Solutions

2.1) a) $E \rightarrow E/25 = 2\times10^{-3}/25 = \frac{2}{25}\times10^{-3}$

$E = \frac{200}{25}\times10^{-5}\ V/m = 8\times10^{-5}\ V/m$

b) $E \rightarrow 3E \quad 8\times10^{-3}\ V/m \rightarrow 24\times10^{-3}\ V/m$

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

2.2 a) $ma = qE$, $a = g$

$q = \frac{mg}{E} = \frac{4\times10^{-16}(9.81)}{(1.6\times10^{-19})(131.25)} = 4$

$4e^-$

b) $ma = qE - mg \quad a = \frac{(3)(1.6\times10^{-19})}{4\times10^{-16}}(131.25) - 9.81$

$a = \frac{qE}{m} - g$

$a = \frac{(3)(1.6)}{4}(6.13) - 9.81 = -2.4\ m/s^2$

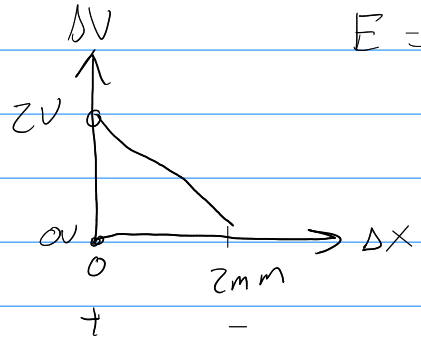
3.1

a) 4 kV and either $2q$ or $1q$?

H^+ 4 keV
He^{++} 8 keV
} 12 keV

b) $|E| = \frac{\Delta V}{\Delta x} = \frac{4\ kV}{5\ cm} = 0.8\ \frac{kV}{cm}$

3.2



$E = \frac{\Delta V}{\Delta x}$ y-intercept: 2 volts

$\Delta V = E\Delta x$

$= \frac{1kV}{m}\ 2\times10^{-3}\ m$

$= 2$ volts

3.3

a) $C = \frac{\varepsilon_0 A}{\Delta x} = 8.85 \times 10^{-12} \frac{F}{m} \frac{1\,cm^2}{2\,mm}$

$C = \frac{8.85 \times 10^{-12}}{2} \frac{F}{m} \frac{(10^{-2}\,m)^2}{10^{-3}\,m} = 4,425 \times 10^{-12-4+3}$

$C = 4,425 \times 10^{-13} = 0,4\,pF$

b) $U = \frac{1}{2} C V^2 = \frac{1}{2} \frac{4}{10} 25\,pJ$

$= 5\,pJ$

3.4 In parallel

4.1 a)1 $\varepsilon_1 - I r_1 + \varepsilon_2 - I r_2 - IR = 0$

$\varepsilon_1 + \varepsilon_2 = I(r_1 + r_2 + R)$

$I = \frac{\varepsilon_1 + \varepsilon_2}{2r + R} = \frac{3V}{54\Omega} = 55\,mA$

a)2 outside loop: $\varepsilon_1 - I_1 r_1 - IR = 0$

inside loop: $\varepsilon_2 - I_2 r_2 - IR = 0$

$\varepsilon_1 = I_1 r_1 + IR$

$\varepsilon_2 = I_2 r_2 + IR$

adel $\varepsilon_1 + \varepsilon_2 = (I)r + 2IR$

$I = \frac{\varepsilon_1 + \varepsilon_2}{r + 2R} = \frac{3V}{102\Omega} = 30\,mA$

b) $P = (55\,mA)(3V) = 165\,mW$

$P = (30\,mV)(1,5V) = 45\,mW$

4.2