Midterm 5/9/21 Taulyn L. Patrizio

1. ⓐ $E_c = 2 \times 10^{-3}$ V/m @ 1mm $E_c = ?$ @ 5mm

$2 \times 10^{-3} = \frac{1}{4\pi}\left(q/(1 \times 10^{-3})^2\right)$ $E = \frac{1}{4\pi}\left(q/(5 \times 10^{-3})^2\right)$

$2 \times 10^{-3}(1 \times 10^{-6}) = q/4\pi$ $E = q/4\pi\left(\frac{1}{25 \times 10^{-6}}\right)$

$E = 2 \times 10^{-3}(1 \times 10^{-6}) \times \left(\frac{1}{25 \times 10^{-6}}\right)$

$E = 0.00008$

$E = 8 \times 10^{-5}$ V/M

ⓑ $E_c = 8 \times 10^{-3}$ V/m @ 1μc $E_c = ?$ @ 3mc

$\frac{8 \times 10^{-3}}{1mc} = \frac{x}{3mc}$

$x = 3(8 \times 10^{-3})$

$x = 24 \times 10^{-3}$

$E_c = 24 \times 10^{-3}$ V/m

2. ⓐ $q = \frac{(4 \times 10^{-16})(9.8)}{6131.25}$ $n = \frac{q}{1.6 \times 10^{-19}}$

$q = 639348 \times 10^{-19}$ $n = 3.9959$

$n \approx 4$

ⓑ $q = q - e$ $F_e = q'E = 2.939 \times 10^{-15}$

$q = 4.79348 \times 10^{-19}$ $F_g = m'g = 3.92 \times 10^{-15}$

$a = \frac{F_g - F_e}{m}$ $m = 4 \times 10^{-16}$ Kg

$a = \frac{3.92 \times 10^{-15} - 2.939 \times 10^{-15}}{4 \times 10^{-16}}$

$a = 2.453$ m/s²

1. (a) $\Delta V = 4kV$

$H = +1q_e$ $\quad KE = qV$ $\quad KE = (+1)(1.6\times10^{-19})(4\times10^{3}) = 6.4\times10^{-16}\ J$

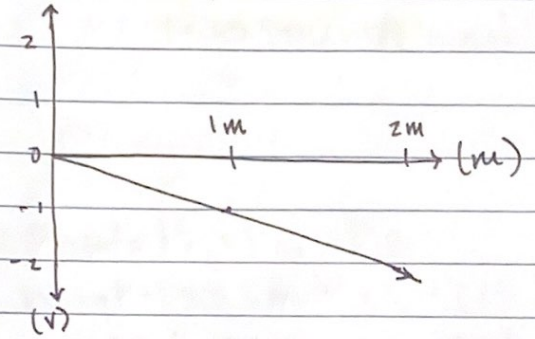
$He = +2q_e$ $\quad KE = (+2)(1.6\times10^{-19})(4\times10^{3}) = 12.8\times10^{-16}\ J$

(b) $\Delta X = 5cm$

$$E = \frac{\Delta V}{\Delta X} = \frac{4\times10^{3}}{5\times10^{-2}}$$

$E = 8\times10^{4}\ V/m$

2.



$E = 1kV/m$

$$E = \frac{-\Delta V}{\Delta X}$$

y intercept = 0, 0

3. (a) $a = 1cm^2$

$$C = \frac{\Sigma \cdot A}{d}$$

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

$C = 4.425\times10^{-13}$

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

$E = \frac{1}{2}(4.425\times10^{-13})(5^2)$

$E = 5.531\times10^{-12}\ J$

4 parallel — capacitance added up meaning more energy

1. (a) $-E_2 + Ir_2 + Ir_1 - E_1 + IR = 0$

$-1.5 + I(r_2 + r_1 + R) = 0$

$-3 + I(r_2 + r_1 + R) = 0$

$I = \frac{3V}{r_2 + r_1 + R}$

$I = \frac{3V}{2 + 2 + 50}$

$I = 55.556\,mA$ serial

$\frac{Vr - 1.5}{2} + \frac{Vr - 1.5}{2} + \frac{Vr}{50} = 0$

$\frac{25Vr - 37.5 + 25Vr - 37.5 + Vr = 0}{50}$

$51Vr = 75$

$I_1 = \frac{1.5 - 1.47}{2} = 15\,mA$

$I_2 = \frac{1.5 - 1.47}{2} = 15\,mA$

$I = I_1 + I_2$

$I = 30\,mA$ parallel

(b) $P_{total} = I^2 r_1 + I^2 r_2 + I^2 R$

$P_{total} = (55.556)^2(2) + (55.556)^2(2) + (55.556)^2(50)$

$p_{total} = 6.173 + 6.173 + 154.3235$

$p_{total} = 166.669\,mW$ serial

$p_{total} = (15m)^2(2) + (15m)^2(2) + (30m)^2(50)$

$p_{total} = 45.9\,mW$ parallel

2. (a) 2ms

(b) 100 mV