

# Lecture 1 List of Demos July 6

1 Large VDG (Yours)

2 Electrostatic Kit (Mine)

(Teflon rod, Glass rod, Wood rod, Spinner, Silk, LED, UVa electroscope)

3. Leaf electroscope

4. Pivoting 2 x 4 balanced on glass

5. Use two metal spheres, measure charge on it, show induction of opposite charge using electrometer.

6 Electrophorous two aluminum pie plates with styrofoam

7 Show hanging charged/conducting pith ball: first attraction by induction, then contact, then conduction of charge, then repulsion.

Use double string

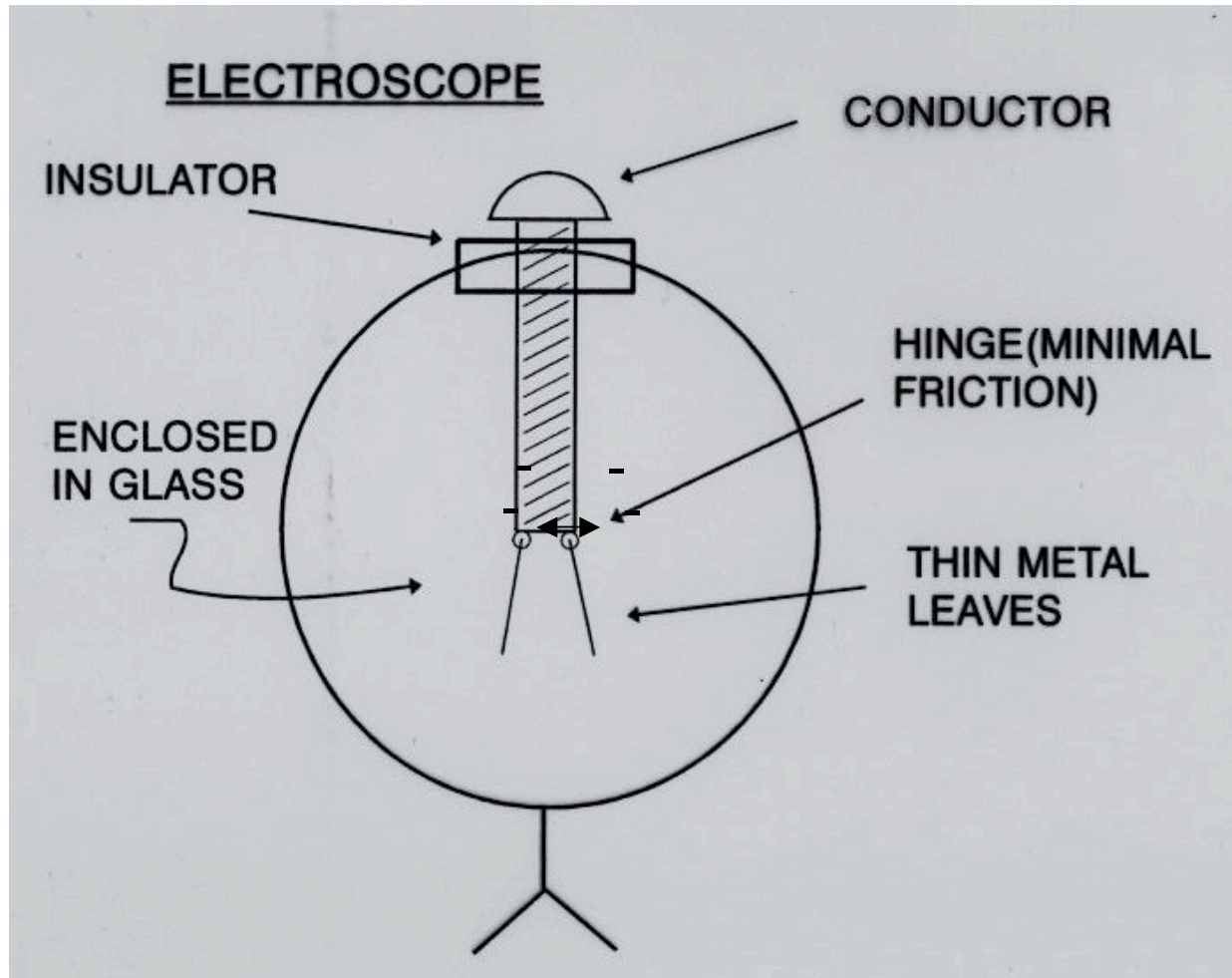
8. Two hanging pith balls with double string plus calculation

# Demo 1: Charged Hair Van de Graaff

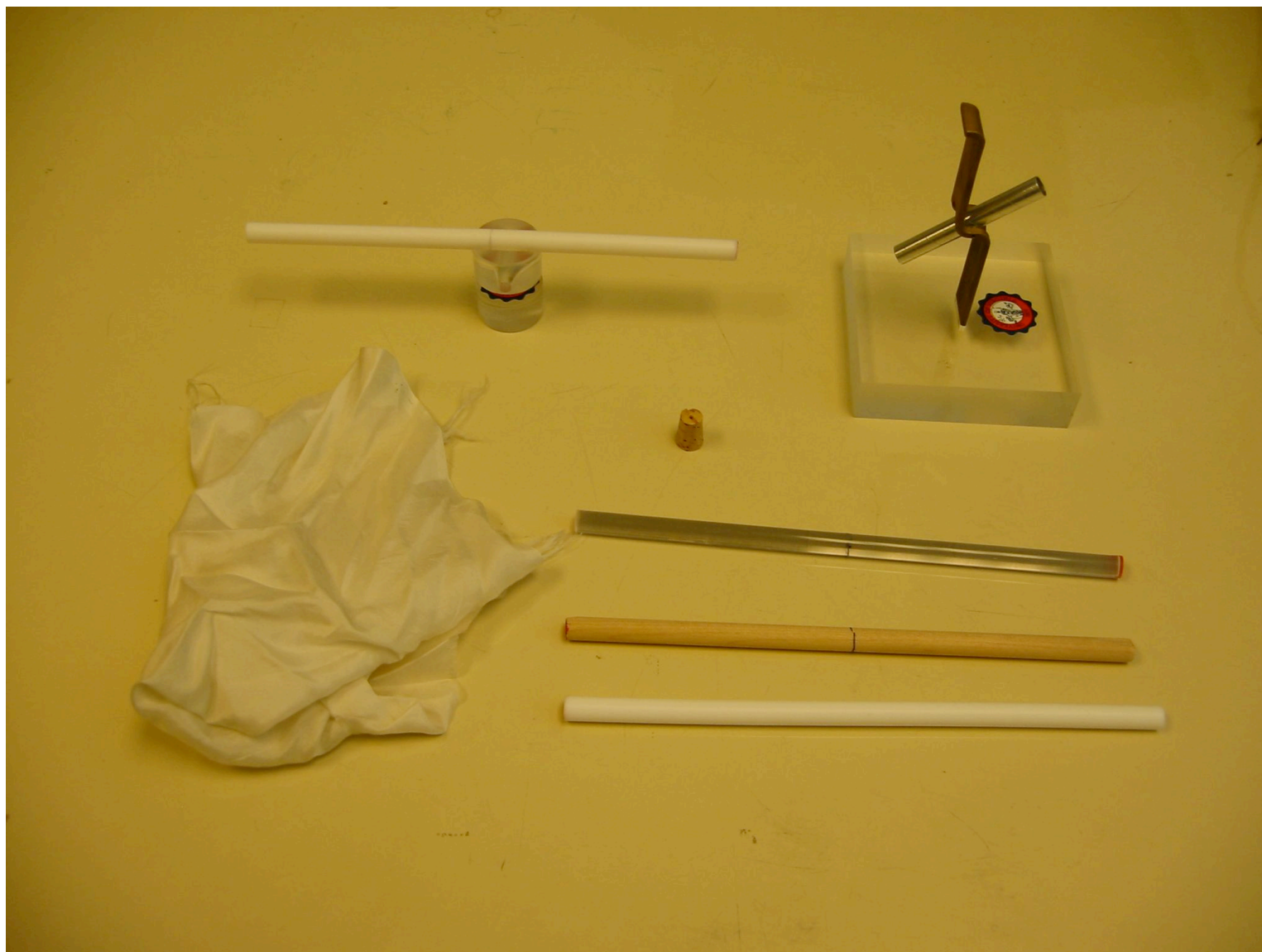
- Charge hair of female teacher with VDG. Take a picture.
- How does this gadget produce a mini-lightning bolt?
- What upward forces are keeping your hair up?
- How are these forces produced?
- Why do the hair strands spread out from each other?
- Why do they spread out radially from the head?
- Is hair a conductor or insulator? How can we find out? Does it depend if is wet or dry.
- To understand what is going on we need a model of electricity.

Demo 4. Pivoting 2 x 4 balanced on a semi-hemispherically shaped piece of glass.

# Demo 3 Leaf Electroscope



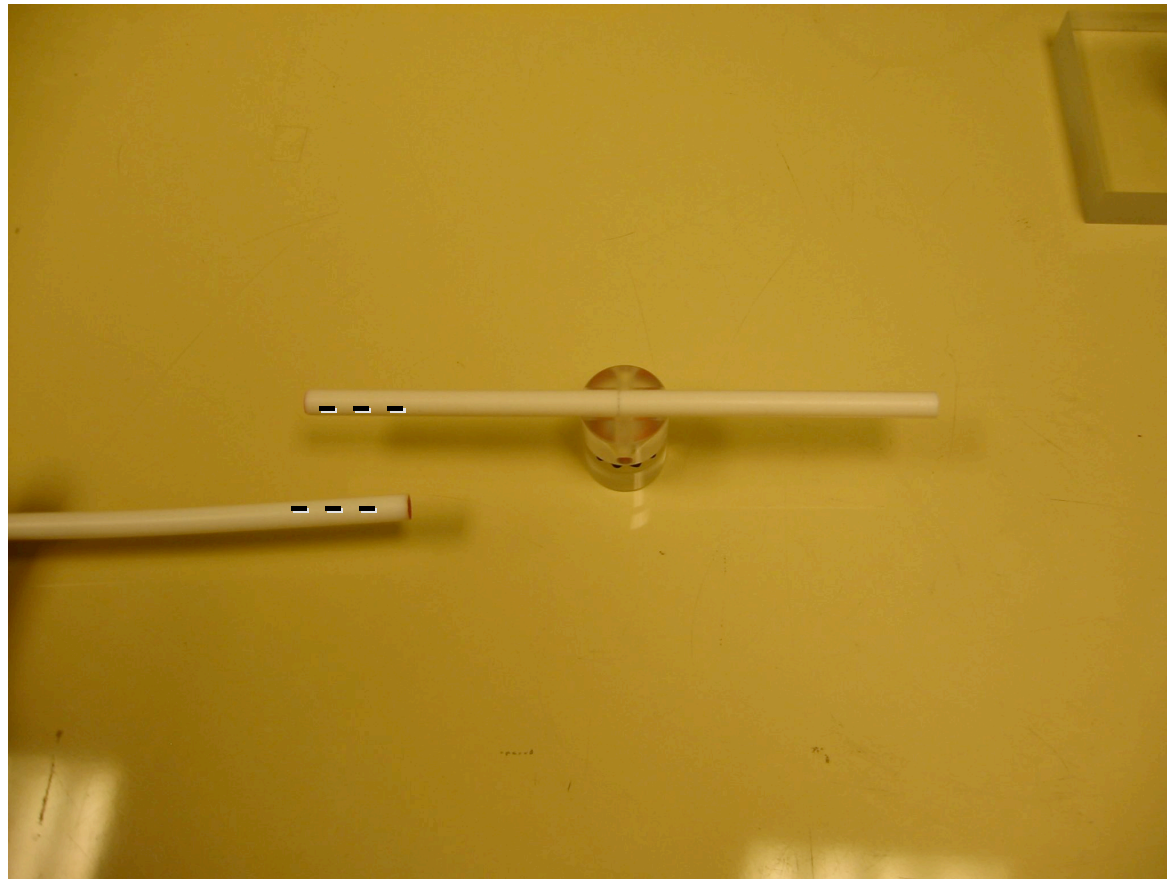
# Demo 2 Electrostatics kit



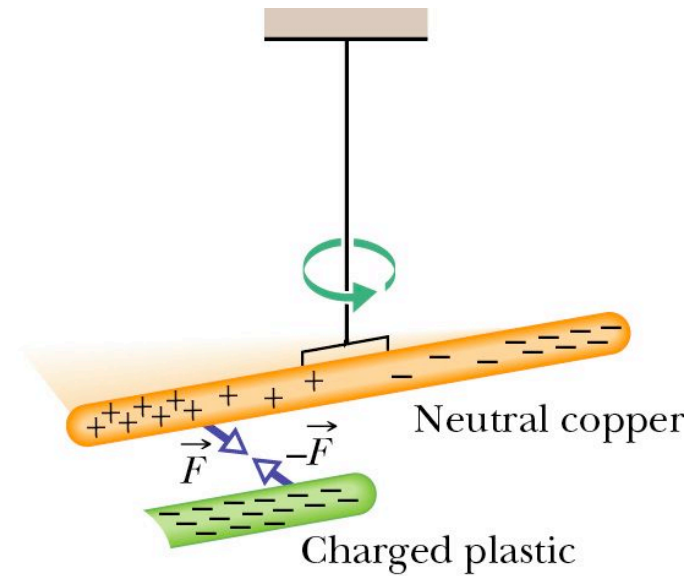
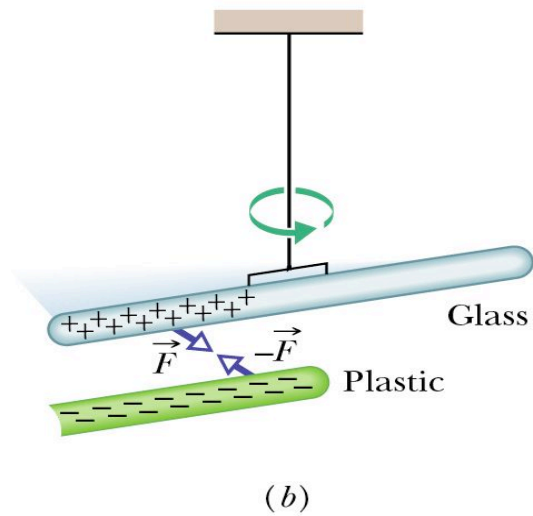
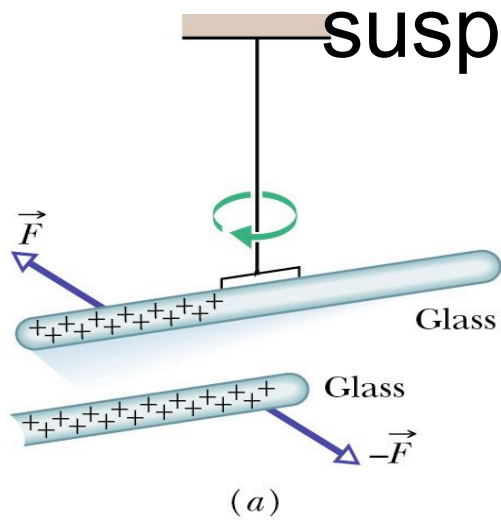
# Charging Insulators by Friction/Rubbing using the Spinner

- Rub two materials together
  - Rub teflon rod with silk.
  - Show repulsion between two teflon rods
  - Show attraction between acrylic and silk
  - Show attraction between wood and teflon or acrylic

## Two teflon rods on spinner

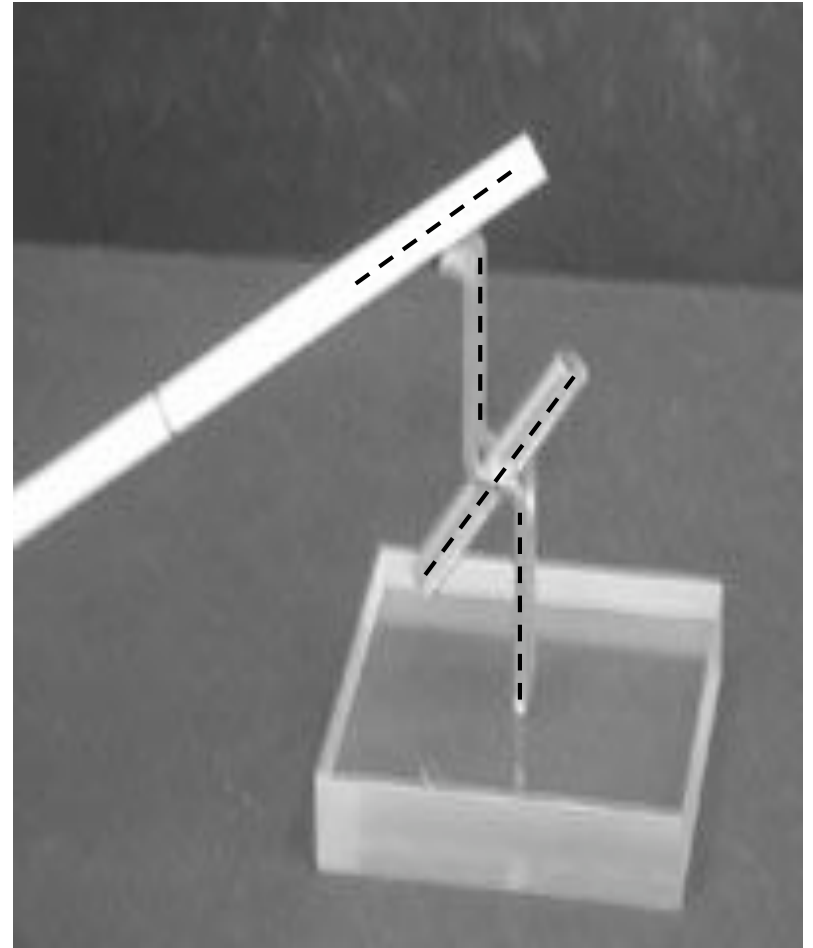
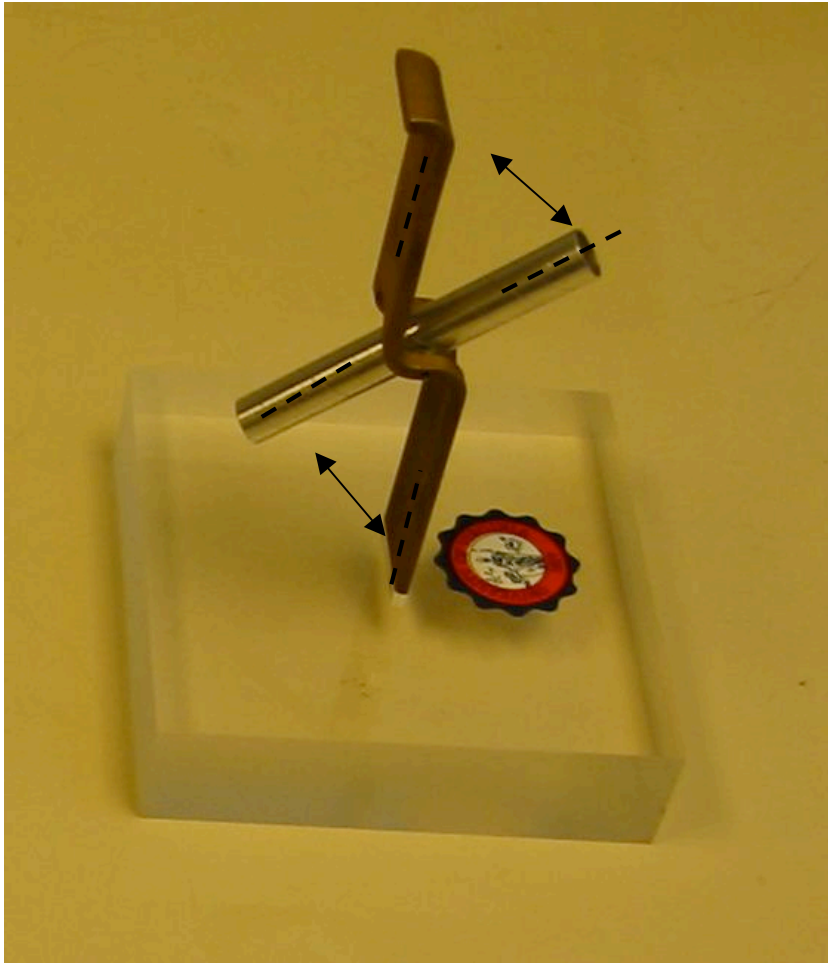


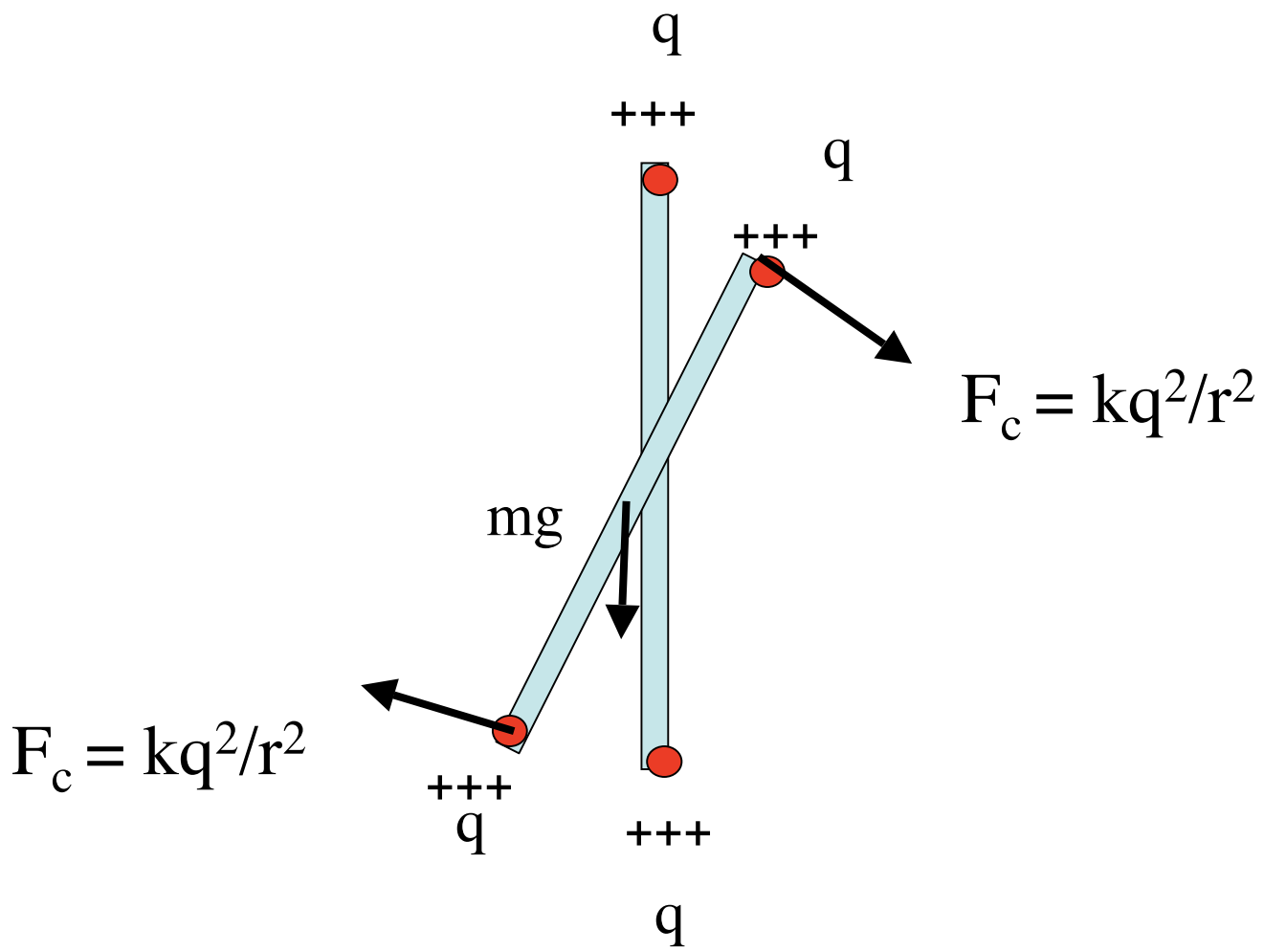
# Charged rods on spinner/similar to rods suspended by string





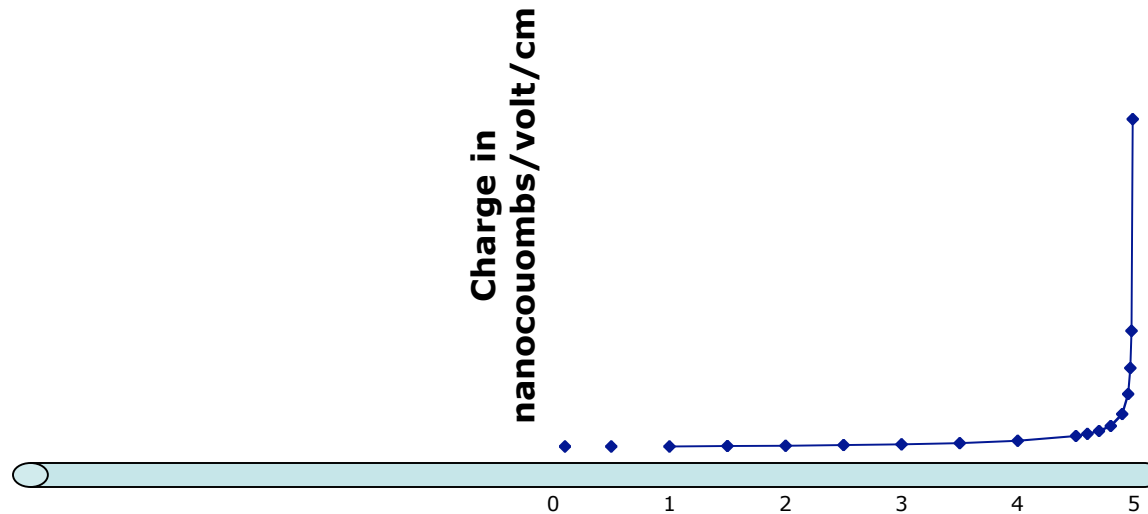
# Detect charge using UVa Electroscope





# How is charge distributed along a conducting rod?

Am J. Phys. 65,846(1977)



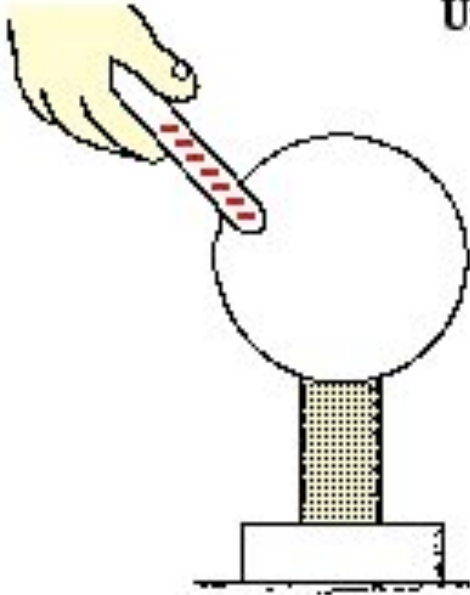
Click on C1\_21\_Charge

# Charging by Contact / Induction using conductors

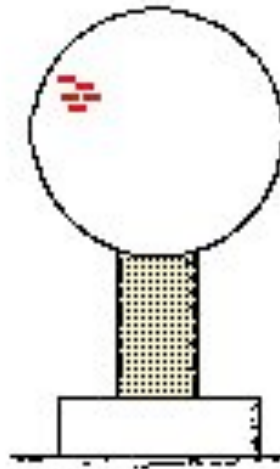
- Show electronic electroscope with cage: gives magnitude and sign of charge. Use teflon and acrylic to show difference
- Demo 5 Show uniformity of charge around sphere using electrometer..
- Show induction:
  - Demo using conducting spheres and electrometer
  - Demo electrophorus
  - Demo Electroscope
- Demo: Show hanging charged/conducting pith ball: first attraction by induction, then contact, then conduction of charge, then repulsion

## Demo 5. Show Uniform Distribution of Charge on Sphere using Electrometer

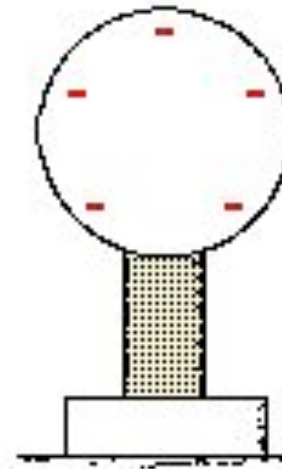
### Uniform Distribution of Charge on Conductors



A metal sphere is mounted on an insulating stand and touched by a charged plastic golf tube.



The metal sphere acquires a negative charge, located at the point of contact.

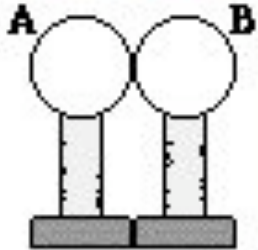


Since metal is a conductor, the charge quickly distributes itself across the surface of the sphere.

## Demo 6 Show induction using two conducting spheres and Electrometer

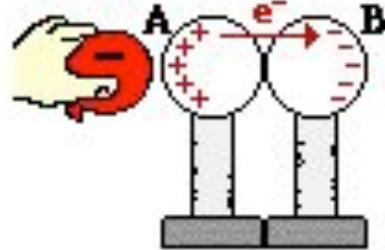
### Charging by Induction

Diagram i.



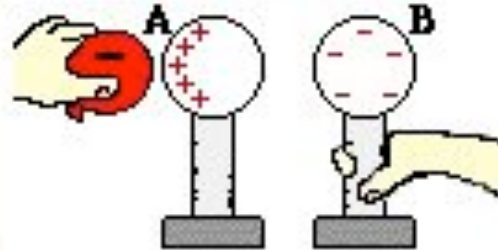
Two metal spheres are mounted on insulating stands.

Diagram ii.



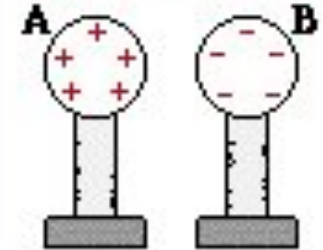
The presence of a - charge induces  $e^-$  to move from spheres A to B. The two-sphere system is polarized.

Diagram iii.



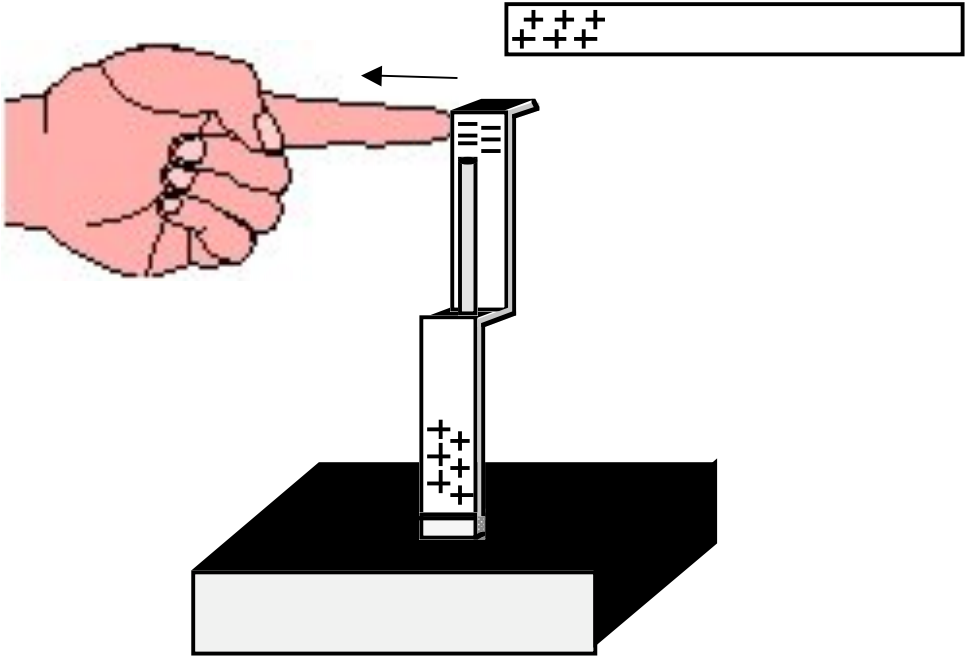
Sphere B is separated from sphere A using the insulating stand. The two spheres have opposite charges.

Diagram iv.



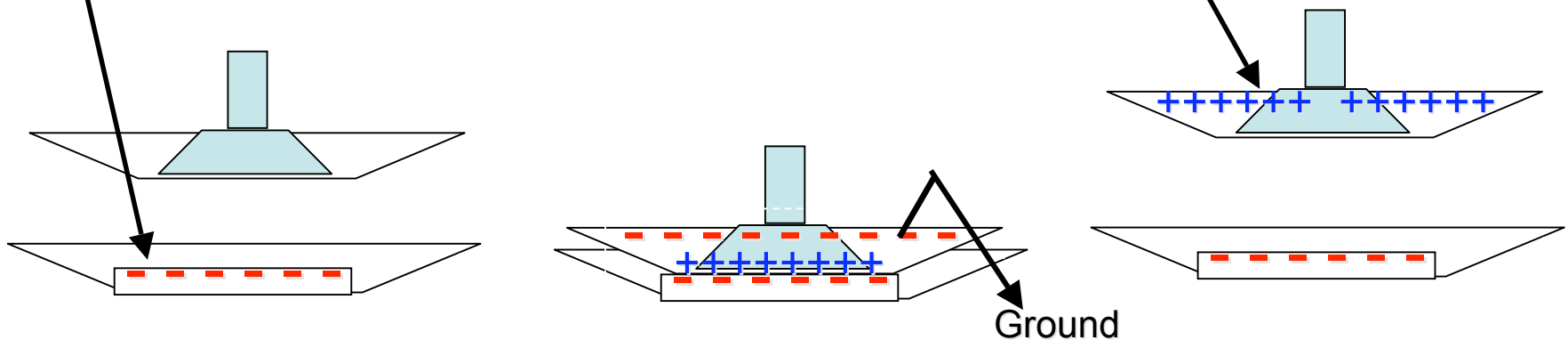
The excess charge distributes itself uniformly over the surface of the spheres.

Show Induction using electroscope (small effect)



## Demo 7 Electrophorous(Induction)

- Rub foam surface with silk.
- Place aluminum pan with insulating handle on to charged surface.
- Touch aluminum pan to ground it.
- Separate pans. What is the charge on the pan?
- Repeat indefinitely



Key: Negative charge(electrons), immobile on foam surface, repels electrons in conducting aluminum pie plate. When you ground the aluminum pan, those electrons are repelled to ground leaving the pie plate positively charged. Discharge pie plate and then repeat process as long as foam is charged



## Demo 8 One hanging pith ball showing attraction and repulsion with teflon rod

Demo: Show hanging charged/conducting pith ball: first attraction by induction then contact, then conduction of charge, then repulsion.

Demo: Two charged hanging pith balls at some angle  $\theta$ .  
Determine charge of pith ball.