PHYSICS HOMEWORK WEEK 3 ELECTRIC FLUX/POTENTIAL DIFFERENCES

PAGES 698 #20,31, PAGES 674-675 #3,5,7

(2) $\Phi_E = EA\cos\theta = (20\times10^5 \frac{N}{C})(60m\times30m)(\cos10^\circ)$

$= 3.54\times10^5 \frac{Nm^2}{C}$

(3a) $\Phi_E = EA\cos\theta \rightarrow$ max when $\theta = 0^\circ$

$E = \frac{\Phi_E}{A} = \frac{5.20\times10^5 \frac{Nm^2}{C}}{\left[\pi\cdot(0.2m)^2\right]}$ $\quad E = 4.14\times10^6 \frac{N}{C}$

(3) $\Delta U = -q\int \underbrace{\vec{E}\cdot\vec{ds}}_{\text{in the same direction}} = -qEd = -(12\times10^{-6}C)(250\frac{N}{C}\text{ or }\frac{V}{m})(0.20m)$

$= -6\times10^{-4}J$

b) $\Delta V = -Ed = -(250\frac{V}{m})(0.2m) = -50V$

(5) $W = Fd = mad \qquad V_f^2 = V_0^2 + 2ad$

$W = m\left(\frac{V_f^2 - V_0^2}{2}\right) \leftarrow \frac{V_f^2 - V_0^2}{2} = ad$

work is the difference between final and initial energy

$\Delta V = \frac{\Delta U}{q} = \frac{m(V_f^2 - V_0^2)}{2q} = \frac{(9.11\times10^{-31}kg)\left[(1.4\times10^5 m/s)^2 - (3.70\times10^6)^2\right]}{2(1.60\times10^{-19}C)}$

$\Delta V = 38.9V$, the origin has higher potential

$q_{proton} = +1.60\times10^{-14}\,C$

⑦ a) $V = \frac{kq}{r} = 8.99\times10^{9}\,\frac{Nm^2}{C^2}\,\frac{(1.60\times10^{-14}\,C)}{0.01m} = +1.44\times10^{-7}\,V$

b) $\Delta V = V_2 - V_1 = kq\left(\frac{1}{r_2} - \frac{1}{r_1}\right)$

$= 8.99\times10^{9}\,\frac{Nm^2}{C^2}\,(1.60\times10^{-14}\,C)\left(\frac{1}{0.02m} - \frac{1}{0.01m}\right)$

$= -7.19\times10^{-8}\,V$

c) $q_{electron} = -1.60\times10^{-14}\,C$

$V = \frac{kq}{r} = -1.44\times10^{-7}\,V$

d) $\Delta V = V_2 - V_1 = kq\left(\frac{1}{r_2} - \frac{1}{r_1}\right) = +7.19\times10^{-8}\,V$