2

1) (a) E feild = 2×10^{-3} V/m $r = 1mm = 10^{-3} m$

$E_c = \frac{Kq}{r^2}$

$2 \times 10^{-3} = \frac{(9 \times 10^9) q}{(10^{-3})^2}$

$q = \frac{2 \times 10^{-3} \times (10^{-3})^2}{9 \times 10^9}$

$= 2.22 \times 10^{-19}$ C

E_c at 5mm

$r = 5mm = 5 \times 10^{-3} m$

$E_c = \frac{Kq}{r^2}$

$= \frac{(9 \times 10^9)(2.22 \times 10^{-19})}{(5 \times 10^{-3})^2}$

$\boxed{E_c = 8 \times 10^{-5} \text{ V/m}}$

(b) E_c at $3 \mu C$ $E = 8 \times 10^{-3}$ V/m

$E_c = \frac{Kq}{r^2} \Rightarrow \sqrt{r^2} = \sqrt{\frac{Kq}{E_c}}$

$r = \frac{(9 \times 10^9)(1 \times 10^{-6})}{8 \times 10^{-3}}$

$r = 1060.66 m$

$q = 3 \mu C = 3 \times 10^{-6} C$ $E_c = \frac{9 \times 10^9 \times 3 \times 10^{-6}}{(1060.66)^2}$

$= 0.02400$

$\boxed{= 2.4 \times 10^{-2} \text{ V/m}}$

2

2) (a) $w = m \times g$ $\quad$ E Feild $= 6131.25$ N/C

muss $= \rho V$

muss $(m) = 4 \times 10^{-16}$ Kg $\quad qE = mg \quad q = \frac{mg}{E} = \frac{(4 \times 10^{-16})(9.8)}{6131.25 \text{ N/C}}$

$= 6.3934 \times 10^{-19}$

$\frac{e \cdot q}{e} = \frac{e}{e} = n$

$\boxed{n = 3.9}$

(b) $FE = q'E = 2.94 \times 10^{-15}$

$m' = m - c = 4.0 \times 10^{-16}$

$Fg = m'g = 3.92 \times 10^{-15}$ N

$a = \frac{Fg - Fe}{m} = \frac{(3.92 \times 10^{-15} N) - (2.94 \times 10^{-15} N)}{4.0 \times 10^{-16} \text{ Kg}}$

$\boxed{a = 2.46 \text{ m/s}^2}$

3

1) (a) $KE = qV$

$KE_H = (1.6 \times 10^{-19}) \times (4 \times 10^{3})$

$\boxed{= 6.4 \times 10^{-16}\ J}$

$KE_{He} = (2 \times 10^{-19})\ (4 \times 10^{3})$

$\boxed{= 12.8 \times 10^{-16}\ J}$

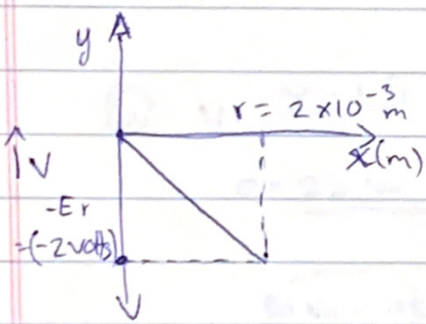
(b) $E = \frac{\Delta V}{\Delta x}$

$= \frac{4 \times 10^{3}}{5 \times 10^{-2}}$

$\boxed{= 8 \times 10^{4}\ V/m}$

2) $E = 1000\ V/m$ $\qquad V = -E \times x$

$r = 2mm = 2 \times 10^{-3} m$



y-int = 0

3) a) capacitance

$C = \frac{\epsilon_0 A}{r}$

$= \frac{8.85 \times 10^{-12} \times 10^{-4}}{2 \times 10^{-3}}$

$\boxed{= 4.425 \times 10^{-13}\ F}$

b) Energy (J)

$= \frac{1}{2} CV^2$

$= \frac{1}{2} \times 4.425 \times 10^{-13} \times 25$

$\boxed{= 55.31 \times 10^{-13}\ J}$

4) We should connect capacitance in parallel since parallel systems keep the potential difference the same while increasing the total capacitance

4

1) ⓐ $r_1 = 2r$ $r_2 = 2r$ $R = 50r$

$E_1 = 1.5v$ $E_2 = 1.5v$ $I = ?$

Kirchhoff's rule

$-E_2 + Ir_2 + Ir_1 - E_1 + IR = 0$

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

$$I = \frac{3V}{r_1 + r_2 + R} = \frac{3}{2+2+50} = \frac{3}{54} = \boxed{55.56\,mA}$$

ⓑ $$V = \frac{V - 1.5}{2} + \frac{V_x - 1.5}{2} + \frac{V_x}{5V}$$

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

$51V_x = 75$

$\boxed{V_x = 1.47v}$

$I_1 = \frac{1.5 - 1.47}{2r} = 15\,mAmp$ $I_2 = \frac{1.5 - 1.47}{2r} = 15\,mAmp$

$I = I_1 + I_2$

$= 15 + 15$

$\boxed{= 30\,mA}$

->

$$\text{Total } P_c = P_{r_1} + P_{r_2} + P_R$$

$$= (15\,m)^2\ 2 + (15\,m)^2 \times 2 + (30m)^2 \times 50$$

$$= 45.9\ mW$$

Total $\boxed{= 45\ mW}$

C_1

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

$$= (0.056A)^2\ (2) + (0.056A^2)\ (2)$$

$$= (0.056A)^2\ (50)$$

$$= 0.17\ W$$

$$\boxed{= 170\,mW}$$

C_2 Parallel

$$P_{total} = (I_1)^2 r_1 + (I_2)^2 r_2 + (I^2)\ R$$

$$= (0.015A)^2\ (2) + (0.015A)^2 + (0.030)^2\ (50)$$

$$= 0.045\ Aw$$

$$\boxed{= 45.9\ mW}$$