

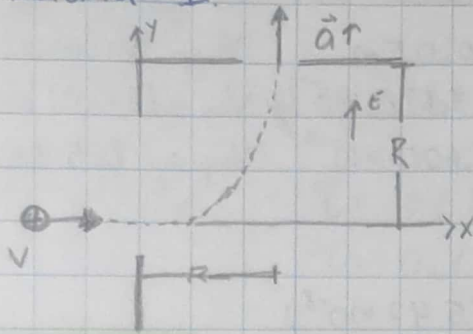


UNIVERSIDAD DE SAN CARLOS DE GUATEMALA
FACULTAD DE INGENIERÍA
ESCUELA DE CIENCIAS
DEPARTAMENTO DE FÍSICA
FÍSICA 2
INGA. CLAUDIA CONTRERAS

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HTZ.

Problema 1.



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

$$m = 1.67 \times 10^{-27} \text{ kg}$$

$$E = 6.96 \text{ j N/C}$$

$$V = 10 \times 10^3 \text{ m/s}$$

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

$$F_y = ma \Rightarrow F = Eq$$

$$a = \frac{(6.96)(1.6 \times 10^{-19})}{1.67 \times 10^{-27}} = 6.96 \times 10^8$$

$$V_i = V_x = 10 \times 10^3 \text{ m/s}$$

$$V_x = \frac{x}{t} = \frac{R}{t} \Rightarrow R = t V_x$$

$$y_0 = 0 \quad V_{y0} = 0 \quad y_t = y_0 + V_{y0}t + \frac{1}{2} a t^2$$

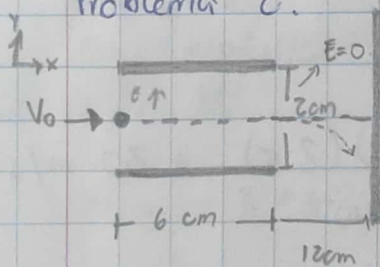
$$y_t = \frac{1}{2} a \left(\frac{R}{V_x} \right)^2 = \frac{1}{2} a \frac{R^2}{V^2}$$

$$\frac{R}{R^2} = \frac{a}{2V^2} \Rightarrow \frac{2V^2}{a} = R$$

$$R = 0.3 \text{ m}$$

$$R = \frac{2(10 \times 10^3)^2}{(6.96 \times 10^8)} = 0.287 \text{ m}$$

Problema 2.



$$V_0 = 6.50 \times 10^6 \text{ m/s}$$

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

$$E = 1.1 \times 10^3 \text{ N/C}$$

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

$$a_y = \frac{-eE}{m_e} = \frac{-(1.6022 \times 10^{-19})(1.1 \times 10^3)}{9.1094 \times 10^{-31}}$$

$$a_y = -1.934 \times 10^{14} \text{ m/s}^2$$

$$x = V_0 t \Rightarrow t = \frac{0.06}{6.5 \times 10^6} = 9.23 \times 10^{-9} \text{ s}$$

$$\frac{x}{V_0} = t$$

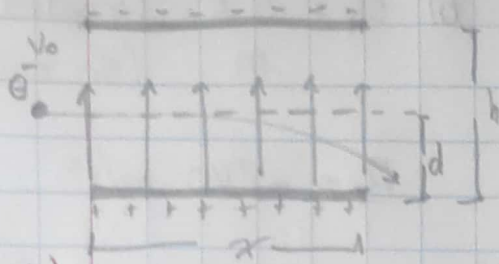
$$\Delta y = -8.238 \times 10^{-5} \text{ m}$$

$$y_t - y_0 = V_{y0}t + \frac{1}{2} a t^2$$

$$\Delta y = 8.24 \times 10^{-5} \text{ m}$$

$$\Delta y = \frac{1}{2} (-1.934 \times 10^{14}) (9.23 \times 10^{-9})^2$$

Problema 3:



$$d = 4.7 \text{ mm}$$

$$h = 1.0 \text{ cm}$$

$$x = 10 \text{ cm}$$

$$v_0 = 5.10 \times 10^7 \text{ m/s}(\hat{x})$$

$$v_{0y} = 0$$

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

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

b)

$$\text{En } x: t = \frac{x}{v_{0x}} = \frac{0.1 \text{ m}}{5.10 \times 10^7} =$$

$$t = 1.9607 \times 10^{-9} \text{ s}$$

En y:

$$y = v_0 t + \frac{1}{2} a t^2$$

$$a = 2.44 \times 10^{15} \text{ m/s}^2$$

$$\Delta y = \frac{1}{2} a t^2$$

$$\frac{2 \Delta y}{t^2} = a \Rightarrow a = \frac{2(4.7 \times 10^{-5})}{(1.9607 \times 10^{-9})^2} = 2.44 \times 10^{15} \text{ m/s}^2$$

$$a = \frac{\vec{E} q}{m} \Rightarrow |\vec{E}| = \frac{m a}{q} = \frac{9.1094 \times 10^{-31} (2.44 \times 10^{15})}{-1.6022 \times 10^{-19}} = 13872.7$$

$$d) \vec{E} = \frac{\sigma}{\epsilon_0} \Rightarrow \sigma = \epsilon_0 \vec{E} = (8.8542 \times 10^{-12}) (13872.7) = 1.228 \times 10^{-7} \text{ nC/m}^2$$

$$\vec{E} = 13.9 \text{ kN/C}$$

$$\sigma = 123 \text{ nC/m}^2$$

Problema 4:

$$v_y = 50 \text{ m/s en } t=0$$

$$m = 5.0 \text{ g}$$

$$v_x = v_z = 0$$

$$q = 40 \text{ mC}$$

$$v_t = ? \text{ en } t=2 \text{ s}$$

$$a = \frac{F q}{m} = \frac{2.5(40 \times 10^{-3})}{5 \times 10^{-3}} =$$

$$E_x = 2.5 \text{ N/C}$$

$$E_y = E_z = 0$$

$$a = 20 \text{ m/s}^2 \text{ (en } \hat{x})$$

$$v_{0x} = 0$$

$$v_{fx} = v_{0x} + a t$$

$$v_{fx} = 20(2) = 40 \text{ m/s}$$

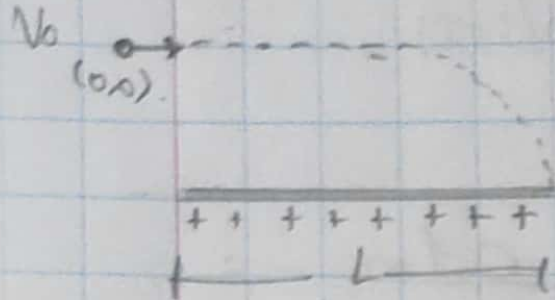
$$v_{fx} = v_x$$

$$v_{fy} = v_y$$

$$V = \sqrt{40^2 + 50^2} = 64.03 \text{ m/s}$$

$$V = 64 \text{ m/s}$$

Problema 6:



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

$$m = 50.0 \text{ g}$$

$$E = 3000 \text{ N/C}$$

$$v_0 = 20 \text{ m/s}$$

$$L = 0.450 \text{ m}$$

$$v_{0x} = v_x$$

$$v_{0y} = 0$$

$$b) a_y = \frac{F q}{m} = \frac{(3000)(-4 \times 10^{-3})}{(50 \times 10^{-3})}$$

$$a_y = -240 \text{ m/s}^2$$

$$a) t = \frac{x}{v_{0x}} = \frac{0.450}{20} = 0.0225 \text{ s}$$

$$v_y = v_{0y} + at$$

$$v_y = (240)(0.0225)$$

$$v_y = 5.4 \text{ m/s}$$

$$\Delta y = v_{0y}t + \frac{1}{2}at^2$$

$$\Delta y = -60.8 \text{ mm}$$

$$\Delta y = \frac{1}{2}(-240)(0.0225)^2 = -0.06075 \text{ m}$$

$$a = -240 \text{ m/s}^2$$

Problema 6:

$$W_E = U_0 - U_f$$

a) $p = 6 \text{ mC/m}$

$$\theta_0 = \pi/3$$

$$E = 1 \times 10^3 \text{ N/C}$$

$$U_0 = -(6 \times 10^{-6})(1 \times 10^3) \cos \pi/3 = -3 \times 10^{-3} \text{ J}$$

$$U_f = -(6 \times 10^{-6})(1 \times 10^3) \cos 0^\circ = -6 \times 10^{-3} \text{ J}$$

$$W_E = -3 \times 10^{-3} - (-6 \times 10^{-3}) = 3 \times 10^{-3} \text{ J}$$

$$W_E = 3 \times 10^{-3} \text{ J}$$

b) $I_{\text{cm}} = 1.1 \times 10^{-11} \text{ kg} \cdot \text{m}^2$

$$U_0 + K_0 = U_f + K_f$$

$$U_0 - U_f = K_f$$

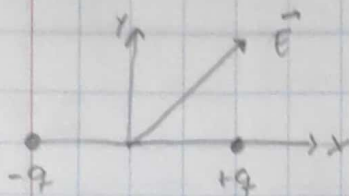
$$U_0 - U_f = \frac{1}{2} I \omega^2$$

$$\sqrt{\frac{2(U_0 - U_f)}{I}} = \omega$$

$$\omega = \sqrt{\frac{2(-3 \times 10^{-3} + 6 \times 10^{-3})}{1.1 \times 10^{-11}}} = 23,554.9 \text{ rad/s}$$

$$\omega = 23.35 \times 10^3 \text{ rad/s}$$

Problema 7:



$$+q = +3 \mu\text{C}$$

$$-q = -3 \mu\text{C}$$

$$x = 0.75 \text{ m}$$

$$-x = -0.75 \text{ m}$$

$$\vec{E} = (4\hat{i} + 3\hat{j}) \times 10^6 \text{ N/C}$$

a) $U = -(\vec{p} \cdot \vec{E}) \Rightarrow U = -(p_x E_x + p_y E_y)$

$$U = -(4.5 \times 10^{-6})(4 \times 10^6) = -18 \text{ J}$$

$$U = -18 \text{ J}$$

b) $W = \Delta U = U_f - U_o \rightarrow U_o = -18 \text{ J}$

$$\theta = 0$$

$$U_f = -p E \cos \theta$$

$$|\vec{E}| = \sqrt{(4 \times 10^6)^2 + (3 \times 10^6)^2} = 5 \times 10^6 \text{ N/C}$$

$$U_f = -(4.5 \times 10^{-6})(5 \times 10^6) \cos 0 = -22.5 \text{ J}$$

$$W = -22.5 + 18 = -4.5 \text{ J}$$

$$W = -4.5 \text{ J}$$

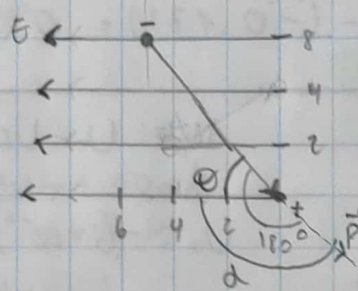
Problema 8:

$$p = 7.2 \mu\text{Cm}$$

$$-q_1 \text{ en } (-5, 8)$$

$$+q_2 \text{ en } (0, 0)$$

$$E = 4 \times 10^7 \text{ N/C (a)} \rightarrow$$



$$\theta = \tan^{-1} \left(\frac{8}{-5} \right)$$

$$\theta = -58^\circ$$

$$\alpha = 180 - 58 = 122$$

a)

$$\tau = |p| E \sin \alpha$$

$$\tau = (7.2 \mu\text{Cm})(4 \times 10^7) \sin 122 = 244.2 \text{ Nm}$$

$$\tau = 244 \text{ N}\cdot\text{m}$$

b) $W = U_f - U_o$

$$U_o = -p E \cos \theta = -(7.2 \mu\text{Cm})(4 \times 10^7) \cos 122^\circ = 152.6$$

$$U_f = -p E \cos \theta = -(7.2 \mu\text{Cm})(4 \times 10^7) \cos 0^\circ = -288$$

$$W = -288 - 152.6 = -440.6$$

$$W = -441 \text{ J}$$

Problema 9:

$$E = 300 \text{ N/C}$$

$$q = 2.00 \times 10^{-9} \text{ C}$$

$$W = U_0 - U_f$$

$$U_0 = - (2 \times 10^{-9}) (300) \cos 90^\circ = 0$$

$$U_f = - (2 \times 10^{-9}) (300) \cos 30^\circ = -6 \times 10^{-7}$$

a)

$$W = 0 - (-6 \times 10^{-7}) = 6 \times 10^{-7} \text{ J}$$

$$W = 600 \text{ nJ}$$

b) $\tau = 3 \times 10^{-7} \text{ Nm}$

$$\tau = p E \sin \theta$$

$$\theta = \sin^{-1} \left(\frac{\tau}{pE} \right) = \sin^{-1} \left(\frac{3 \times 10^{-7}}{(2 \times 10^{-9})(300)} \right) = 30^\circ$$

$$\theta = 30^\circ$$