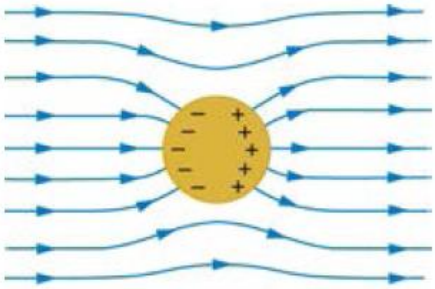
Name: _____

Notes – 18.7 Conductors and Electric Fields in Static Equilibrium

1. Conductors contain free charges (i.e. electrons) that move _____. When excess charge is placed on a conductor or the conductor is put into a static electric field, charges in the conductor quickly respond to reach a steady state called electrostatic _____.

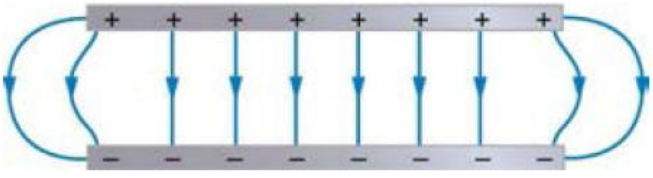
2. The free charges move until the field is _____ to the conductor's surface.

3. A conductor placed in an electric field will be _____. A very important point is that the charges will rearrange themselves such that no _____ exists inside the conductor. If there were a field inside the conductor, free charges in the conductor would continue moving in response to that field until it was neutralized.

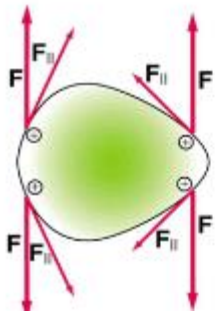


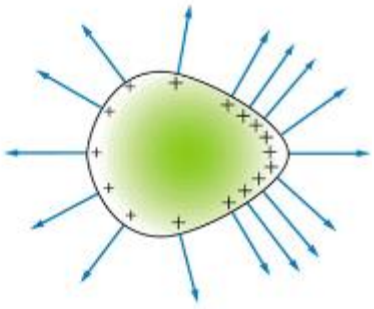
4. Properties of a Conductor in Electrostatic Equilibrium
    1. The electric field is inside a conductor is _____.
    2. Just outside a conductor, the electric field lines are _____ to its surface, ending or beginning on charges on the surface.
    3. Any excess charge resides entirely on the _____ of a conductor.

5. Two metal plates with equal, but opposite, excess charges. The field between them is _____ in strength and direction except near the edges.

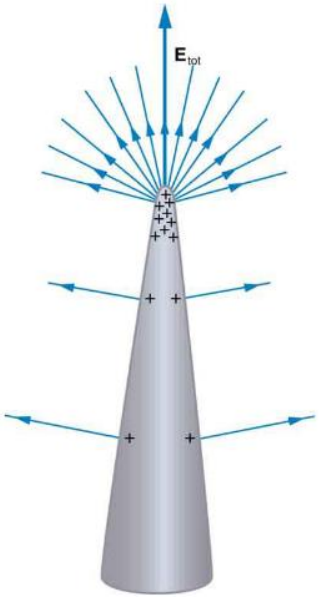


6. Applications of Conductors





A. On a very sharply curved surface, the charges are so concentrated at the point that the resulting electric field can be great enough to remove them from the surface. As the top left diagram shows, this is because, at sharp points, the repulsive forces (F) of neighboring charges are not as parallel to the surfaces on which the charges reside. Lightning rods work best when they are most pointed. The large charges created in storm clouds induce an opposite charge on a building that can result in a lightning bolt hitting the building. The induced charge is bled away continually from the concentrated charge at the top of a lightning rod, preventing the more dramatic lightning strike.



B. On the other hand, smooth surfaces are used on high-voltage transmission lines and Van de Graaff generators, for example, to avoid leakage of charge into the air.

C. Another device that makes use of some of these principles is a Faraday cage. This is a metal shield that encloses a volume. All electrical charges will reside on the outside surface of this shield, and there will be no electrical field inside. A Faraday cage is used to prohibit stray electrical fields in the environment from interfering with sensitive measurements.

D. During electrical storms if you are driving a car, it is best to stay inside the car as its metal body acts as a Faraday cage with zero electrical field inside. If in the vicinity of a lightning strike, its effect is felt on the outside of the car and the inside is unaffected, provided you remain totally inside. This is also true if an active ("hot") electrical wire was broken (in a storm or an accident) and fell on your car.