Chapter 18 Worksheet 2

1. What is an electric field?

2. How do we determine the direction of the electric field?

3. How do you determine the strength of an electric field?

4. What is electrical potential energy?

5. What is electric potential? What is another name for electric potential?

6. What is electric potential measured in?

7. What is a capacitor?

8. Give some common uses for capacitors?

9. How can you increase the voltage on a Van de Graaff generator?

Problems

1. In the Human body, nerve cells work by pumping sodium ions out of a 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

2. Willa the witch dusts her crystal ball with her silk scarf, causing the ball to become charged with 5.0×10^{-9} C. Willa then stares into the crystal ball and the wart on the end of her nose experiences an electric field strength of 2200 N/C. How far is the tip of her nose from the center of the crystal ball? .14 m

3. In eighteenth-century Europe, it was common practice to ring the church bells in an attempt to ward off lightning. However, during one 33 year period, nearly 400 church steeples were struck while the bells were being rung. If a bolt of lightning discharges 30.0 C of charge from a cloud to a steeple across a potential difference of 15000 V, how much energy is lost by the cloud and gained by the steeple? 4.5×10^{5} J

4. In problem #1, how thick is the wall of the nerve cell if there is a potential difference of 0.089 between the inside and outside of the cell? 6.8×10^{-9} m

5. Ulrich stands next to the Van de Graaff generator and gets a shock as he holds his knuckle 0.2 m from the machine. In order for a spark to jump, the electric field strength must be 3×10^{6} V/m. At this distance, what is the potential difference between Ulrich and the generator? 6×10^{5} V

6. A small cork with an excess charge of +6.0 μC (1μC = 10^{-6}) is placed 0.12 m from another cork, which carries a charge of -4.3 μC.
   a. What is the magnitude of the electric force between the corks? 16 N
   b. Is this force attractive or repulsive? attractive

7. Two electrostatic point charges of +60.0 μC and +50.0 μC exert a repulsive force on each other of 175 N. What is the distance between the two charges? .393 m

8. Proportional Reasoning: consider a pair of electrically charged coins suspended from insulating threads, a certain distance from each other. There is a specific amount of electrostatic force between them.
   A) If the charge on one coin were halved, what would happen to the force between them? 1/2
   B) If the charge on both coins were doubled, what would happen to the force between them? 4x
   C) If the distance between the coins were tripled, what would happen to the force between them? 1/9
   D) If the distance between them were reduced to one-fourth the original distance, what would happen to the force between them? 16 x
   E) If the charge on each object were doubled and the distance between them were doubled, what would happen to the force between them? Stays the same

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

10. In 18th century Europe, it was common practice to ring the church bells in an attempt to ward off ***lightning***. However, during one 33 year period, nearly 400 church steeples were struck while the bells were rung. If a bolt of lightning discharges 30.0 C of charge from a cloud to a steeple across a potential difference of 15000 V, how much energy is lost by the cloud and gained by the steeple? 450000 J or 4.5 x 10^{5} J

11. Amir shuffles his feet across the living room rug, building up a charge on his body. A spark will jump when there is a potential difference of 9000 V between the door and the palm of Amir's hand. This happens when his hand is 0.3 cm from the door. At this point, what is the electric field between Amir's hand and the door? 3 x 10^{6} V

12. Ulrich stands next to the Van de Graff generator and gets a shock as he holds his knuckles 0.2 m from the machine. In order for a spark to jump, the electric field strength must be 3 x 10^{6} N/C. At this distance, what is the potential difference between Ulrich and the generator? 6 x 10^{5} V