Physics 260 Homework Solution 11

Chapter 25

1 PSE6 25.P.001

$$W = q\Delta V = -N_A e(V_f - V_i)$$

2 PSE6 25.P.004

$$\Delta K = \Delta U$$
$$-\frac{1}{2}mv^2 = q_e \Delta V$$

Solve for ΔV.

3 PSE6 25.P.005

a. Change in potential energy is minus the work done.

$$\Delta U = -\text{work done} = -F_x \Delta x - Fy\Delta y = -qE\Delta x$$

b.

$$\Delta V = \frac{\Delta U}{q}$$

4 PSE6 25.P.006

$$E = \frac{V}{d}$$

5 PSE6 25.P.009

Label the intermediate point C with coordinates (C_x, C_y). The potential difference between point A and B is

$$V_\mathrm{B} - V_\mathrm{A} = -\int_{A_y}^{C_y} E\mathrm{d}y - \int_{C_x}^{B_x} E\mathrm{d}x = -E\cos 180^\circ (C_y - A_y) - E\cos 90^\circ (B_x - C_x) = E(C_y - A_y)$$

6 PSE6 25.P.016

a. The forces due to two identical charges are same in magnitude and opposite in directions. Therefore, the net force is zero.

b. It is also zero. Electric fields due to two charges cancel each other.

c.

$$V = \frac{k_e q_1}{r_1} + \frac{k_e q_2}{r_2} = \frac{2k_e q}{r}$$

7 PSE6 25.P.017

a.

$$r = \frac{|V|}{|E|}$$

b.

$$r = \frac{k_e q}{V}$$

8 PSE6 25.P.021

$$U = k_e q^2 \left(\frac{1}{L} + \frac{1}{\sqrt{L^2 + W^2}} + \frac{1}{W} \right)$$

9 PSE6 25.P.031

$$V = \frac{k_e q}{r} \qquad \Longleftrightarrow \qquad r = \frac{k_e q}{V}$$

The spacing of the equipotential line is inversely proportional to the change in potential.

10 PSE6 25.P.037

a. Plug different x values into the expression for electric potential.

b. $E = -\frac{dV}{dx} = -b$.

11 PSE6 25.P.045

The distance r from the rod to point O is the same throughout the rod, $r = L/\pi$ where L is the length of the rod. So the electric potential at point O is

$$V = \int \mathrm{d}V = \frac{k_e}{r} \int \mathrm{d}q = \frac{k_e Q}{r}$$

12 PSE6 25.P.049

Since it is a spherical conductor with positive charge, electric field is zero inside and nozero outside. When it is nonzero, the direction of the field is pointed outward and its magnitude is given by the equation $E = k_e q/r^2$. Electric potential inside the conductor is the same as potential on the surface of the conductor. Therefore, answers to part (a) and (b) are the same, $V = k_e q/R$, where R is the radius of the spherical conductor. Part (b) uses the same equation to find electric potential but with a different r value.

13 PSE6 25.P.051

a.

$$E_{max} = 3.00 \times 10^6 V/m = \frac{k_e Q}{r^2} = V_{max}\frac{1}{r}$$

$$V_{max} = E_{max} r$$

b.

$$\frac{k_e Q_{max}}{r} = V_{max}$$

$$Q_{max} = \frac{V_{max} r}{k_e}$$

14 PSE6 25.QQ.001

15 PSE6 25.QQ.002

16 PSE6 25.QQ.008

17 PSE6 25.QQ.009

The answers to problem 14-17 can be found in the textbook. All the answers to the quik quiz problems are at the end of each chapter.

18 PSE6 25.QQx.005

Less while holding the needle because sharp object(conductor) has very high electric field (Page 781 in textbook).