

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

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Firma:

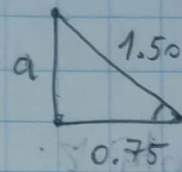
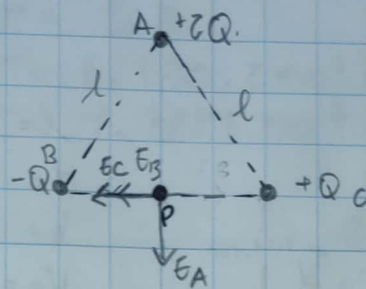
Catedrático: Ing. Claudia Contreras

Sección: C.

Pregunta 1:

$$Q = 8.25 \text{ nC}$$

$$l = 1.50 \text{ m}$$



$$a = \sqrt{1.5^2 - 0.75^2}$$

$$a = \frac{3\sqrt{3}}{4}$$

a) $E = \frac{k|q|}{r^2}$

$$E_A = \frac{k(2(8.25 \text{ nC}))}{(3\sqrt{3}/4)^2} = 88 \text{ N/C } (-\hat{j})$$

$$E_B = \frac{k(8.25 \text{ nC})}{(0.75)^2} = 132 \text{ N/C } (-\hat{i})$$

$$E_C = \frac{k(8.25 \text{ nC})}{(0.75)^2} = 132 \text{ N/C } (+\hat{i})$$

$$E_R = E_A + E_B + E_C = (-132 - 132)\hat{i} + 88\hat{j} =$$

$$E_R = -264(\hat{i}) + 88(\hat{j})$$

$$E = \sqrt{(-264)^2 + (88)^2} = 278.3 \text{ N/C} \quad E = 278 \text{ N/C}$$

b) $U_{\text{sit}} = U_A + U_B + U_C \quad U = \frac{kq_A q_B}{r_{AB}} + \frac{kq_A q_C}{r_{AC}} + \frac{kq_B q_C}{r_{BC}}$

$$U_{\text{sit}} = \frac{k}{1.5} \left(2(8.25 \text{ nC})(8.25 \text{ nC}) + 2(8.25 \text{ nC})(8.25 \text{ nC}) + (-8.25 \text{ nC})(8.25 \text{ nC}) \right)$$

$$U_{\text{sit}} = -4.083 \times 10^{-7}$$

$$U_{\text{sit}} = -408 \text{ nJ}$$

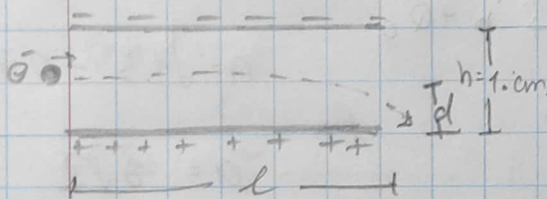
c) $V_P = V_A + V_B + V_C$ (por el principio de superposición)

$$V_P = \frac{K \cdot 2Q}{r_A} + \frac{K(-Q)}{r_B} + \frac{KQ}{r_C}$$

$$V_P = K \left(\frac{2(8.25n)}{(3\sqrt{3}/4)} + \frac{(-8.25n)}{(0.75)} + \frac{(8.25n)}{(0.75)} \right) = 114.31 \text{ V}$$

$$V = -114.31 \text{ V}$$

Pregunta 2:



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

$$d = 4.70 \text{ mm} = 0.0047 \text{ m}$$

$$h = 1.0 \text{ cm} = 0.01 \text{ m}$$

$$v_0 = 6.15 \times 10^7 \text{ m/s} \text{ (x-axis)}$$

$$v_{0x} = 6.15 \times 10^7 \text{ m/s} = v_x$$

$$x_0 = 0 \quad x_f = 0.1$$

$$a_x = 0$$

$$a_y = ?$$

$$v_{0y} = 0$$

$$y_f = 0$$

$$y_0 = 0.0047 \text{ m}$$

$$x_f = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$$

$$x_f = v_{0x}t$$

$$\frac{x_f}{v_{0x}} = t$$

$$v_{0x}$$

$$t = \frac{0.1}{6.15 \times 10^7 \text{ m/s}} = 1.626 \text{ ns}$$

$$t = 1.626 \times 10^{-9} \text{ s}$$

$$b) y_f = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$$

$$-y_0 = \frac{1}{2}a_y t^2$$

$$\frac{-2y_0}{t^2} = a_y$$

$$a_y = \frac{-2(0.0047)}{(1.626 \times 10^{-9})^2} =$$

$$a_y = -3.555 \times 10^{15} \text{ m/s}^2$$

$$a = 3.56 \times 10^{15} \text{ m/s}^2$$

$$a) E = \frac{am}{q} = \frac{(9.1094 \times 10^{-31})(3.56 \times 10^{15})}{(1.6022 \times 10^{-19})} =$$

$$E = 20,240.58 \text{ N/C}$$

$$E = 20.2 \text{ kN/C}$$

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c) $E = \frac{q_{enc}}{\epsilon_0 A}$ $\sigma = \epsilon_0 E$
 $\sigma = \epsilon_0 (20.2 \times 10^3)$
 $\sigma = 1.7885 \times 10^{-7}$

$E A = \frac{\sigma A}{\epsilon_0}$

$E \epsilon_0 = \sigma$

$\sigma = 178.9 \times 10^{-9} \text{ C/m}^2$

Pregunta 3:

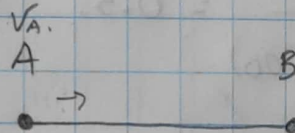
$m = 3 \text{ } \mu\text{g} \rightarrow 3 \text{ nkg}$

$q = 7.50 \text{ nC}$

$v_A = 45 \text{ m/s}$

$v_B = 120 \text{ m/s}$

$v_B - v_A = ?$



$W = \Delta K$

$W = \Delta V q$

$\Delta V = \frac{\Delta K}{q}$

$\Delta V = \frac{K_B - K_A}{q} = \frac{\frac{1}{2} m v_B^2 - \frac{1}{2} m v_A^2}{q}$

$\Delta V = \frac{\frac{1}{2} (3 \text{ n}) (120)^2 - \frac{1}{2} (3 \text{ n}) (45)^2}{(7.50 \text{ n})} = 2475 \text{ V}$

$\Delta V = 2.47 \text{ KV}$

Pregunta 4:

a)

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

$$U_f = -pE \cos 0^\circ = -(2 \times 10^{-9})(300) \cos 0^\circ = -6 \times 10^{-7}$$

$$-W = \Delta U$$

$$-W = -6 \times 10^{-7} - 0 = -6 \times 10^{-7}$$

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

$$W = 600 \times 10^{-9} \text{ J}$$

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

$$\tau = pE \sin \theta$$

$$\frac{\tau}{pE} = \sin \theta$$

$$\sin \theta = \frac{3 \times 10^{-7}}{(2 \times 10^{-9})(300)} = 0.5 \Rightarrow \theta = \sin^{-1}(0.5) = 30^\circ$$

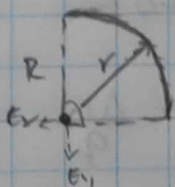
$$\theta = 30^\circ$$

Pregunta 5:

$$S = 3.50 \text{ m}$$

$$\lambda = 8 \text{ nC/m}$$

$$r = R$$



$$dE = \frac{k dq}{r^2}$$

$$S = R\theta$$

$$ds = R d\theta$$

$$dq = \lambda ds$$

$$dE = \frac{k \lambda R d\theta}{r^2}$$

$$\frac{S}{\pi/2} = R$$

$$\frac{3.5}{\pi/2} = R$$

$$dE = \frac{k \lambda R d\theta}{r^2} = \frac{k \lambda d\theta}{r} (\cos \theta + \sin \theta)$$

$$E_y = \frac{k \lambda}{3.5/\pi/2} \int_0^{\pi/2} d\theta \sin \theta = -\cos \theta \Big|_0^{\pi/2}$$

$$E = \sqrt{(32.3)^2 + (32.3)^2}$$

$$|E| = 45.6 \text{ N/C}$$

$$E_x = \frac{-k \lambda}{3.5/\pi/2} \cos \theta = -32.3 \text{ N/C}$$

$$E_x = \frac{-k \lambda}{3.5/\pi/2} \sin \theta \Big|_0^{\pi/2} = \frac{k \lambda}{3.5/\pi/2} \sin(\pi/2) = 32.3 \text{ N/C}$$

$$|E| = 45.6 \text{ N/C}$$