

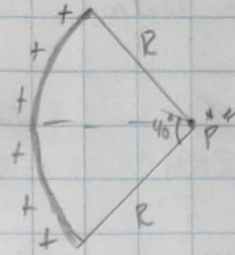
HT 4

P. 1

a) $\lambda = 4.0 \text{ nC/m}$

$r = R$

$dv = \frac{k dq}{r}$



$q = \lambda l$

$dq = \lambda dl$

$dl = R d\theta$

$dq = \lambda R d\theta$

$S = \theta R$

$S = l$

$V = \int_0^{20} \frac{k \lambda R d\theta}{R} = 2K\lambda \int_0^{20} d\theta =$

$V = 2K\lambda \left[\theta \right]_0^{20} = 2K\lambda \left[\frac{20\pi}{180} - 0 \right] = 25.13 \text{ V}$

$V = 25.13 \text{ V}$

b) $E = 3x^2 \hat{i} - V$

$V = 0 \text{ en } x = 0$

$V_a - V_b \text{ en } x_a = 2\text{m}$

$x_b = 3\text{m}$

$V_a - V_b = \int_{x_a}^{x_b} \vec{E} \cdot d\vec{l} = \int_{x_a}^{x_b} E_x dx + \int_{y_a}^{y_b} E_y dy + \int_{z_a}^{z_b} E_z dz$

$V_a - V_b = \int_2^3 3x^2 dx = x^3 \Big|_2^3 = 3^3 - 2^3 = 19\text{V}$

$V_a - V_b = 19\text{V}$

P. 2

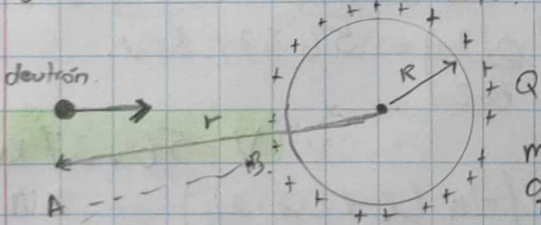
a) $R = 10\text{cm}$

$Q = +20 \mu\text{C}$

$eV = 1.6 \times 10^{-19} \text{ J}$

$V = \frac{kq}{R} = \frac{R(20 \times 10^{-6})}{0.1} = 1.8 \times 10^6 \text{ V}$

b) deutrón.



$m = 3.84 \times 10^{-27} \text{ kg}$

$q = 1.6 \times 10^{-19} \text{ C}$

$K = 45 \text{ KeV}$

$V = 1.8 \times 10^6 \text{ V}$

$E_A = E_B$

$U_A + K_A = U_B + K_B$

$qV_A + K_A = qV_B$

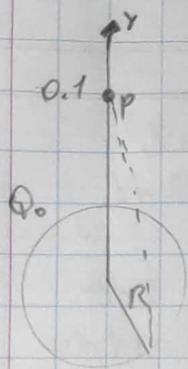
$q \frac{kQ}{r_A} + 45K(1.6 \times 10^{-19}) = q \frac{kQ}{r_B}$

$r_B = \frac{2.088 \times 10^{-14}}{6.48 \times 10^{-14}} = 0.44\text{m}$

$r_B = \frac{qKQ}{qKQ/r_A + 45 \times 10^3 (1.6 \times 10^{-19})}$

$r_B = 0.34 \text{ m}$

P.3

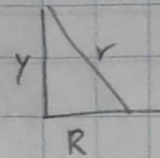


$$Q_0 = 5 \mu\text{C}$$

$$R = 0.1 \text{ m}$$

$$y = 0.1 \text{ m}$$

$$S = 2\pi R$$



$$\lambda = \frac{Q}{2\pi R}$$

$$dq = \lambda ds$$

$$r = \sqrt{R^2 + y^2}$$

$$dv = \frac{k dq}{r} = \frac{k \lambda ds}{\sqrt{R^2 + y^2}}$$

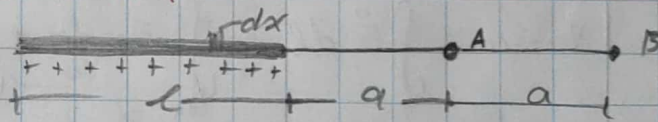
$$V = \int \frac{k \lambda 2\pi R ds}{\sqrt{R^2 + y^2}} = \frac{k}{\sqrt{R^2 + y^2}} \int \frac{Q}{2\pi R} 2\pi R = \frac{k Q}{\sqrt{R^2 + y^2}}$$

$$V = \frac{k (5 \times 10^{-6})}{\sqrt{(0.1)^2 + (0.1)^2}} = 37.8 \times 10^4 \text{ V}$$

$$V = 37.8 \times 10^4 \text{ V}$$

P.4

a) $l = 0.50 \text{ m}$
 $\lambda = 5 \mu\text{C/m}$
 $a = 0.2 \text{ m}$



$$dv = \frac{k dq}{r} = \frac{k \lambda dx}{l + a - x}$$

$$V = \int_0^l \frac{k \lambda dx}{l + a - x} = k \lambda \left(-\ln(l + a - x) \Big|_0^l \right) = k \lambda \ln \left(\frac{a + l}{a} \right)$$

$$V = 9 \times 10^9 (5 \times 10^{-6}) \ln \left(\frac{0.7}{0.2} \right) = 56374.3 \text{ V}$$

$$V = 56.37 \text{ kV/m}$$

b) $V_B = \int_0^l \frac{k \lambda dx}{l + 2a - x} = k \lambda \left(-\ln(l + 2a - x) \Big|_0^l \right) = k \lambda \ln \left[\frac{2a + l}{2a} \right]$

$$V_B = 9 \times 10^9 (5 \times 10^{-6}) \ln \left(\frac{0.9}{0.4} \right) = 36491.9 \text{ V}$$

$$V_B = 36.5 \text{ kV/m}$$

$$U_A + K^2 = U_B + K_B$$

$$q V_A = q V_B + K_B$$

$$q (V_A - V_B) = \frac{1}{2} m_e v^2$$

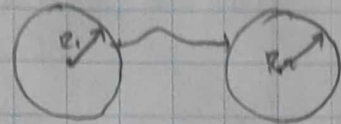
$$V_B = \sqrt{\frac{2(1.6 \times 10^{-19})(56374.3 - 56491.9)}{1.67 \times 10^{-27}}} = 1.95 \times 10^6 \text{ m/s}$$

$$v = 1.95 \times 10^6 \text{ m/s}$$

P.5

a) $q_1 = -15 \mu\text{C}$
 $R_1 = 5 \times 10^{-3} \text{ m}$

$q_2 = 30 \mu\text{C}$
 $R_2 = 10 \times 10^{-3} \text{ m}$



$$V_1 = V_2$$

$$\frac{k q_1}{R_1} = \frac{k q_2}{R_2}$$

$$\frac{q_1}{R_1} = \frac{q_2}{R_2}$$

$$\frac{q_1}{R_1} = \frac{15 \mu - q_1}{R_2} \Rightarrow$$

$$\frac{R_2 q_1}{R_1} = 15 \mu - q_1$$

$$R_2 \frac{q_1}{R_1} = 15 \mu - q_1$$

$$\frac{10 \times 10^{-3}}{5 \times 10^{-3}} q_1 + q_1 = 15 \mu$$

$$2 q_1 + q_1 = 15 \mu \Rightarrow q_1 = \frac{15 \mu}{3} = 5 \mu\text{C}$$

$$q_1 = 5 \mu\text{C}$$

b) $V_2 = \frac{k q_2}{R_2} = \frac{k (10 \mu)}{10 \times 10^{-3}}$

$$V_2 = 9 \times 10^6 \text{ V}$$

$$q_2 = 15 \mu - q_1$$

$$q_2 = 10 \mu\text{C}$$

$$V_2 = 9 \times 10^6 \text{ V}$$

P. 6

$$A = (4, 8) \text{ m}$$

$$B = (10, 6) \text{ m}$$

$$E = 15.0 \text{ N/C}$$

$$V = Ed$$

$$V = \frac{W}{q} \Rightarrow W = qEd$$

$$d = \sqrt{(10-4)^2 + (6-8)^2}$$

$$d = 15.23 \text{ mm}$$

$$V_a - V_b = \frac{W}{q}$$

$$V_{ab} = \frac{qEd}{q} = Ed = (15)(15.23) = 228.5 \text{ V}$$

$$V_a - V_b = 228.5 \text{ V}$$

P. 7

$$V(x, y) = 3x^2 + 2y^2$$

$$E_x = ?$$

$$x = 2$$

$$y = 1 \text{ mm}$$

$$\frac{dV}{dx} = 6x$$

$$E_x = -\frac{dV}{dx}$$

$$E_x = 6(2) = -12 \text{ V}$$

$$E_x = -12 \text{ V}$$