Name ________________________________ Date __________

Partners __________________________________________ _______________________

Static Electricity: E&M Lab #1  
M.L. West

Objective: to become familiar with some phenomena of static electricity both at low voltages and at high voltages.

Equipment: soft materials, hard materials, empty soda can, empty cat food can, pith ball, paper bits, puffed wheat, rice krispies, Styrofoam packing peanut, sink, electroscope, balloon, DIROD electrostatic generator, jingle bell, clappers. Read the description of the DIROD by L Kowalski.

Define: pith
Lucite
PET

Procedure:
1. Low Voltages:
Soft materials: (fur, silk, wool, polyester, human hair, etc.).

Hard materials: (clear lucite plastic, glass, hard black rubber, PET clear plastic tube, rubber comb, pale green plastic strip, gray plastic tube, empty Skippy peanut butter jar, styrofoam cup, etc.)

Indicators: (Pith ball on thread, tiny bits of paper, puffed wheat, rice krispies, hair on your forearm, foam packing pieces, etc.)

a) Rubbing things together:
Rub each of the hard materials with each of the soft materials in turn. Which combinations produce measurable static charges?
Which are the best three combinations? (Rub ____ on ____ ) x 3
Which indicator is most sensitive?

b) Controlling a can
Charge up your most successful combination from above (rubbing ____ on ____ ). Place one of the metal cans on its side on a level surface so that it can roll easily. Make the charged-up hard material control the rolling of the metal can without touching the can. Make the metal can accelerate, stop, and then accelerate in the opposite direction.

What happens if you let the hard object touch the can?
Which of the two cans is easier to control?

c) **Controlling a stream of water**
Charge up your most successful combination from above. Go to the sink and bring your hard material near a thin stream of water without touching it. Describe what happens.

What happens if you let the charged object touch the water?

How does the effect depend on how far the charged object is from the faucet horizontally?

How does the effect depend on how far the charged object is from the faucet vertically (along the stream)?

Is some other combination of rubbed materials more effective at this particular task?

d) **Charging an electroscope**
Gently charge up your most successful combination from above. Bring it near the ball of the electroscope. Describe what happens.

What happens if you let them touch? (Be gentle with this very sensitive instrument.)

Use your other combinations and see if you can distinguish the **two types** of electric charges.

e) **Charging a balloon**
Blow up a balloon, tie it, rub it on a sweater or your hair and hang it on the wall to show that your group is finished with part 1.

2. **High Voltages:**
DIROD Apparatus (Electrostatic Generator)
Re-read the description of the DIROD by Ludwik Kowalski while you look at it.

a) Connect the leads from the DIROD to the metal spheres mounted on the clear plastic and wood stand. Use the plastic handles to set the edges of the metal spheres to be 1 cm apart. Turn on the motor at a medium speed (4). Be careful! Describe the sparks.

Use the plastic handle to gradually move the spheres apart and describe how the sparks change. You might want to do this experiment with the room darkened somewhat.
When the sparks stop happening, turn off the DIROD, turn on the room lights, and carefully discharge the DIROD with the U-shaped tool. Do not get a shock!
Record the reading of kilovolts on the plastic handle.
What is the significance of this number?

Did you smell anything?

b) Use the plastic handle to set the edges of the large metal spheres about 5 cm apart.
Suspend a jingle bell (or a small binder clip) from a thread from an arched insulated stand. Place the hanging bell midway between the spheres. Turn on the DIROD at a low motor setting (2). Describe what the jingle bell does.

Turn off the DIROD and describe what the jingle bell does then.

Try a higher motor speed and describe the jingle bell's response.

c) Put aside the stand with the large metal spheres.
Place the two metal plates parallel to each other but not touching, near the DIROD.
Connect one to each side of the DIROD.
Position one clapper (J-shaped piece) on each metal plate so that its tall back is only one cm from the other clapper.

Turn on the DIROD with a low setting (3). Describe what the clappers do.

Try a higher motor speed and describe the response.

3. Home experiments from Electricity, Magnetism, and Light by Saslow:
   a) #1.2 The home Twister version of Gilbert’s versorium (p 64, p 42)

   b) #1.4 Electrical screening (p 65)

   c) #1.7 Sticky tape (p 66)

Applications to everyday life:

Discussion question:
If left charged, an electroscope will gradually become discharged. How long does this take? Why does it discharge?

Reference:
Saslow, WM, Electricity, Magnetism, and Light, Academic Press, 2002

Individual report: For each section write a description of your procedure with drawings. Describe what happened and then how you can explain the results by what you know about electric charges. The report is due next week at the beginning of the period.