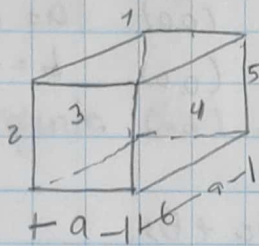


Universidad de San Carlos de Guatemala
Facultad de Ingeniería, Departamento de Física
Primer Examen Física 2, Vacaciones Primer Semestre 2023.

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Problema 1:



$$a = 0.2 \text{ m.}$$

$$\Phi_1 = -70 \text{ Nm}^2/\text{C.}$$

$$\Phi_2 = -300 \text{ Nm}^2/\text{C.}$$

$$\Phi_3 = -300 \text{ Nm}^2/\text{C.}$$

$$\Phi_4 = +300 \text{ Nm}^2/\text{C.}$$

$$\Phi_5 = -400 \text{ Nm}^2/\text{C.}$$

$$\Phi_6 = -500 \text{ Nm}^2/\text{C.}$$

$$\Phi_T = -1270 \text{ Nm}^2/\text{C.}$$

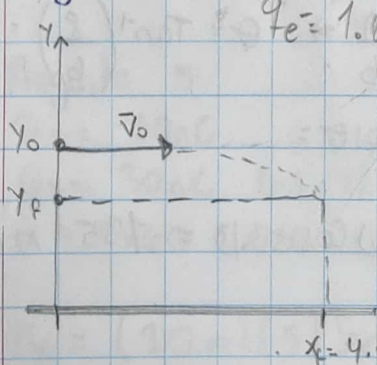
$$\Phi_T = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\epsilon_0 \Phi_T = q_{\text{enc}}$$

$$q_{\text{enc}} = (8.8542 \times 10^{-12}) (-1270) = -1.12 \times 10^{-8} \text{ C.} = -11.2 \text{ nC}$$

$$Q_{\text{neto}} = -11.2 \text{ nC}$$

Pregunta 2:



$$q_e = 1.6022 \times 10^{-19} \text{ Kc.}$$

$$K_e = 3.204 \times 10^{-16} \text{ J.}$$

$$\sigma = +4.00 \text{ } \mu\text{C}/\text{m}^2.$$

$$E = \sigma$$

$$m_e = 9.1094 \times 10^{-31} \text{ Kg.}$$

$$\epsilon_0$$

$$K = \frac{1}{2} m v^2$$

$$\sqrt{\frac{2K}{m}} = v_0 \rightarrow v_0 = \sqrt{\frac{2(3.204 \times 10^{-16})}{9.1094 \times 10^{-31}}}$$

$$E_n \text{ X.}$$

$$v_{0x} = 2.65 \times 10^7 \text{ m/s}$$

$$x_f = 0.04 \text{ m}$$

$$v_{0x} = 2.65 \times 10^7 \text{ m/s}$$

$$E = \frac{\sigma}{\epsilon_0} = 451.76 \times 10^3 \text{ N/C}$$

$$y = \left(\frac{E q_e}{2 m_e v_{0x}^2} \right) x_f^2$$

$$y = \frac{(451.76 \text{ K})(1.6022 \times 10^{-19})}{2(9.1094 \times 10^{-31})(2.65 \times 10^7)^2} (0.04)^2$$

$$a = \frac{451.76 \times 10^3 (1.6022 \times 10^{-19})}{9.1094 \times 10^{-31}}$$

$$q = -7.94 \times 10^{16} \text{ m/s}^2$$

$$y = 0.0905 \text{ m.}$$

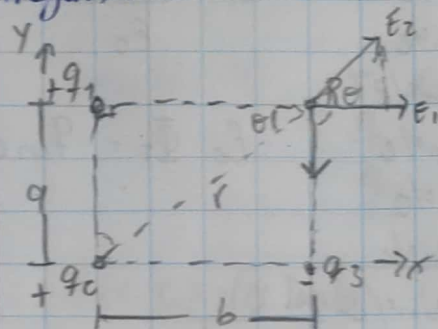
$$t = \frac{x}{v_{ox}} = \frac{0.04}{2.65 \times 10^7} = 1.51 \times 10^{-9} \text{ s}$$

$$y_f = y_0 + v_{oy}t + \frac{1}{2}at^2 \quad y_0 = 0.0905 - \frac{1}{2}(-7.94 \times 10^6)(1.51 \times 10^{-9})^2$$

$$y_f - \frac{1}{2}at^2 = y_0 \quad y_0 = 0.181 \text{ m}$$

$$\Delta y = y_f - y_0 = 0.0905 - 0.181 = -0.0905 \text{ m}$$

Pregunta 3:



$$q_1 = +1.50 \mu\text{C} \quad (a, a) \quad a = 8 \text{ m}$$

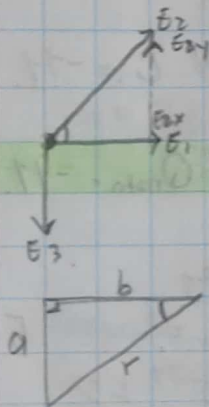
$$q_2 = +2.50 \mu\text{C} \quad (a, 0) \quad b = 6 \text{ m}$$

$$q_3 = -3.50 \mu\text{C} \quad (b, b)$$

$$E_p = E_1 + E_2 + E_3$$

$$E_{1x} = \frac{k(1.50 \mu\text{C})}{(b)^2} = 375 \text{ N/C } (+\hat{i})$$

$$E_{3y} = \frac{k(3.50 \mu\text{C})}{8^2} = 492.18 \text{ N/C } (-\hat{j})$$



$$r^2 = a^2 + b^2$$

$$r^2 = 100$$

$$r = 10$$

$$\tan \theta = \frac{a}{b} \Rightarrow \theta = \tan^{-1}\left(\frac{8}{6}\right) = 53.13^\circ$$

$$E_{2x} = \frac{k q_2 \cos \theta}{r^2}$$

$$E_{2x} = \frac{k(2.50 \mu\text{C}) \cos 53.13}{100} = 135 \text{ N/C } (+\hat{i})$$

$$E_{2y} = \frac{k(2.50 \mu\text{C}) \sin 53.13}{100} = 179.99 \text{ N/C } (-\hat{j})$$

$$E_p = (375 + 135) \hat{i} + (-492.18 + 180) \hat{j} = (510 \hat{i} + (-312.18) \hat{j})$$

$$|E| = \sqrt{510^2 + (-312.18)^2} = 597.96 \text{ N/C} \quad \theta = \tan^{-1}\left(\frac{312.18}{510}\right)$$

$$\theta = -37.47^\circ \Rightarrow \theta = 360 - 37.47^\circ = 322.53^\circ$$

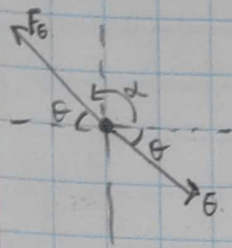
$$|E| = 597.96 \text{ N/C}$$

$$\theta = 322.53^\circ$$

c) $F = qE$ $q = -1 \mu C$

$F = (1 \mu)(598) = 59.8 \times 10^{-3} N$ $F = 59.8 \text{ mN}$

d) Como $q = (-)$ entonces F_e y E_e opuestos.



$\theta = -31.47$

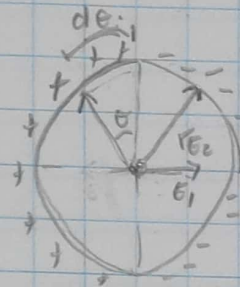
$\alpha = 180 - 31.47 = 148.5^\circ$

Pregunta 4:

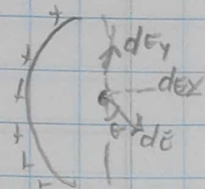
$r = 0.01 \text{ m}$

$q_1 = +1 \mu C$

$q_2 = -1 \mu C$



$s = R\theta$
 $ds = R d\theta$



$E_x = \frac{k\lambda ds \sin\theta}{R}$ $dq = \lambda R d\theta$

$E_y = 0$

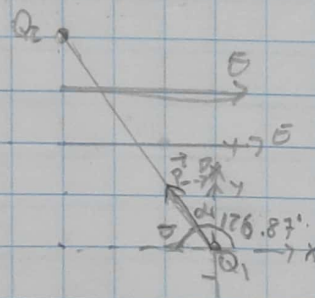
$E_x = \frac{2k\lambda}{R} \int_{\pi/2}^{\pi} \sin\theta ds = \frac{2k\lambda}{R^2\theta} \int_{\pi/2}^{\pi} \sin\theta ds$ $\lambda = \frac{q}{R\theta}$

Pregunta 5:

$Q_1 = -30 \text{ nC}$

$Q_2 = 30 \text{ nC}$ $(-3, 4)$

$E = 2.60 \text{ kN/C}$ $+z$



$\tan\theta = \left(\frac{4}{3}\right)$

$\theta = 53.13^\circ$

$\alpha = 36.87^\circ$

$r = \sqrt{3^2 + 4^2}$

$r = 5$

$P_x = (30 \text{ n})(5) \sin 36.87^\circ = 90 \text{ n}$

$P_y = (30 \text{ n})(5) \cos 36.87^\circ = 119.99 \text{ n}$

$P = \sqrt{(90 \text{ n})^2 + (119.99 \text{ n})^2} = 150 \text{ n}$

$P = 150 \text{ n C} \cdot \text{m}$

$\tau = (150 \text{ n})(2.60 \times 10^3) \sin 126.87^\circ = 311.9 \times 10^{-6} \text{ Nm}$

$\tau = 312 \times 10^{-6} \text{ Nm}$