Physics 210 - Solutions to Multiple Choice Week 4

1. $\Delta K.E. = -\Delta P.E = -q(V_B - V_A)$

$K.E_B - K.E_A = -q(V_B - V_A)$

$4.8 - 0 = -(-8mC)(V_B - V_A) \Rightarrow V_B - V_A = +.6kV$

2. $V_A - V_B = -\int_{r_B}^{r_A} \vec{E} \cdot d\vec{s} = -\vec{E} \cdot (\vec{r}_A - \vec{r}_B)$

$= -(4\hat{i} + 3\hat{j}) \cdot [(2-5)\hat{i} + (3-7)\hat{j}] = 24\,V$

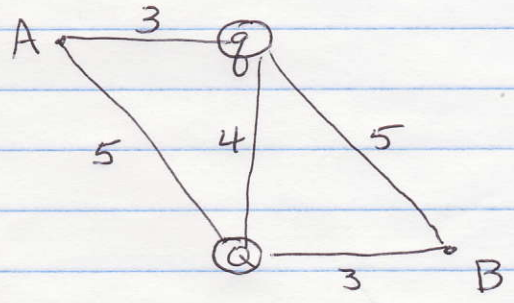
3. $KE_B - K.E_A = -q(V_B - V_A)$

$\frac{1}{2}m(v_B^2 - v_A^2) = -q\Delta V$

$-\frac{1}{2}\frac{m}{q}(v_B^2 - v_A^2) = \Delta V$

$-\frac{1}{2}\left(\frac{1.67\times10^{-27}}{1.6\times10^{-19}}\right)\left[(80\times10^3)^2 - (50\times10^3)^2\right] = -20V$

4.

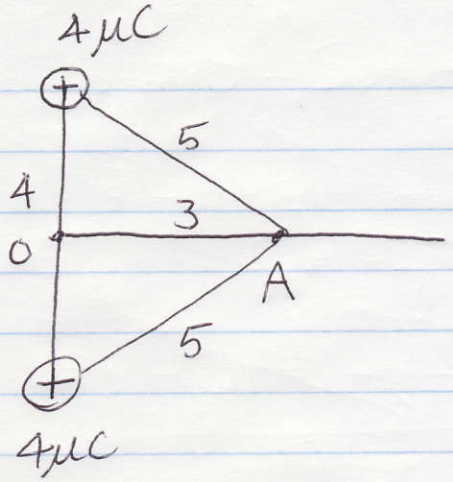


$V_A - V_B = \left[\frac{kq}{3} + \frac{kQ}{5}\right] - \left[\frac{kQ}{3} + \frac{kq}{5}\right]$

$= k\left[\frac{2nC}{3} - \frac{2nC}{5}\right] - k\left[-\frac{2nC}{3} + \frac{2nC}{5}\right]$

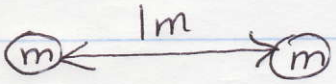
$= 4.8V$

5

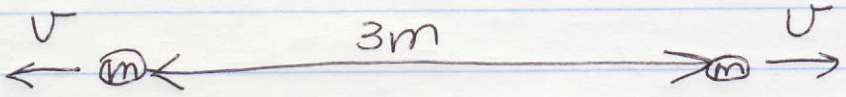


$$V_A - V_0 = \left(\frac{kQ}{5} + \frac{kQ}{5}\right) - \left(\frac{kQ}{4} + \frac{kQ}{4}\right)$$
$$= 2kQ\left(\frac{1}{5} - \frac{1}{4}\right)$$
$$= -3.6\,kV$$

6.



$$(E_{tot})_i = (E_{tot})_f$$

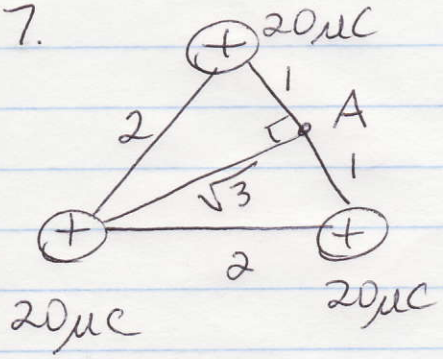


$$K.E_i + P.E_i = K.E_f + P.E_f$$

$$0 + \frac{kQ(5Q)}{1} = \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{kQ(5Q)}{3}$$

$$\frac{1}{2}mv^2 = \frac{k5Q^2}{2}\left(1 - \frac{1}{3}\right) = 2.2\,J$$

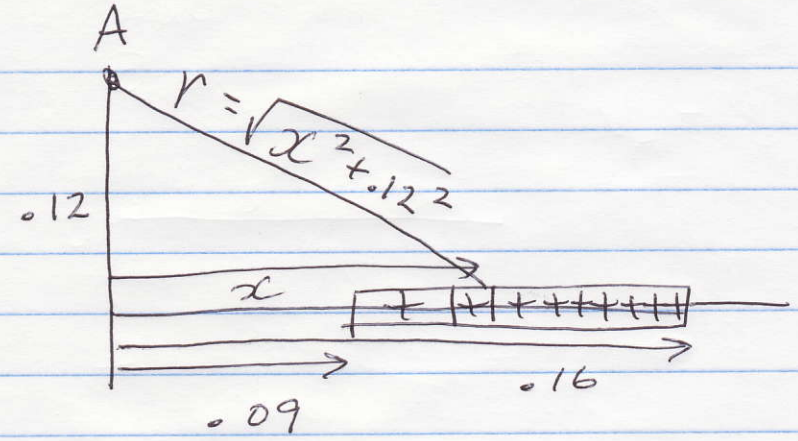
7.



$$V_A = k\frac{20\mu C}{1} + k\frac{20\mu C}{1} + k\frac{(20\mu C)}{\sqrt{3}}$$
$$= 464\,V$$

work to bring charge from infinity $= q\Delta V$
$= 45\mu C\,(464\,V - 0)$
$= 21\,J$

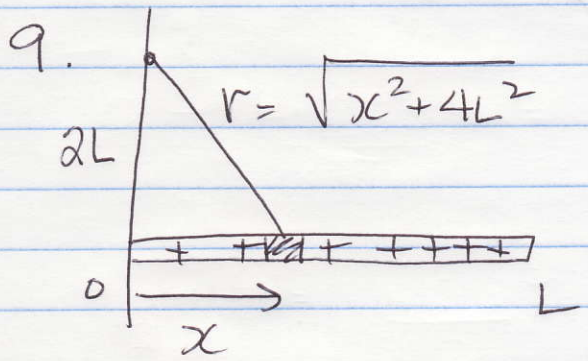
8



$$V_A = \int \frac{k\,dq}{r} = k\int \frac{\lambda\,dx}{\sqrt{x^2+.12^2}} = kb\int \frac{x\,dx}{\sqrt{x^2+.12^2}}$$

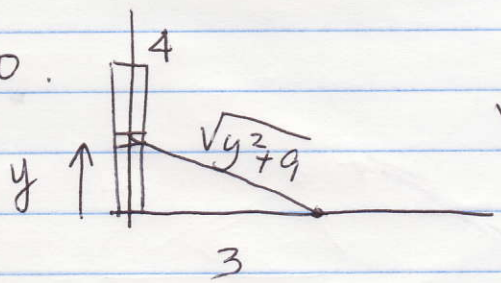
$$= \frac{kb}{2}\int_{.09}^{.16} \frac{2x\,dx}{\sqrt{x^2+.12^2}} = kb\left(\sqrt{x^2+.12^2}\,\Big|_{.09}^{.12}\right) = 5.4\text{V}$$

9.



$$V = kb\int_0^L \frac{x\,dx}{\sqrt{x^2+4L^2}} = 17\text{V}$$

10.



$$V = \int \frac{k\,dq}{r} = \int_0^4 \frac{k\lambda\,dy}{\sqrt{y^2+9}} \qquad \lambda = 5\text{nC/m}$$

$$= \int_0^4 \frac{45\,dy}{\sqrt{y^2+9}}$$

11. $$V_B - V_A = -\int_{x_A}^{x_B} 3x\,dx = -\frac{3x^2}{2}\Big|_3^5 = -24\text{V}$$