

Name _____ Date _____

Partners _____

Static Electricity: E&M Lab #1

M.L. West

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

Procedure:

1. Small Voltages:

a) Rubbing things together:

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.)

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?

Which indicator is most sensitive?

Define pith, Lucite, PET

b) Soda can and cat food can

Charge up your most successful combination from above. Place one of the metal cans on its side on a level surface so that it can roll easily. Make the 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) Water stream

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 them touch?

Why does the effect depend on how far the charged object is from the faucet? Horizontally?

Vertically?

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

d) Electroscope

Gently charge up your most successful combination from above. Bring it near the ball of the electroscope. 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.

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

e) 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)

Read the description of the DIROD by Ludwik Kowalski.

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). 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 the textbook (Electricity, Magnetism, and Light by W. Saslow):

a) Gilbert's versorium (wooden stick suspended horizontally) (p 42)

The home W twister version of the versorium (p 64)

b) Electroscope, homemade electroscope (p 67) and Canton's tin cylinder (p 50)

Gently charge up the glass rod with silk. Bring it near the ball of the electroscope, describe.

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

Try this with the Canton's cylinder. You may need to wet the threads a little.

c) Charging by contact (p 48)

d) Compass needle (p 65)

e) Electrical screening (p 65)

f) Sticky tape (p 66)

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.

Applications to everyday life: