WS 206 Show all work clearly on a separate sheet.

Additional Exercises

A-1: A raindrop acquires a negative charge of 3.0×10^{-18} C as it falls. What is the force of attraction when the raindrop is 6.0 cm from the bulb on the end of a car antenna that holds a charge of 2.0×10^{-6} C? 1.5×10^{-11} N

A-2: In a grain elevator on Farmer Judd's farm, pieces of grain become electrically charged while falling through the elevator. If one piece of grain is charged with 5.0×10^{-16} C while another holds 2.0×10^{-16} C of charge, what is the electrostatic force between them if they are separated by 0.050 m? 3.6×10^{-19} N

A-3: Rocco, an auto body painter, applies paint to automobiles by electrically charging the car's outer surface and oppositely charging the paint particles that he sprays onto the car. This causes the paint to adhere easily to the car's surface. If two paint particles of equal charge experience a force of 4.0×10^{-8} N between them at a separation of 0.020 cm, what is the charge on each? 4.2×10^{-13} C

A-4: After unpacking a shipment of laboratory glasswear, Mrs. Payne dumps the box of styrofoam packing chips into a recycling bin. The chips rub together and two chips 0.015 m apart repel each other with a force of 6.0×10^{-3} N. What is the charge on each of the chips? 1.2×10^{-8} C

A-5: Wiz, the cat, is batting at two Ping-pong balls hanging from insulating threads with their sides just barely touching. The balls each acquire a positive charge of 3.5×10^{-9} C from Wiz's fur and swing apart. a) If a force of 6.0×10^{-5} N acts on one of the balls, how far apart are they from each other? b) Is the force between them one of attraction or repulsion? .043 m repulsion

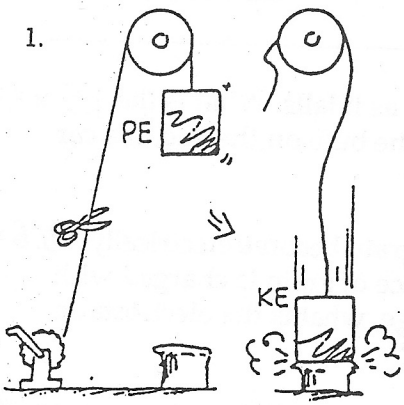
A-6: A particle of ink in an ink-jet printer carrying a charge of 8.0×10^{-13} C is deflected onto the paper by a force of 3.2×10^{-4} N. How strong is the field that causes this force? 4.0×10^{8} N/C

A-7: In the human body, nerve cells work by pumping sodium ions out of the cell in order to maintain a potential difference across the cell wall. If a sodium ion carries a charge of 1.60×10^{-19} C as it is pumped with an electrical force of 2.0×10^{-12} N, what is the electric field between the inside and outside of the nerve cell? 1.3×10^{7} N/C

A-8: Two van de Graaff generators, whose centers are separated from one another by 0.50 m, each become charged after they are switched on. One van de Graaff generator holds $+3.0 \times 10^{-2}$ C while the other holds -2.0×10^{-2} C. What is the magnitude and direction of the electric field halfway between them? 7.2×10^{9} N/C

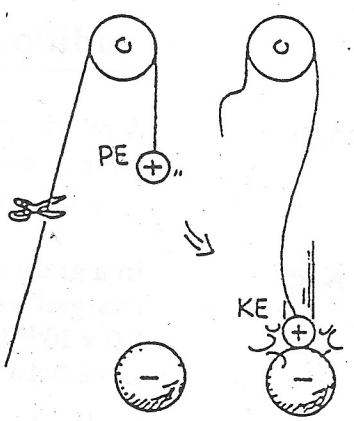
A-9: The Millikan oil drop experiment of 1909 allowed Robert A. Millikan to determine the charge of an electron. In the experiment, an oil drop is suspended between two charged plates by an electric force that equals the gravitational force acting on the 1.1×10^{-14}-kg drop. a) What is the charge on the drop if it remains stationary in an electric field of 1.72×10^{5} N/C? b) How many extra electrons are there on this particular oil drop? 6.4×10^{-19} C 4.0 e^-

Electric Potential

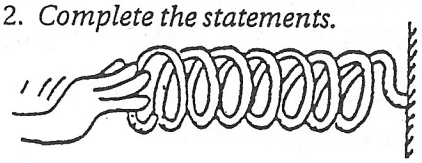
1. 

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.

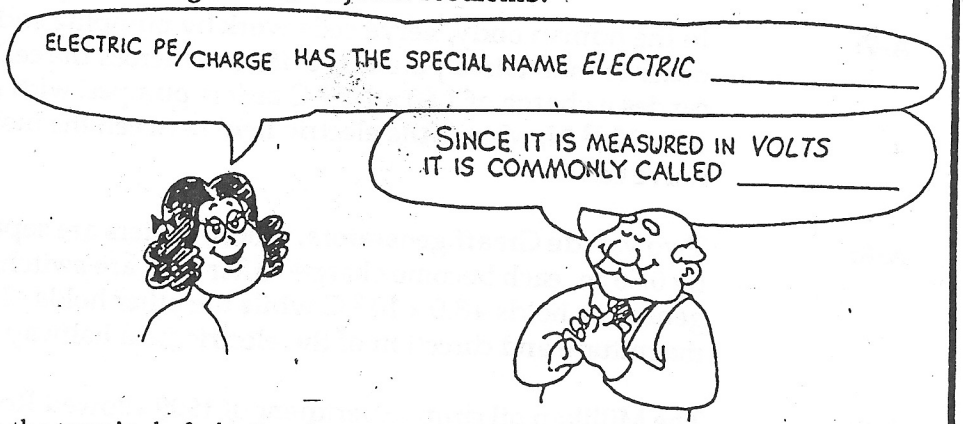
Similarly, a force pushes the charge (call it a test charge) closer to the charged sphere. The work done in moving the test charge is the product of the average _____ and the _____ moved. W = _____. This work _____ the PE of the test charge.

If the test charge is released, it will be repelled and fly past the starting point. Its gain in KE at this point is _____ to its decrease in PE.

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 = PE/charge.** 1 volt = 1 joule/1coulomb.

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 get mixed up 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 Drew it!