Electrostatic Problem Set #2 (Using the Force Boxes)

1. 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?

2. 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^{-9} C as it 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?

3. 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 between them?

4. 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?

5. In the eighteenth century Europe, it was common practice to ring the church bells in an attempt to ward of 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 30.0C of charge from a cloud to a steeple across a potential difference of 1000 V, How much energy is lost by the cloud and gained by the steeple?

6. In exercise 2, how thick is the wall of the nerve cell if there is a potential difference of 5.0×10^{-9} V between the inside and outside of the cell?

7. 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?

8. Problem # 67 on page 585 of the Physics Textbook.

9. Problem # 68 on page 585 of the Physics Textbook.

10. Problem # 69 on page 585 of the Physics Textbook.

11. Problem # 70 on page 585 of the Physics Textbook.