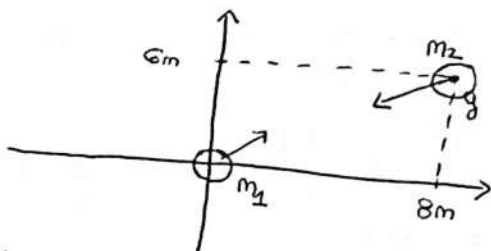


FÍSICA JUNIO 2022

A-1. $\vec{g}(8,6) = -\frac{Gm_2}{r^2} \cdot \vec{u}_r = -\frac{G \cdot 20}{40^2} \left(\frac{4}{5}\vec{i} + \frac{3}{5}\vec{j} \right)$

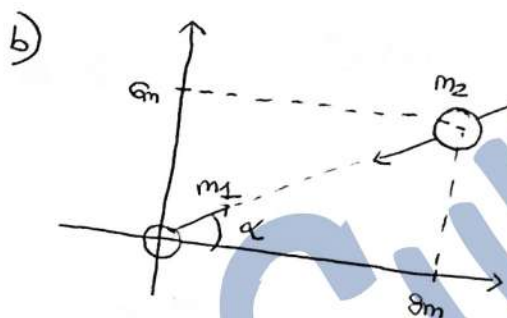
$$= -\frac{G}{10^2} (16\vec{i} + 12\vec{j}) = -\frac{6.67 \cdot 10^{-11}}{40^2} (16\vec{i} + 12\vec{j})$$

$$= -1.07 \cdot 10^{-11} \vec{i} - 0.8 \cdot 10^{-11} \vec{j} \frac{m}{s^2}$$



$\vec{F}_{12} = m_2 \cdot \vec{g}(8,6) = 3 \cdot (-1.07 \cdot 10^{-11} \vec{i} - 0.8 \cdot 10^{-11} \vec{j}) = -3.21 \cdot 10^{-11} \vec{i} - 2.4 \cdot 10^{-11} \vec{j} \text{ N}$

$m_2 = 3 \text{ Kg}$



$E_{m0} = E_{m\phi}$

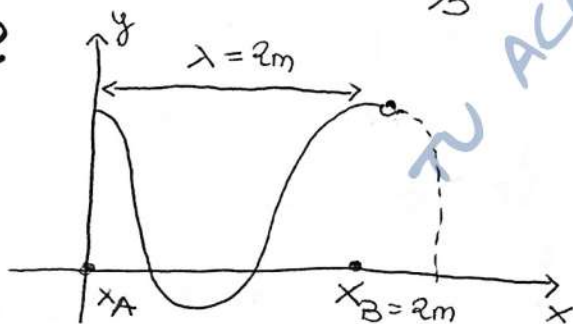
$$\frac{1}{2} m_2 \cdot v_0^2 = \frac{Gm_1 m_2}{r}$$

$$\frac{1}{c} = \frac{1}{c_0} - \frac{v_0^2}{2Gm_1} = \frac{1}{10} - \frac{(1.2 \cdot 10^{-5})^2}{2 \cdot 6.67 \cdot 10^{-11} \cdot 20} = \frac{307}{6670} \Rightarrow c = \frac{6670}{307} \approx 21.73 \text{ m}$$

$\vec{c} \left(21.73 \cdot \frac{4}{5}, 21.73 \cdot \frac{3}{5} \right) \text{ m} = 17.38 \vec{i} + 13.04 \vec{j} \text{ m}$

$\cos \alpha = 4/5$ $\sin \alpha = 3/5$

A-2



$\frac{T}{2} = 4 \text{ seg} \rightarrow T = 8 \text{ seg}$

$v = \frac{\lambda}{T} = \frac{2 \text{ m}}{8 \text{ seg}} = \frac{1}{4} = 0.25 \frac{\text{m}}{\text{seg}}$

$y(x,t) = A \sin(\omega t + kx + \phi_0)$

$y(0,0) = A \sin \phi_0$

$\sin \phi_0 = 1$

$\phi_0 = \pi/2 \text{ rad}$

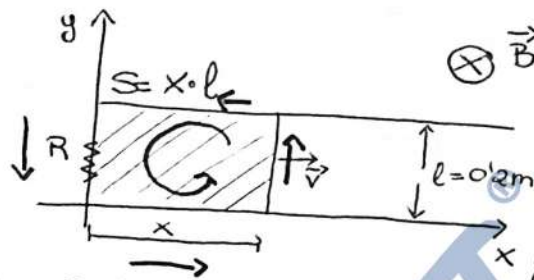
$A = 10 \text{ cm} = 0.1 \text{ m}$

$\omega = \frac{2\pi}{T} = \frac{2\pi}{8} = \frac{\pi}{4} \text{ rad/seg}$

$k = \frac{2\pi}{\lambda} = \frac{2\pi}{2} = \pi \text{ rad/m}$

$$y(x, t) = 0.1 \sin\left(\frac{\pi}{4}t + \pi x + \frac{\pi}{2}\right) \quad m \quad m = 0.1 \cos\left(\frac{\pi}{4}t + \pi x\right) m$$

A-3



$$\phi_m = \vec{B} \cdot \vec{S} = B \cdot S \cdot \cos \alpha = B \cdot S = B \cdot x \cdot l$$

$$\mathcal{E}_{ind} = -\frac{d\phi_m}{dt} = -B \cdot l \frac{dx}{dt} = \mathcal{E}_{ind} = -B \cdot l \cdot v$$

$$i_{ind} = \frac{\mathcal{E}_{ind}}{R} = \frac{B \cdot l \cdot v}{R} = \frac{0.4 \cdot 0.2 \cdot 2}{0.5} = 0.32 A \quad (\text{Anticlockwise})$$

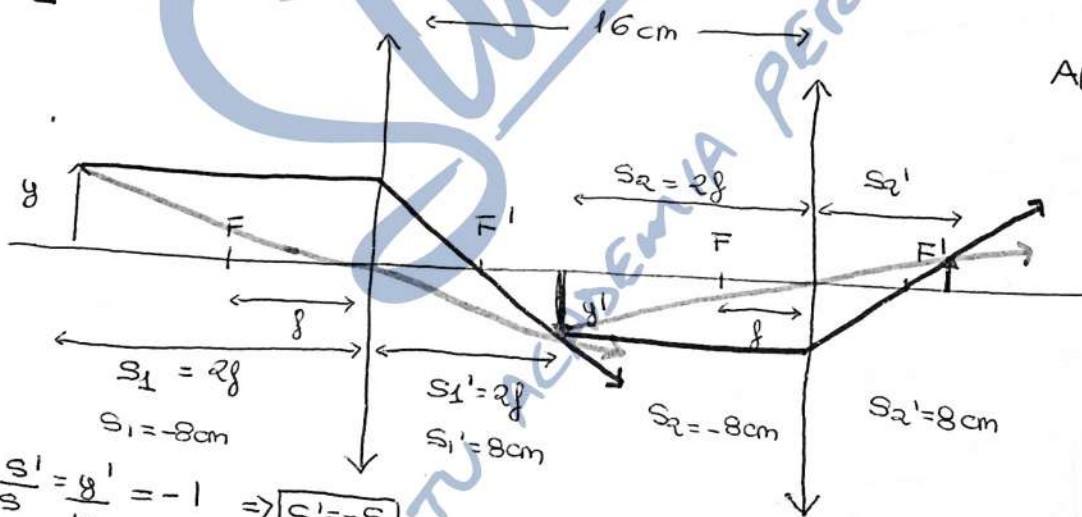
b) $\vec{F} = i \vec{l} \times \vec{B}$

$$\vec{F} = -0.32 \cdot 0.2 \cdot 0.4 \vec{z}$$

$$\vec{F} = -0.0256 \vec{z} N$$



A-4



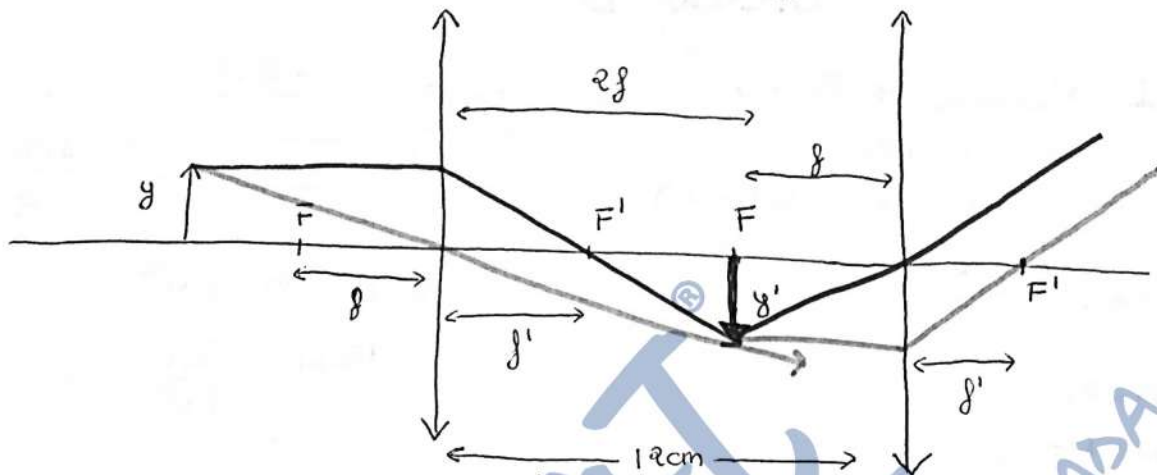
$A_{lateral} = -1$

$$A = \frac{s'}{s} = \frac{y'}{y} = -1 \Rightarrow \boxed{s' = -s}$$

$$\frac{1}{s'} - \frac{1}{s} = \frac{1}{f'}$$

$$\frac{1}{-s} - \frac{1}{s} = \frac{1}{f'} \Rightarrow f' = -\frac{s}{2} = +\frac{0.08}{2} = +0.04 m$$

$$P = \frac{1}{f'} = \frac{1}{0.04} = 25 \text{ dioptrías}$$



Se tiene que desplazar 4 cm a la izquierda

A-5 $\lambda = \frac{l}{n} = \frac{T/2}{\ln 2} = \frac{138'38}{\ln 2} = 199'64 \text{ días}$

$$\lambda = \frac{\ln 2}{T/2} = \frac{\ln 2}{138'38 \text{ d}} \cdot \frac{1 \text{ día}}{24 \text{ h}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 5'8 \cdot 10^{-8} \text{ seg}^{-1}$$

$$m_0 = 30 \text{ mg} = 30 \cdot 10^{-3} \text{ g} \cdot \frac{1 \text{ mol}}{240 \text{ g}} \cdot \frac{6'02 \cdot 10^{23} \text{ moléculas}}{1 \text{ mol}} = 8'6 \cdot 10^{19} \frac{\text{moléculas}}{\text{átomos}}$$

$$\Delta_0 = \lambda \cdot N_0 = 5'8 \cdot 10^{-8} \cdot (8'6 \cdot 10^{19}) = 4'988 \cdot 10^{12} \approx 5 \cdot 10^{12} \text{ Bq}$$

b) $m(t) = m_0 \cdot e^{-\lambda t}$

$$5 \text{ mg} = 30 \text{ mg} e^{-\lambda t} \rightarrow e^{-\lambda t} = \frac{5}{30} = \frac{1}{6} \rightarrow \ln(e^{-\lambda t}) = -\ln 6$$

$$t = T/2 \cdot \frac{\ln 6}{\ln 2} = 357'7 \text{ días}$$

$$\lambda t = \ln 6$$

$$t = \frac{\ln 6}{\lambda}$$

OPCIÓN B

B-1 $v_{\text{escape}} \rightarrow E_m = 0$

$$E_m = E_c + E_p$$

$$0 = \frac{1}{2} m v_e^2 + \left(\frac{-G M_p \cdot m}{R_p} \right)$$

$$v_e = \sqrt{\frac{2 G M_p}{R_p}}$$

$$R_M = R_T / 2$$

$$M_M = M_T / 10$$

$$\frac{v_{eT}^2}{v_{eM}^2} = \frac{\frac{2 G M_T}{R_T}}{\frac{2 G M_T / 10}{R_T / 2}} = \frac{1}{1/10} \cdot \frac{1/2}{1} = 5$$

$$v_{eT}^2 = 5 \cdot v_{eM}^2$$

$$v_{eM} = \frac{v_{eT}}{\sqrt{5}}$$

b) $E_{m0} = E_{m1}$

$$\frac{1}{2} m \left(\frac{v_{eT}}{\sqrt{5}} \right)^2 - \frac{G M M_T}{R_T} = - \frac{G m M_T}{r}$$

$$v_{eT}^2 = \frac{2 G M_T}{R_T}$$

$$\frac{1}{2} \cdot \frac{2 G M_T}{5 R_T} - \frac{G M_T}{R_T} = - \frac{G M_T}{r}$$

$$r = \frac{5}{4} R_T$$

$$\frac{1}{r} = \frac{1}{R_T} - \frac{1}{5 R_T} = \frac{4}{5 R_T}$$

$$h = r - R_T = \frac{5}{4} R_T - \frac{4}{4} R_T = \frac{R_T}{4} = \frac{6'37 \cdot 10^6}{4} = 1'59 \cdot 10^6 \text{ m}$$

$$r = 7'96 \cdot 10^6 \text{ m}$$

B-2 $\beta = 10 \log_{10} \frac{I}{I_0}$

$$I = I_0 \cdot 10^{\beta/10}$$

$$I = \frac{P}{S} = \frac{P}{4\pi r^2}$$

$$I_A = I_0 \cdot 10^6$$

$$I_B = I_0 \cdot 10^8$$

$$I_1 \cdot r_1^2 = I_2 \cdot r_2^2$$

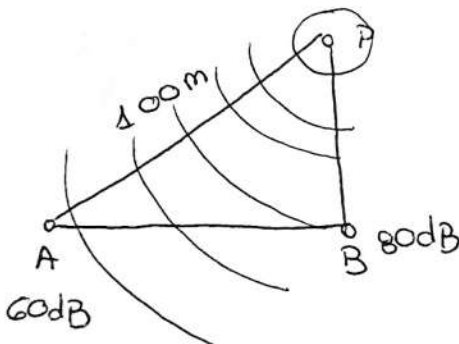
$$I_A \cdot r_A^2 = I_B \cdot r_B^2$$

↓
h

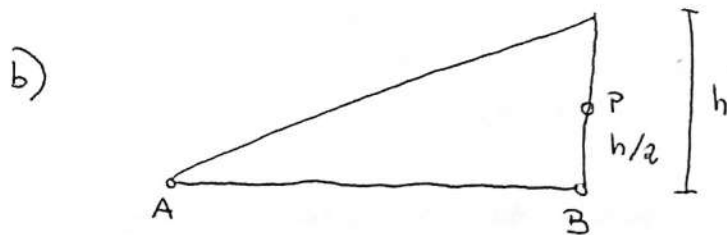
$$h^2 = \frac{I_A}{I_B} \cdot r_A^2$$

$$h^2 = \frac{I_0 \cdot 10^6 \cdot 10^4}{I_0 \cdot 10^8}$$

$$h = 10 \text{ m}$$



$$P = I \cdot 4\pi r^2 = I_0 \cdot 10^6 \cdot 4\pi \cdot 10^4 = 4\pi \cdot 10^{-12+10} = 4\pi \cdot 10^{-2} \text{ W}$$

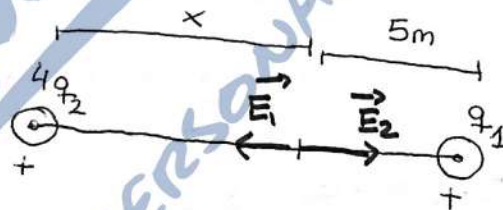
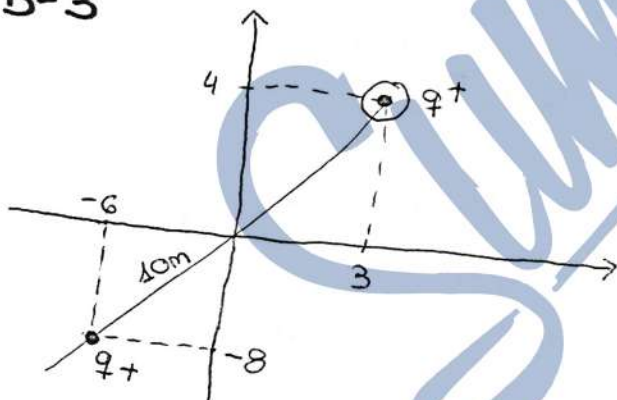


$$I_B = \frac{P}{4\pi \cdot 10^2} + \frac{P}{4\pi \cdot 5^2} = \frac{P}{4\pi} \left(\frac{1}{100} + \frac{1}{25} \right) = \frac{P}{4\pi} \cdot \frac{5}{100}$$

$$I_B = \frac{5 \cdot 4\pi \cdot 10^{-2}}{4\pi \cdot 10^2} = 5 \cdot 10^{-4} \frac{W}{m^2}$$

$$\beta_B = 10 \log_{10} \frac{5 \cdot 10^{-4}}{10^{-12}} = 87 \text{ dB}$$

B-3



$$E_1 = E_2$$

$$\frac{k \cdot 4q}{x^2} = \frac{kq}{5^2}$$

$$x^2 = 100 \rightarrow x = 10 \text{ m}$$

$$V(0,0) = 1'08 \cdot 10^4 \text{ V}$$

$$V = \frac{kq}{5} + \frac{4kq}{10} = \frac{3}{5} kq$$

$$q_1 = 2 \mu\text{C}$$

$$q_2 = 8 \mu\text{C}$$

$$\rightarrow q = \frac{5}{3} \frac{V(0,0)}{k} = \frac{5}{3} \frac{(1'08 \cdot 10^4)}{9 \cdot 10^9}$$

$$q = 2 \cdot 10^{-6} \text{ C}$$

B-4

$$n = \frac{c}{v} \quad \rightarrow \quad c = n_1 \cdot v_1 = n_2 \cdot v_2$$

$$v = \lambda \cdot \omega$$

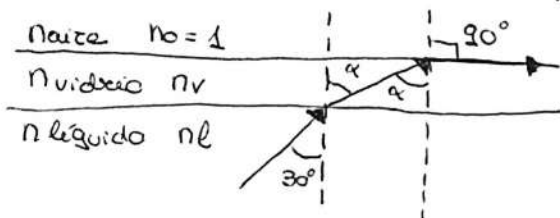
$$\lambda v = 0.7 \cdot \lambda_0$$

La frecuencia no varía al pasar de un medio a otro.

$$n_v \cdot \lambda v = n_0 \cdot \lambda_0$$

$$\lambda v = \frac{\lambda_0}{n_v} = 0.7 \lambda_0$$

$$n_v = \frac{1}{0.7} = 1.43$$



liq - vid
vid - aire

$$n_l \cdot \sin 30^\circ = n_v \cdot \sin \alpha = 1$$

$$n_v \cdot \sin \alpha = n_0 \cdot \sin 90^\circ = 1$$

$$n_l = \frac{1}{\sin 30^\circ} = 2$$

B-5

$$E_{ce} = E_f = h \cdot \omega = h \cdot \frac{c}{\lambda} = \frac{6.63 \cdot 10^{-34} \cdot 3 \cdot 10^8}{5 \cdot 10^{-12}} = 3.978 \cdot 10^{-14} \text{ J}$$

$$E_{ce} = \frac{3.978 \cdot 10^{-14} \text{ J}}{1.6 \cdot 10^{-19} \text{ J/eV}} = 2.49 \cdot 10^5 \text{ eV}$$

b)

$$E_c = E - E_0 = \gamma E_0 - E_0 = (\gamma - 1) E_0 = (\gamma - 1) m_0 \cdot c^2 = E_f$$

$$\gamma - 1 = \frac{E_f}{m_0 \cdot c^2} = \frac{3.978 \cdot 10^{-14}}{9.1 \cdot 10^{-31} \cdot (3 \cdot 10^8)^2} = 0.4857$$

$$\gamma = \frac{1}{\sqrt{1 - \beta^2}} \quad \rightarrow \quad \beta = \frac{v}{c} \quad \rightarrow \quad 1 - \beta^2 = \frac{1}{\gamma^2}$$

$$\rightarrow \gamma = 1.4857$$

$$\beta = \sqrt{1 - \frac{1}{\gamma^2}} = 0.739 \approx 0.74$$

$$v = 0.74 \cdot c$$

$$v = 2.22 \cdot 10^8 \text{ m/s}$$