Electrostatics 3

1. Two oppositely charged, parallel plates have a potential difference of 15.0 Volts. If the separation distance between the plates is 3 cm, what is the value of the constant electric field between the plates?

2. In a scanning electron microscope, a beam of electrons is sent at a sample with detectors around the chamber to record the result of the interactions between the electrons and the sample. The resolution for an image is dependent on the acceleration voltage and the type of sample. Suppose that an electron is accelerated through a 10.0 kV potential difference.

a. How much potential energy is converted to kinetic energy for the electron?

b. How fast would the electron be traveling at the end if the motion if it started at rest?

c. How close is this to the speed of light?

3. What is the electric potential at a point 5 cm from a +4.0 μ C charge?

4. A +3.0 μ C charge is placed in the same region as a – 1.0 μ C charge.

a. Sketch the electric field lines in the region. (Keep track of the number of lines on each charge.)

b. Draw at least five equipotential surfaces. (Draw the equipotential surfaces as dotted line to differentiate these from the electric field lines.)

5. The four points on a line (below) are equally spaced with the distance between consecutive points set at 10.0 cm. +6.0 μ C charges are placed at points A and B. A -5.0 μ C charge is placed at point C.

A B C D

a. What is the electric potential at point D due to each charge?

b. What is the total electric potential at point D?

c. How would your answers to (a) and (b) change if the charge at point C is moved to a point 10 cm to the right of point D?

d. How would your answers to (a) and (b) change if the charge at point A is moved off of the line, but kept the same distance from point D?

6. Point A is 15 cm from a +2 μ C point charge, while point B is 5 cm away.

a. What is the electric potential difference between points A and B?

b. How much work would you have to do in order to move a +4 μ C charge from point A to point B?

c. How much work would the field do on the charge as it moves from point A to point B?



Above is an equipotential map for some arrangement of charges.

a. Label the potential for each line that is not already labeled.

b. What is the electric potential energy for a +3 μ C charge that is placed at point L?

c. Indicate on the map the direction a positive charge would be pushed if placed at point M.

d. What is the potential difference between:

- i. points N and P?
- ii. points L and O?

e. How much work would be done in moving a +3 μ C charge from P to N?

f. How much work would be done in moving a +3 μ C charge from M to N?

g. Which direction would an electron travel, from P to L or from L to P? Explain.