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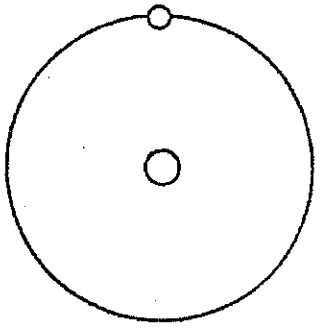
CONCEPTUAL Physics PRACTICE PAGE

Chapter 22 Electrostatics

Coulomb's Law

1. The diagram is of a hydrogen atom.



   a. Label the proton in the nucleus with a + sign and the orbital electron with a – sign.

   b. The electrical interaction between the nucleus and the orbital electron is a force of

   [attraction] [repulsion].

   c. According to Coulomb's Law, $F = k\frac{q_1 q_2}{d^2}$

   if the charge of either the nucleus or the orbital electron were greater, the force between the nucleus and the electron would be

   [greater] [less]

   and if the distance between the nucleus and electron were greater the force would be

   [greater] [less].

   If the distance between the nucleus and electron were doubled, the force would be

   [1/4 much] [1/2 much] [two times as much] [4 times as much].

2. Consider the electric force between a pair of charged particles a certain distance apart. By Coulomb's Law,

   a. if the charge on one of the particles is doubled, the force is

   [unchanged] [halved] [doubled] [quadrupled].

   b. if instead the charge on both particles is doubled, the force is

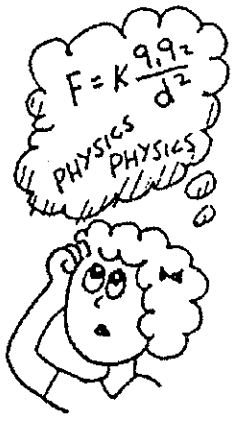
   [unchanged] [halved] [doubled] [quadrupled].

   c. if instead the distance between the particles is halved, the force is

   [unchanged] [halved] [doubled] [quadrupled].

   d. if the distance is halved *and* the charge of both particles is doubled, the force is increased by

   [twice] [four] [more than four].



Chapter 22 Electrostatics
Static Charge

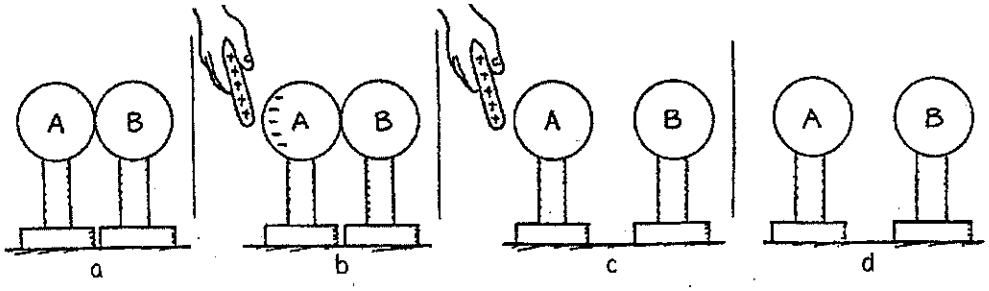
1. Consider the diagram below.

   (*a*) A pair of insulated metal spheres, A and B, touch each other, so in effect they form a single uncharged conductor.

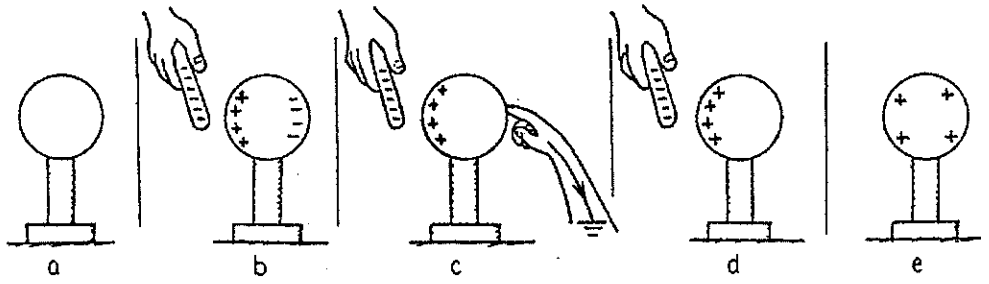
   (*b*) A positively charged rod is brought near A, but not touching, and electrons in the metal sphere are attracted toward the rod. Charges in the spheres have redistributed and the negative charge is labeled. Draw the appropriate + signs that are repelled to the far side of B.

   (*c*) Draw the signs of charge when the spheres are separated while the rod is still present, and in

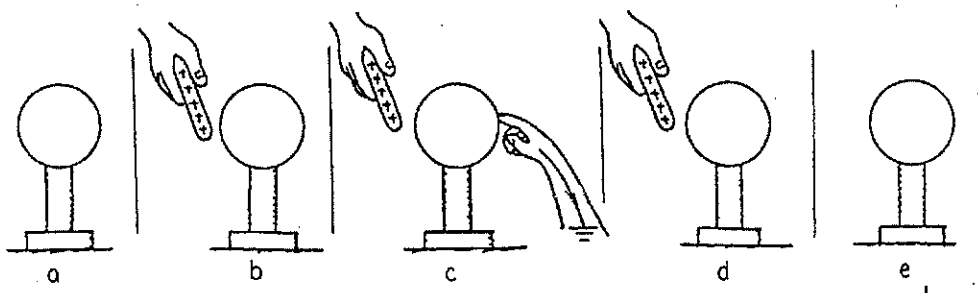
   (*d*) after the rod has been removed. Your completed work should be similar to Figure 22.7 in the textbook. The spheres have been charged by *induction*.



2. Consider below a single metal insulated sphere (*a*), initially uncharged. When a negatively charged rod is nearby (*b*), charges in the metal are separated. Electrons are repelled to the far side. When the sphere is touched with your finger (*c*), electrons flow out of the sphere to Earth through your hand. The sphere is "grounded." Note the positive charge left (*d*) while the rod is still present and your finger removed, and (*e*) when the rod is removed. This is an example of *charge induction by grounding*. In this procedure the negative rod "gives" a positive charge to the sphere.



3. The diagrams below show a similar procedure with a positive rod. Draw the correct charges in diagrams (*a*) through (*e*).



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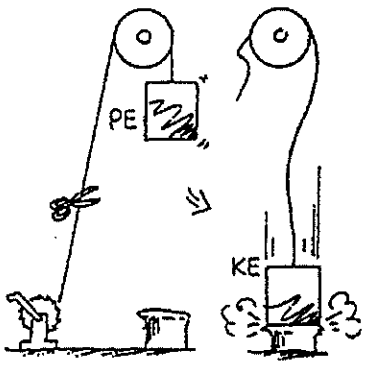
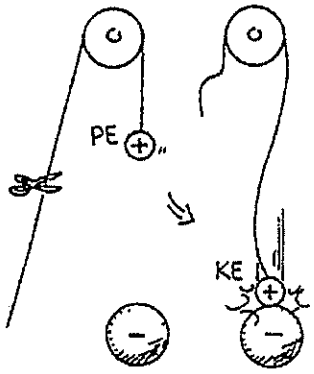
Chapter 22 Electrostatics
Electric Potential

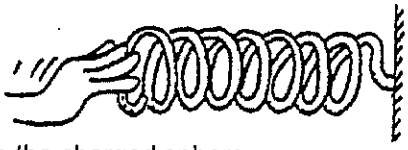


1. Just as PE (potential energy) transforms to KE (kinetic energy) for a mass lifted against the gravitational field (left), the electric PE of an electric charge transforms to other forms of energy when it changes location in an electric field (right). When released, how does the KE acquired by each compare to the decrease in PE?



_____

2. *Complete the statements.*
A force compresses the spring. The work done in compression is the product of the average force and the distance moved, $W = Fd$. This work increases the PE of the spring.



Similarly, a force pushes the charge (call it a test charge) closer to the charged sphere. The work done in moving the test charge is the product of the

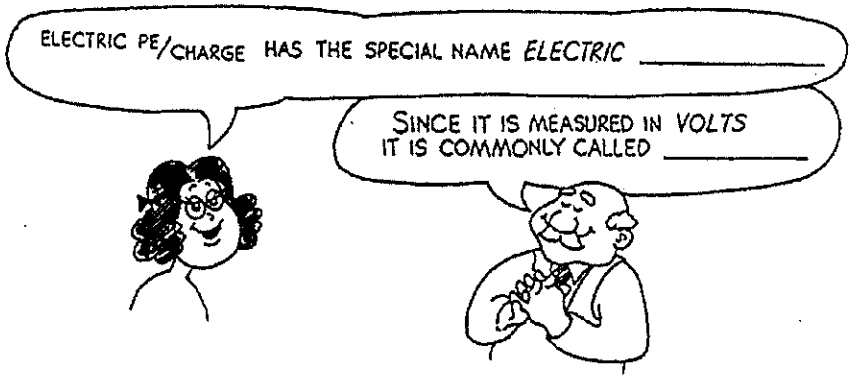
average _____ and the _____ moved.

W = _____. This work _____ the PE of the test charge.

At any point, a greater quantity of test charge means a greater amount of PE, but not a greater amount of PE *per quantity* of charge. The quantities PE (measured in joules) and PE/charge (measured in volts) are different concepts.

By definition: **Electric Potential** = $\frac{\textbf{PE}}{\textbf{charge}}$. 1 volt = 1 joule/coulomb

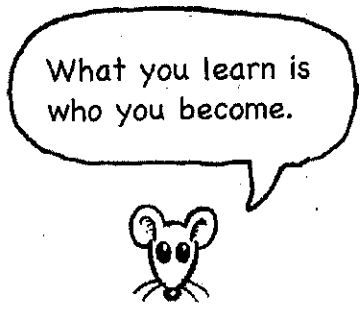
3. *Complete the statements.*



4. If a conductor connected to the terminal of a battery has a potential of 12 volts, then each coulomb of charge on the conductor has a PE of _____ J.

5. Some people are confused between force and pressure. Recall that pressure is force *per area*. Similarly, some people get mixed up between electric PE and voltage. According to this chapter, voltage is electric PE *per* _____.

Hewitt Drawit!


What you learn is
who you become.