



1. A small metal ball is given a negative charge, then brought near (i.e., within about $1/10$ the length of the rod) to end A of the rod. What happens to end A of the rod when the ball approaches it closely this first time?

Since the rod is **grounded**, this means there are conducting wires connecting the rod to the ground (the earth). The earth acts like a big conductor that can hold a LOT of charge. When a conductor like this rod is grounded, any excess charge on it will travel through the conducting wires and into the ground, leaving the rod neutral.

When the negatively-charged ball is brought near to end A, electrons in the rod will be repelled toward end B but some of those electrons will leave the rod and go to ground, which will result in the rod becoming slightly positively charged. It will only be a small number of electrons that go to ground, the others will move towards end B. With a pretty strong net positive charge on end A, it will be **strongly attracted** to the negatively-charged ball.

2. Now consider what happens when the small metal ball is repeatedly given a negative charge and then brought *into contact* with end A of the rod. After a great many contacts with the charged ball, how is any charge on the rod arranged (when the charged ball is far away)?

Whenever negative charge is added to the rod, that excess negative charge will go to ground and leave the rod neutral. So there will be the same amount of positive and negative charge on the rod and it will distribute itself evenly. This means **both ends of the rod will be neutral**.

3. How does end A of the rod react when the (re)charged ball approaches it after a great many previous contacts with end A?

It will act just like it does in question 1 since there is no net charge on the rod (it's grounded, all excess electrons go to ground). The ball will induce a positive charge at end A, and end A will be **strongly attracted** to the ball.

4. How does end B of the rod react when the charged ball approaches it after a great many previous contacts with end A?

End B will also be **strongly attracted** to the ball when the ball is brought near to end B. The ball, again, will induce a positive charge at end B by pushing the electrons towards end A. Since the rod is a conductor, the charges can move far (like from end B to end A) very easily.