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Electric Interactions

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Electric Interactions

Do you need an idea for a scientific study?
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Small shocks from rubbing objects together are a common occurrence. Take the following brief quiz to see how much you already know about electric interactions. See the bottom of page 4 to check your answers.

1. One major difference between gravitational and electric forces is that gravity:
   a. both attracts and repels, while electric forces only attract.
   b. both attracts and repels, while electric forces only repel.
   c. only attracts, while electric forces only repel.
   d. only attracts, while electric forces can attract or repel.

2. If a pair of one coulomb like charges were placed one meter apart, how large would the electric force be between the two charges?
   a. 9 newtons
   b. 900 newtons
   c. 9,000,000 newtons
   d. 9,000,000,000 newtons

3. The inverse square law is valid for all the following *except*:
   a. sound.
   b. gravity.
   c. contact forces.
   d. electrical forces.

4. A person walks across a carpeted floor and when reaching for the doorknob receives a small shock from static electricity. About how many volts does the person receive during this shocking experience?
   a. 0.2 volt
   b. 2 volts
   c. 20,000 volts
   d. 2,000,000,000 volts

5. About how many volts of electricity can an electric eel deliver?
   a. 6 volts
   b. 600 volts
   c. 600,000 volts
   d. 6,000,000 volts

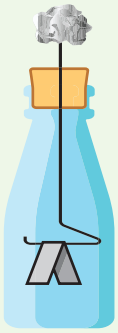
Making An Electroscope

Materials Required

1- wide mouth clear glass bottle with cork
1- 20 cm by 20 cm piece aluminum foil
1- balloon
1- 20-cm long copper wire (no insulation)
1- 3 cm by 0.5 cm piece aluminum foil
1- 8-penny finishing nail

Procedure

1. Make sure to have permission before conducting this investigation.
2. Bend the end of the copper wire into the shape shown in Figure 1 below.



3. Use the nail to make a hole in the middle of the cork so the copper wire fits snuggly through the hole.
4. Fold the small piece of aluminum foil into the shape shown in Figure 1 and place on the bended part of the copper wire.
5. Push the straight end of the copper wire up through the cork and extend the wire about 5 cm out the top of the cork.
6. Ball up the larger piece of aluminum foil and place it on the top of the copper wire that extends from the top of the cork.
7. Carefully place the copper wire apparatus into the bottle.
8. Blow up and tie the end of the balloon.
9. Rub the inflated balloon vigorously on a piece of clothing, such as wool, nylon, or polyester.
10. In Table 1, describe what happens to the small piece of foil when the balloon is brought (a) close to the aluminum foil ball on the top of the electroscope and (b) when the balloon touches the aluminum foil ball on the top.

Table 1. Electroscope Data

Balloon moved…	Observations
Close to ball	
Touching ball	

Questions

1. Explain why the small piece of aluminum foil behaved differently when the balloon was brought close to the top aluminum ball and when it touched the aluminum ball.

Electric Interactions

The Hazards of Small Shocks

While the small shock received after sliding across a car seat and touching the door handle may be unpleasant, this same phenomenon can create serious problems when working with modern day electronics. As these devices become smaller, the electrical circuits that operate them become more closely packed together. This increases the risk of electrical discharges from jumping from one part of the circuit and damaging another part of the circuit.

These discharge sparks can ruin circuit components during normal operation. However, when technicians open these devices for repair and maintenance, the threat of a static charge damaging the circuit components increases significantly. Several steps are used to reduce the threat of unintended electrical discharges. These include providing work surfaces that allow for the buildup of static charge to reduce the chance of discharges. Other technicians wear special clothing that has wires attached to a ground to reduce the chance of charge building up on the technician and clothing. Other technicians wear wristbands that also attach to a ground wire to dissipate static charges.

Electronics is not the only area where spark hazard remediation is required. Have you ever noticed signs at gas stations that warn against filing portable gas cans while in the bed of a truck? Static discharges can ignite the gasoline vapors and lead to dangerous fires if cans are filled while in the truck bed. Instead, place the gas cans on the ground a safe distance away from the truck and pump and touch the can with the gas nozzle before removing the can lid and refueling. This provides a path to dissipate the static charge to the ground and reduces the possibility of fire.

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Answers: **Page 2 Answers:** 1) d, 2) d, 3) c, 4) c, 5) b. **Page 3 Answers:** Making An Electroscope. 1) When brought close but not touching the charged balloon induced a temporary charge in the two sides of the foil separated, but moved back together when the balloon was moved away. When the balloon touched the top ball, the net charge was transferred to the electroscope and the two sides of the foil remained apart.