	UNIVERSIDAD DE SAN CARLOS DE GUATEMALA	FÍSICA 2 C	NOTA:
	FACULTAD DE INGENIERÍA		
	ESCUELA DE CIENCIAS	1S2023	
	DEPARTAMENTO DE FÍSICA		
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Tarea 2

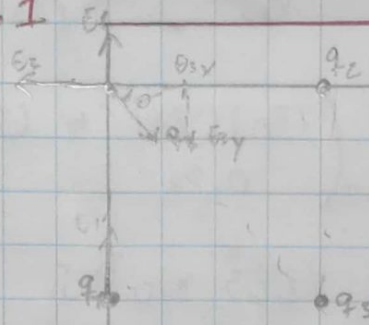
T2

P.1

$$q_1 = 3 \text{ nC} \quad (0, -12) \text{ cm}$$

$$q_2 = 2 \text{ nC} \quad (12, 0) \text{ cm}$$

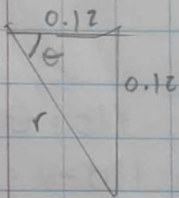
$$q_3 = -4 \text{ nC} \quad (12, -12) \text{ cm}$$



a) $E_R = E_1 + E_2 + E_3$

$$E_1 = \frac{k q_1}{r_1^2} (\hat{j}) = \frac{k (3 \text{ n})}{(0.12)^2} = 1875 \text{ N/C } (+\hat{j})$$

$$E_2 = \frac{k q_2}{r_2^2} (-\hat{i}) = \frac{k (2 \text{ n})}{(0.12)^2} = 1250 \text{ N/C } (-\hat{i})$$



$$r^2 = (0.12)^2 + (0.12)^2$$

$$r^2 = 0.0288 \text{ m}$$

$$r = 0.17 \text{ m}$$

$$\cos \theta = \frac{0.12}{0.17} = \sin \theta$$

$$E_{3x} = \frac{k q_3}{r^2} \cos \theta = \frac{k (4 \text{ n})}{(0.0288)} \left(\frac{0.12}{0.17} \right) = 882.35 \text{ N/C } (-\hat{i})$$

$$E_{3y} = \frac{k q_3}{r^2} \sin \theta = \frac{k (4 \text{ n})}{(0.0288)} \left(\frac{0.12}{0.17} \right) = 882.35 \text{ N/C } (-\hat{j})$$

$$E_{Rx} = -1250 + 882.35 = -367.65 \text{ N/C } (-\hat{i})$$

$$E_{Ry} = 1875 - 882.35 = 992.65 \text{ N/C } (+\hat{j})$$

$$|E_R| = \sqrt{(-367.65)^2 + (992.65)^2} = 1058.5 \text{ N/C}$$

b) $V_R = V_1 + V_2 + V_3$

$$E = 1058 \text{ N/C}$$

$$V_1 = \frac{k q_1}{r_1} = \frac{k (3 \text{ n})}{0.12} = 225 \text{ V}$$

$$V_R = 225 + 150 - 211.8$$

$$V_R = 163.2 \text{ V}$$

$$V_2 = \frac{k q_2}{r_2} = \frac{k (2 \text{ n})}{0.12} = 150 \text{ V}$$

$$V_R = 163 \text{ V}$$

$$V_3 = \frac{k q_3}{r_3} = \frac{k (-4 \text{ n})}{0.17} = -211.8 \text{ V}$$

$$c) U = \frac{k q_1 q_2}{r_{12}} + \frac{k q_1 q_3}{r_{13}} + \frac{k q_2 q_3}{r_{23}}$$

$$U = k \left(\frac{(3n)(2n)}{0.12} + \frac{(3n)(-4n)}{0.12} + \frac{(2n)(-4n)}{0.12} \right)$$

$$U = -1.1823 \times 10^{-6} \text{ J}$$

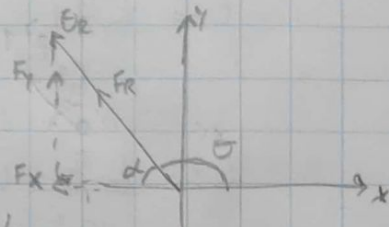
$$U = -1182 \times 10^{-9} \text{ J}$$

$$d) Q = 5 \text{ nC}$$

$$\vec{F} = \vec{E} q$$

$$\rightarrow F_{Ex} = E_{Ex} q$$

$$F_{Ey} = E_{Ey} q$$



$$F_{Ex} = (-367.65)(5 \text{ n}) = -1.838 \times 10^{-6} \text{ N}$$

$$F_{Ey} = (992.65)(5 \text{ n}) = 4.963 \times 10^{-6} \text{ N}$$

$$\alpha = \tan^{-1} \left(\frac{4.963}{-1.838} \right) = -69.678^\circ \rightarrow$$

$$180 = \theta + \alpha$$

$$180 - \alpha = \theta$$

$$\theta = 180 - 69.68$$

$$\theta = 110.3^\circ$$

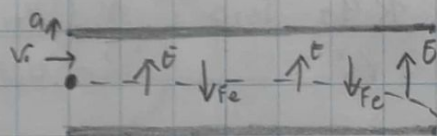
$$\theta = 110^\circ$$

P. 2

$$m = 10.0 \text{ mg} = 10 \times 10^{-6} \text{ g}$$

$$q = -4.00 \text{ uC}$$

$$v = 20 \text{ m/s (0)}$$



$$a) E = 50.0 \text{ N/C (up)}$$

$$\sum F = ma$$

$$F_e = Eq$$

$$F_e = ma$$

$$F_e = (50)(-4 \text{ uC})$$

$$a = 20 \text{ m/s}^2$$

$$a = \frac{F_e}{m}$$

$$F_e = -2 \times 10^{-4} \text{ N}$$

$$a = \frac{-2 \times 10^{-4}}{10 \times 10^{-6}} = -20 \text{ m/s}^2$$

$$b) t = 1.50 \text{ s} \quad v = \sqrt{v_x^2 + v_y^2}$$

$$v = 36.1 \text{ m/s}$$

$$v_x = v_{0x} = 20 \text{ m/s}$$

$$v_y = v_{0y} + at = (-20)(1.5) = -30 \text{ m/s}$$

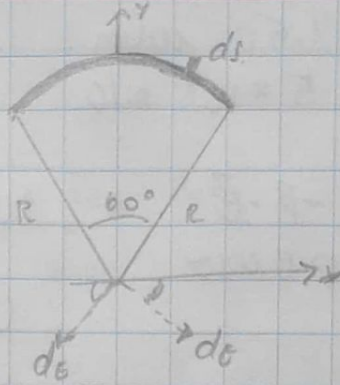
$$|v| = \sqrt{(20)^2 + (-30)^2} = 36.1 \text{ m/s}$$

P.3

$$q = 0.471 \text{ nC}$$

$$\theta = 60^\circ$$

$$R = 18.0 \text{ cm}$$



$$E_x = 0 \rightarrow \text{Por simetria}$$

$$E_y = -j$$

$$dq = \lambda ds$$

$$dq = \lambda R d\theta$$

$$r = R$$

$$\lambda = \frac{q}{R\theta} = \frac{0.471}{0.18} = 2.50 \text{ nC/m}$$

$$dE = \frac{k dq}{R^2} \Rightarrow E_y = \frac{k \lambda R d\theta \sin\theta}{R^2} = \frac{2k\lambda}{R} \int_{\pi/3}^{\pi/2} \sin\theta d\theta$$

$$E_y = \frac{2k\lambda}{R} \left(-\cos\theta \right) \Big|_{\pi/3}^{\pi/2} = \frac{2k\lambda}{R} \left(-\cos\frac{\pi}{2} + \cos\frac{\pi}{3} \right)$$

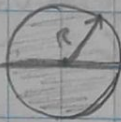
$$E_y = \frac{2k\lambda}{R} \left(\frac{1}{2} \right) = \frac{2(9 \times 10^9)(2.5 \text{ nC/m})}{0.18} \left(\frac{1}{2} \right) = 125$$

$$E = 125 \text{ N/C}$$

P.4

$$\lambda = 9 \text{ nC/m}$$

$$R = 0.08 \text{ m}$$



$$\oint \vec{E} \cdot d\vec{A} = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\Phi = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$q_{\text{enc}} = \lambda l$$

$$q_{\text{enc}} = (9 \text{ nC/m})(2r)$$

$$q_{\text{enc}} = (9 \text{ nC/m})(2 \times 0.08)$$

$$q_{\text{enc}} = 1.44 \times 10^{-9} \text{ C}$$

$$\lambda = \frac{q_{\text{enc}}}{l}$$

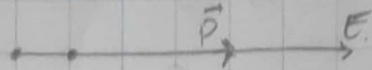
$$\Phi = \frac{1.44 \times 10^{-9}}{\epsilon_0} = 162.6 \text{ N m}^2/\text{C}$$

$$\Phi = 163 \text{ N m}^2/\text{C}$$

P.5

$$p = 4.50 \text{ nCm}$$

$$\vec{E} = 5 \times 10^7 \text{ N/C}$$



a)

$$U = -\vec{p} \cdot \vec{E} \rightarrow |U| = -(4.5 \text{ nC})(5 \times 10^7) \cos 0^\circ$$

$$U = -pE \cos \theta$$

$$U = -225$$

$$U = -225 \text{ J}$$

$$b) W = -\Delta U = U_f - U_o$$

$$U_f = -(4.5 \text{ nC})(5 \times 10^7) \cos 90^\circ = 0$$

$$U_o = -225$$

$$W = 0 - (-225) = 225 \text{ J}$$

$$W = 225 \text{ J}$$

P.6

En A

En B

$$v = 50 \text{ km/s}$$

$$v = 80 \text{ km/s}$$

$$\Delta V_{AB} = V_A - V_B$$

$$W_{FE} = q V_{AB}$$

$$\Rightarrow \frac{K_f - K_o}{q} = V_{AB}$$

$$W_{FE} = \Delta K \rightarrow K_f - K_o$$

$$V_{AB} = \frac{\frac{1}{2} m v_f^2 - \frac{1}{2} m v_o^2}{q} = \frac{\frac{1}{2} (1.6726 \times 10^{-27}) [(80 \times 10^3)^2 - (50 \times 10^3)^2]}{(1.6022 \times 10^{-19})}$$

$$V_{AB} = 20.35 \text{ V}$$

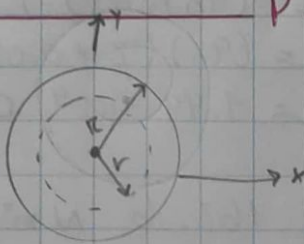
$$V_A - V_B = 20.4 \text{ V}$$

P.7

$$a) +Q = 5.00 \text{ nC}$$

$$R = 10.0 \text{ cm}$$

$$r = R/2$$



$$\int E A = \frac{q_{enc}}{\epsilon_0}$$

$$E (4\pi r^2) = \frac{r^3 Q}{\epsilon_0 R^3}$$

$$E = \frac{Qr}{4\pi R^3 \epsilon_0} = \frac{(5 \text{ nC})(0.05)}{4\pi (0.1)^3 \epsilon_0} = 2246.8 \text{ N/C}$$

$$A_{\text{sup gauss}} = 4\pi r^2$$

$$r = 0.05 \text{ m}$$

$$P_{\text{total}} = P_{\text{enc}}$$

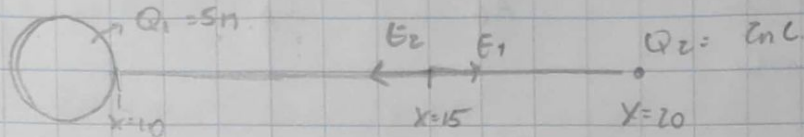
$$Q/V_r = q_{enc}/V_{enc}$$

$$\frac{V_{enc} Q}{V_r} = q_{enc}$$

$$q_{enc} = (r^3/R^3) Q$$

$$E = 2.25 \text{ kN/C}$$

- b) $Q_1 = 2 \text{ nC}$ en $x = 0.2 \text{ m}$,
 E en $x = 0.15 \text{ m}$.



$$E_R = E_1 - E_2 \quad E_2 = k \frac{Q_2}{r^2} = \frac{k(2 \text{ nC})}{(0.05)^2} = 7.20 \times 10^3 \text{ N/C}$$

$$E_1 = \frac{k(5 \text{ nC})}{(0.15)^2} = 2 \times 10^3 \text{ N/C}$$

$$E_R = 2 \times 10^3 - 7.20 \times 10^3 = -5.20 \times 10^3 \text{ N/C} \quad (-i)$$

$$E = 5.20 \text{ kN/C}$$

P. 8.

$$R = 0.15 \text{ m}$$

$$\rho = 2.50 \text{ mC}$$

$$r = 0.05 \text{ m}$$



$$q_{\text{enc}} = \rho V$$

$$\oint E dA = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$E = \frac{\rho r}{2\epsilon_0} = \frac{(2.5 \text{ mC})(0.05)}{2\epsilon_0}$$

$$E(2\pi r l) = \frac{\rho \pi r^2 l}{\epsilon_0}$$

$$E = 7058.7 \text{ N/C}$$

$$E = 7.1 \text{ kN/C}$$