Mid term COCO

20/20 perfect

Section 2

1

a. $2\times10^{-3} = \frac{x}{(1\times10^{-3})^2}$ $\quad x = Vq$ $\quad x = 2\times10^{-9}$

$E_c = \frac{2\times10^{-9}}{(.006)^2}$ ✓

$\boxed{E_c = 8\times10^{-5}\ V/m}$

b. $8\times10^{-3} = \frac{(9\times10^{9})(1\times10^{-6})}{d^2}$

$d = \sqrt{\frac{(1\times10^{-6})(9\times10^{9})}{8\times10^{-3}}}$

$d = 1060$

$E_c = \frac{(3\times10^{-6})(9\times10^{9})}{(1060.66)^2}$ ✓

$\boxed{E_c = 2.4\times10^{-2}\ V/m}$

(2) a. $F = ma$ $\quad m = 4\times10^{-16}\ kg$ $\quad a = 10\ m/s^2$

$F = 4\times10^{-15}\ N$

$F = qE$

$\frac{4\times10^{-15}\ N}{6131.25} = \frac{q(6131.25\ N/C)}{6131.25\ N/C}$ ✓

$q_{tot} = 6.5\times10^{-19} \rightarrow \frac{6.5\times10^{-19}}{1.6\times10^{-19}} = \boxed{4e}$

b)

$q = 6.5\times10^{-19} - 1.6\times10^{-19}$

$q = 4.9\times10^{-19}$

$F = qE$

$F = (4.9\times10^{-19})(6131.25)$

$F_E = 3\times10^{-15}$

$F_{(g)} = 4\times10^{-15}$

4 $\quad a = \frac{f_g - f_e}{m}$ $\quad F_{net} = ma$ $\quad \frac{F_g - F_e}{m} = a$ ✓

$a = \frac{4\times10^{-15} - 3\times10^{-15}}{4\times10^{-16}}$ $\quad \boxed{a = 2.5\ m/s^2}$

Section 3

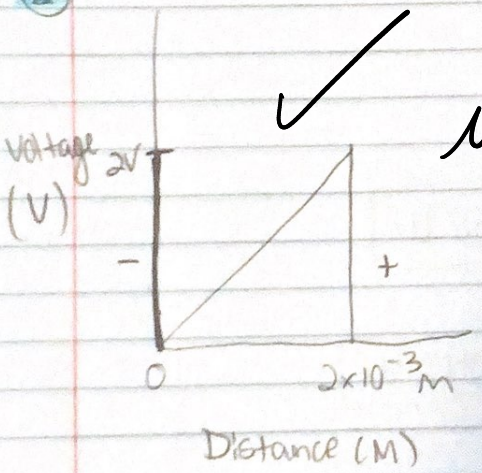
① a) $\Delta E = qV$ yes, if you added the H^+ to the He^{++} you get $4+8 = 12$ keV

$1.6\times10^{-19}\left((4\times10^{+3})+(4\times10^{3}\cdot 2)\right) = \boxed{12000\,eV}$

b) $E = \frac{+\Delta V}{\Delta x}$ $\quad E = \frac{4000V}{.05} = \boxed{8\times10^{4}\,\frac{V}{m}}$ ✓

② ✓ very good

$V - Int = 0$



③ a) $C = \frac{\varepsilon_0 A}{d}$ $\quad 1\,cm^2 \rightarrow 1\times10^{-4}\,m$

$C = \frac{(8.85\times10^{-12})(1\times10^{-4})}{(2\times10^{-3})}$ ✓

$\boxed{C = 4.43\times10^{-13}\,F}$ ✓

b) $U = \frac{1}{2}CV^2$

$U = (4.43\times10^{-13})(2^2)(\frac{1}{2})$

$= \boxed{5.5\times10^{-12}\,J}$ ✓

④ Parallel ✓

Section 4

① a)

Series: $I = \frac{(emf_1 + emf_2)}{(r_1 + r_2 + R_{load})}$

$I = \frac{(1.5+1.5)}{2+2+50} = \boxed{.056\ A}$ ✓

Parallel: $r_{tot}^{-1} = \frac{1}{2} + \frac{1}{2} = 1$

$\frac{1.5}{1+50} = \boxed{.03A}$ ✓

b) $P = IV$

Series: $P = (.056)(3) = \boxed{.168\ W}$ ✓

Parallel: $P = (.03)(1.5) = \boxed{.045\ W}$ ✓

c) ✓ (checks out)

② a) $\boxed{2\ ms}$ ✓

b) $35 - (-75) = \boxed{105V}$ ✓