15.5 Conductors in Electrostatic Equilibrium

When no net motion of charge occurs within a conductor, the conductor is said to be in **electrostatic equilibrium.**

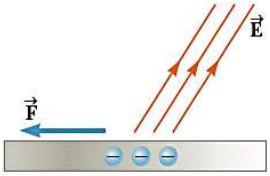
Properties of isolated conductors include:

1. The electric field is zero everywhere inside the conducting material.
2. Any excess charge on an isolated conductor resides entirely on its surface.
3. The electric field just outside a charged conductor is perpendicular to the conductor's surface.
4. On an irregularly shaped conductor, the charge accumulates at sharp points, where the radius of curvature of the surface is smallest.

Property 1 can be understood by examining what would happen if it were not true. If there were an electric field inside a conductor, the free charge there would move and a flow of charge, or current, would be created. If there were a net movement of charge, however, the conductor would no longer be in electrostatic equilibrium.

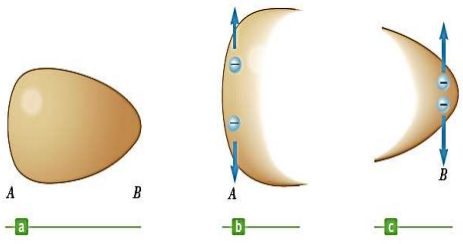
Property 2 is a direct result of the $1/r^2$ repulsion between like charges described by Coulomb's law.

Property 3 can be understood by again considering,



If the charges moved, however, a current would be created and the conductor would no longer be in electrostatic equilibrium. Therefore, $\vec{E}$ must be perpendicular to the surface.

Property 4 must be true, consider the following situation-



(a) A conductor with a flatter end *A* and a relatively sharp end *B*. Excess charge placed on this conductor resides entirely at its surface and is distributed so that (b) there is less charge per unit area on the flatter end and (c) there is a large charge per unit area on the sharper end.

As a result, there is less tendency for the charges to move apart along the surface here and the amount of charge per unit area is greater than at the flat end.