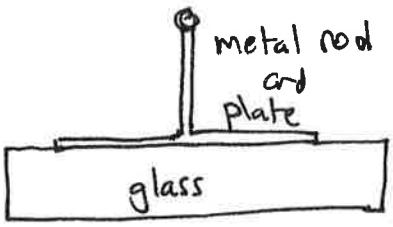
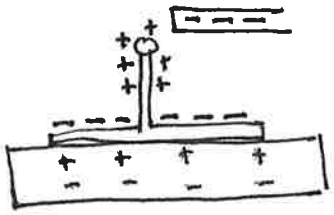
EX 4.1 (Muschenbroek's bottle)

To simplify our discussion let's use a flat glass plate instead of a (curved) bottle. A metal rod connected to a flat lead plate rests atop the glass plate. The top is now like the inside of the bottle and the bottom like the outside.



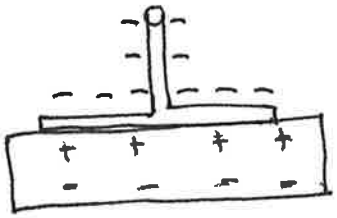
(a) Prior to rubbing the plastic rod, the glass plate is uncharged.

(b) After the plastic rod is rubbed and brought near the metal rod, we have this scenario:



The metal plate becomes ⊖ charged since the ⊕ charge is drawn up into the metal rod. The glass plate now becomes polarized, as ⊕ charges are attracted to the ⊖ charges in the metal plate.

(c) When the plastic rod is touched to the metal rod, we now have this:



Now the metal plate has a large number of ⊖ charges. The glass plate is polarized, with ⊕ charges on top and ⊖ charges on bottom.

But the bottom has fewer ⊖ charges than are on the top metal plate. So they are not in equilibrium: the metal rod is more ⊖ charged than the bottom.

(d) When a copper wire connects the top and bottom, they become equilibrated, as ⊖ charge flows from the metal rod to the bottom of the plate.