or clothing. See if you can “create” static electricity by rubbing two electrically neutral balloons together. *What is your result?*

Step 5: Discharge your two strips of tape by running each one between your fingers. Hold them near each other to verify that they neither attract nor repel one another. Now stick the two strips together, but this time do it with the adhesive sides facing one another. Peel the strips apart again, then bring them near each other. *Are the strips now neutral, or do they attract one another?*

Step 6: Finally, peel four separate strips from a roll and neutralize them with your fingers. Then stick them together in pairs with the sticky side of one stuck to the dry side of the other. Now peel each pair apart so you have four charged strips. Hold pairs of these strips together in different combinations. *What do you discover?* You can determine the polarity of the four strips by rubbing a balloon on your hair (rubber always acquires a negative charge when it touches hair), then holding it near the strip being investigated. If the balloon and the tape strip repel, the strip is negatively charged.

**Analysis:**

1. How did the strips of tape become charged in Step 3?

2. How do you explain why the strips of tape are not charged when peeled apart in Step 5 while they are in Step 4?

3. Paper is a reasonably good conductor compared to plastic tape. Explain why masking tape does not work well for this activity.