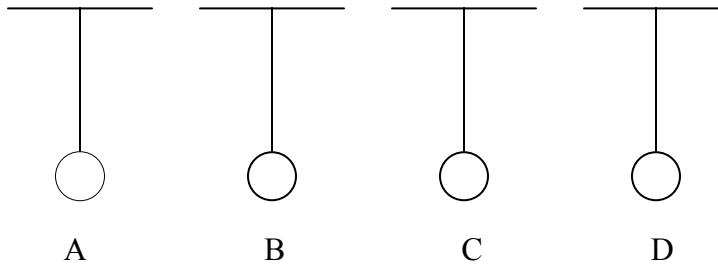


Homework 1
PHYS 1404
due January 29, 2004

Homework should be written out neatly on a separate sheet of paper. Explain your reasoning.

1) A hard rubber or plastic rod is rubbed with fur and is touched to an electroscope. The electroscope exhibits the presence of a net charge with the flexible leaf standing away from the fixed center post. If one brings one's hand or any large uncharged object near, but not touching, the top of the electroscope, the leaf is observed to drop somewhat. Explain. Use sketches of the charge distributions as part of your explanation.

2) Suppose we have four conductor-coated pith balls A, B, C, and D suspended on non-conducting threads. The charge states of all four balls are initially unknown. We now take a rubber rod, rub it with fur so that it has a negative charge, and bring it in contact with sphere A. Then we bring the balls near each other (without contact), *two by two*. The interactions are as follows: (1) B, C, and D are all attracted to A; (2) B and C have no discernible effect on each other; (3) B and C are both attracted to D.



a) What are the charge states of A, B, C, and D? Explain your reasoning.

b) In the story above and its conclusions, what were the observations and what were the inferences?

3) In the sequence illustrated in the following picture, diagram A shows an electroscope carrying a net positive charge and exhibiting a deflection of its needle accordingly. In each of the diagrams B, C, and D, a very strongly negatively charged rod is brought successively closer to the electroscope. (The charged rod does not touch the electroscope.) Sketch an arrangement of excess positive or negative charges in various regions to show what happens to the charges on the electroscope as the charged rod is brought closer and the deflection of the needle changes. Explain why you drew the arrangements the way you did.

