

**The Difference between Insulators and Conductors**

Go to the Physics Exploration Center. Enter through the resource room 311/312 Thaw Hall. Go to the electrostatic setup which consists of pith balls, PVC rod, plexiglass rod, electroscope and 'electrophorus'.

(a) Touch the PVC rod (insulator) with your hands all around to remove excess charges left on the rod by the previous person doing the exploration. Why will excess charges be removed by touching the rod everywhere and not just in one place? If you had excess charge on a metal (conductor), would you necessarily need to touch it all around or is touching one end of the metal rod good enough to remove excess charges on it? Explain.

(b) Put the uncharged PVC rod on the pivot stand so that it is free to rotate. Rub another PVC rod at one end with fur (PVC gets negatively charged) and bring it close (but not touching) to an end of the uncharged PVC rod on pivot. Draw a diagram showing the charges induced on the pivoted PVC rod and explain why the motion you observe makes sense. Rub a plexiglass rod with silk and bring it close to an end of the uncharged PVC rod on pivot. Draw a diagram showing the charges induced on the pivoted PVC rod and explain why the motion you observe makes sense.

(c) Lift the uncharged PVC rod from the pivot and rub it with fur at ONE END. Put it back on the pivot. Now repeat part (b) by bringing charged PVC and plexiglass rods near the end of the PVC rod on pivot that you rubbed. Do you observe what you expected? Explain by drawing diagrams in both cases. Now repeat part (b) by bring charged PVC and plexiglass rods near the end of the PVC rod on the pivot that you did not rub. Do you observe what you expected? Explain by drawing diagrams in both cases.

(d) Would your observations be different if you had rubbed one end of a metal rod (instead of PVC) and put some excess charge on it and mounted it on the pivot and then brought a charged PVC rod to the two ends of the metal rod. Explain why this case is different from part (c) and that the observation will be the same regardless of which end of the metal rod you bring the charged PVC rod.

(e) You see pith balls suspended from fine threads. Rub the PVC rod with fur vigorously. What does rubbing do to the rod and fur? Now bring the PVC rod near a pith ball (but not touching). What do you notice? Draw a diagram showing charge separation on the PVC rod and pith ball to explain why the pith ball gets attracted to the rod. After the pith ball jumps to the rod and touches it, what does it do (attracts or repels)? Explain by redrawing the charges on the pith ball and PVC rod.