Phys102 (Sec # 40) Quiz # 7 (Ch.23&24)

Name: Key ID #

1- Consider a metallic spherical shell of inner radius 5 cm and outer radius 8 cm. A point charge q1= -5 micro-C rests at the center of the shell. The metallic shell carries a net charge q2= +10 micro-C. Determine the electric field at:

a) 4 cm from the center of the shell.

$$E = k\frac{q_{enc}}{r^2} = 9\times10^9\ \frac{5\times10^{-6}}{(0.04)^2} = 2.8\times10^7\ \frac{N}{C}\ \text{(radially inward)}$$

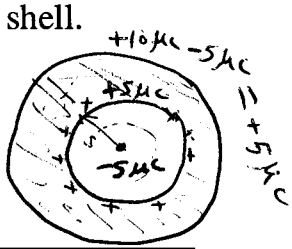
b) 7 cm from the center of the shell.

$$E = 0$$

c) Find the net charge on the inner and outer surfaces of the shell.

$$q_{inner} = +5\,\mu C$$

$$q_{outer} = +10\,\mu C - 5\,\mu C = +5\,\mu C$$



2- The following figure shows two charges, $q_1 = +5e$ and $q_2 = -2e$,

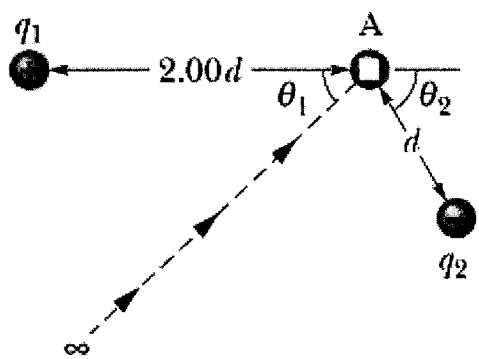
Where:

e = charge of electron = 1.6×10^{-19} C

d = 2 cm

$\theta_1 = 30°$

$\theta_2 = 60°$



a) What is the electric potential at point A?

$$V_A = k\left(\frac{q_1}{2d} + \frac{q_2}{d}\right)$$

$$= 9\times10^9\left(\frac{5\times1.6\times10^{-19}}{2(0.02)} - \frac{2\times1.6\times10^{-19}}{0.02}\right)$$

$$= \boxed{3.6\times10^{-8}}\ V$$

b) Calculate the work we must do in order to bring Q = +10e, initially at rest from infinity to point A along the dashed line?

$$W_{app.} = Q\Delta V = Q(V_f - V_\infty) = QV_A = 10\times1.6\times10^{-19}\,(3.6\times10^{-8})$$

$$= \boxed{5.76\times10^{-26}}\ J$$

or equivalentally:

$$W_{app.} = \Delta U = U_f - U_i = k\left(\frac{q_1 Q}{2d} + \frac{q_1 q_2}{r_{12}} + \frac{q_2 Q}{d}\right) - k\left(\frac{q_1 q_2}{r_{12}}\right)$$

$$= kQ\left(\frac{q_1}{2d} + \frac{q_2}{d}\right)$$

$$= Q\Delta V = 5.76\times10^{-26}\ J$$