EXAMEN EVAU FÍSICA 2022

A1

a)

$$r_{12} = \sqrt{8^2 + 6^2} = 10$$

$$\overrightarrow{u_{12}} = \frac{\overrightarrow{r_{12}}}{r_{12}} = \frac{(8,6)}{10}$$

$$\vec{E} = -G\frac{m_1}{r_{12}^2}\overrightarrow{u_{12}} = -6{,}67 \cdot 10^{-11} \cdot \frac{20}{10^2} \cdot \frac{(8,6)}{10} = (-1{,}07 \cdot 10^{-11}\,\vec{\imath} - 8 \cdot 10^{-12}\vec{\jmath})\ N/kg$$

$$\vec{F} = m_2 \cdot \vec{g} = (-3{,}21 \cdot 10^{-11}\,\vec{\imath} - 2{,}4 \cdot 10^{-11}\,\vec{\jmath})\ N$$

b)

$$E_{m_f} = E_{m_i} \rightarrow E_{c_f} + E_{p_f} = E_{c_i} + E_{p_i} \rightarrow E_{c_f} = 0 \rightarrow$$

$$-G\frac{m_1 m_2}{r_f} = \frac{1}{2}m_2 v_i^2 - G\frac{m_1 m_2}{r_i} \rightarrow -G\frac{m_1}{r_f} = \frac{1}{2}v_i^2 - G\frac{m_1}{r_i}$$

$$r_f = \frac{-Gm_1}{\frac{1}{2}v_i^2 - G\frac{m_1}{r_i}} = \frac{-6{,}67 \cdot 10^{-11} \cdot 20}{\frac{1}{2} \cdot (1{,}2 \cdot 10^{-5})^2 - 6{,}67 \cdot 10^{-11} \cdot \frac{20}{10}} = 21{,}73\ m$$

A2

a)

$$\left.\begin{matrix} \lambda = 2\ m \\ T = 8\ s \end{matrix}\right\} v = \frac{\lambda}{T} = \frac{2}{8} = 0{,}25\ m/s$$

b)

Como nos dicen que en el instante inicial la onda tiene velocidad cero y desplazamiento positivo, significa que la onda comienza en el 0,0 en +A. Será muy cómodo por tanto expresar la onda como una onda de tipo coseno sin desfase inicial.

A3

a)

$$S = 0{,}2 \cdot 2t$$

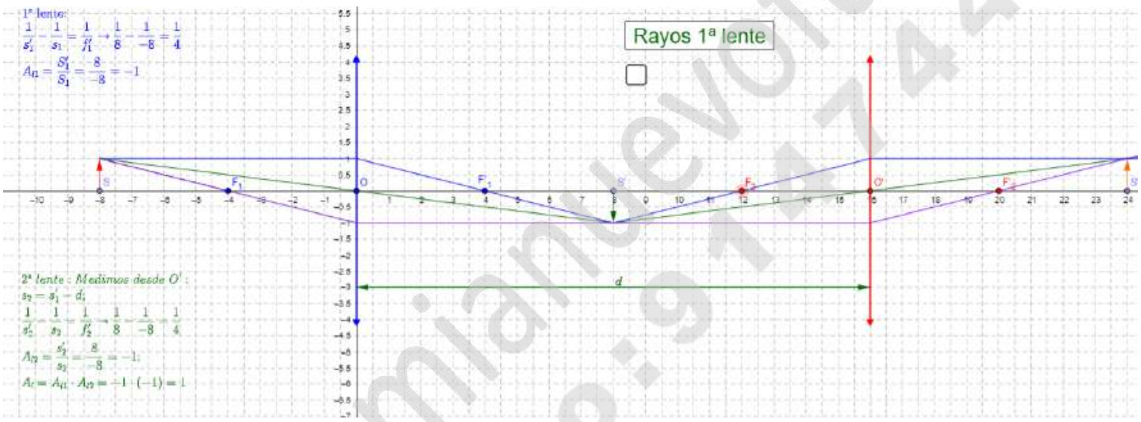
$$\phi = B \cdot S = -0{,}4 \cdot 0{,}2 \cdot 2t = -0{,}16\, t\ Wb$$

$$\varepsilon = -\frac{d\phi}{dt} = 0{,}16\ V \rightarrow I = \frac{\varepsilon}{R} = \frac{0{,}16}{0{,}5} = 3{,}2\ A$$

b)

$$\vec{F} = I \cdot (\vec{l} \times \vec{B}) \rightarrow l \perp B \rightarrow F = IlB = 3{,}2 \cdot 0{,}2 \cdot 0{,}4 = 0{,}256\ N$$

A4



a)

$$M_A = -1 \rightarrow \frac{s'_A}{s_A} = \frac{y'_A}{y_A} = -1 \rightarrow s'_A = -s_A$$

$$\frac{1}{s'_A} + \frac{1}{s_A} = \frac{1}{f'_A} \rightarrow \frac{2}{s'_A} = \frac{1}{f'_A} \rightarrow f'_A = \frac{s'_A}{2} \rightarrow (Igual\ para\ B)$$

$$s'_A = \frac{d}{2} = \frac{16}{2} = 8\ cm$$

$$f'_A = \frac{s'_A}{2} = 4\ cm$$

$$P_A = P_B = \frac{1}{f'_A} = \frac{1}{0{,}04} = 25\ dioptrias$$

b)

Para que esto ocurra la imagen de la primera lente tiene que quedar sobre el foco de la segunda, por lo que debemos mover la lente hacia la izquierda 4 cm.

A5

a)

$$m_0 = 30\ mg$$

$$T_{\frac{1}{2}} = 138{,}38\ días$$

$$\lambda = \frac{\ln 2}{T_{\frac{1}{2}}} = 0{,}005009\ días^{-1} = 5{,}797 \cdot 10^{-8}\ s^{-1}$$

$$\tau = 1{,}72 \cdot 10^{7}\ s$$

$$N_0 = 30 \cdot 10^{-6}\ kg \cdot \frac{1\ mol}{210 \cdot 1{,}66 \cdot 10^{-27}\ kg} \cdot \frac{6{,}02 \cdot 10^{23}\ núcelos}{1\ mol} = 5{,}18 \cdot 10^{43}\ núcleos$$

$$A_0 = \lambda N_0 = 3 \cdot 10^{36}\ Bq$$

b)

$$m = m_0 \cdot e^{-\lambda t}; \frac{m}{m_0} = e^{-\lambda t} \rightarrow \ln \frac{m}{m_0} = -\lambda t \rightarrow t = \frac{\ln \frac{m}{m_0}}{-\lambda} = \frac{\ln \frac{5}{30}}{-0{,}005009\ días^{-1}} = 357{,}71\ días$$

B1

$$M_M = \frac{M_T}{10}; r_M = \frac{r_T}{2}$$

a)

$$v_e = \sqrt{\frac{2GM}{r}} \rightarrow \frac{v_{e_M}}{v_{e_T}} = \frac{\sqrt{\frac{2GM_m}{r_M}}}{\sqrt{\frac{2GM_T}{r_T}}} = \sqrt{\frac{2}{10}} = \sqrt{\frac{1}{5}} = \frac{\sqrt{5}}{5} \rightarrow v_{e_M} = \frac{\sqrt{5}}{5} v_{e_T}$$

b)

$$\Delta E_m = 0$$

$$E_{m_f} = E_{m_i}$$

$$-G\frac{Mm}{r_f} = \frac{1}{2}mv_i^2 - G\frac{Mm}{r_i} \rightarrow r_f = \frac{-GM_T m}{\frac{1}{2}mv_i^2 - G\frac{M_T m}{r_i}} = \frac{-GM_T}{\frac{1}{2}\frac{2GM_T\sqrt{5}}{r_T 5} - G\frac{M_T}{r_T}} =$$

$$= \frac{-r_T}{\frac{\sqrt{5}}{5} - 1} = 1{,}8\, r_T = 1{,}15 \cdot 10^7\ m$$

$$h = 1{,}8\, r_T - r_T = 0{,}8\, r_T = 5 \cdot 10^6\ m$$

B2

a)

$$\beta_a = 10 \log \frac{I_A}{I_0} \rightarrow I_A = I_0\, 10^{\frac{\beta_A}{10}} = 10^{-12} \cdot 10^{\frac{60}{10}} = 10^{-6}\ W/m^2$$

$$I_A = \frac{P}{4\pi r_A^2} \rightarrow P = I_A \cdot 4 \cdot \pi \cdot r_A^2 = 10^{-6} \cdot 4 \cdot \pi \cdot 100^2 = 0{,}13\ W;$$

$$I_B = I_0 \cdot 10^{\frac{\beta_B}{10}} = 10^{-4}\ W/m^2$$

$$I_B = \frac{P}{4\pi r_B^2} \rightarrow r_B = \sqrt{\frac{P}{4\pi I_B}} = \sqrt{\frac{0{,}13}{4\pi \cdot 10^{-4}}} = 10{,}17\ m = h$$

b)

$$I_{B_t} = I_{B_1} + I_{B_2}$$

$$I_{B_1} = 10^{-4}\ W/m^2$$

$$I_{B_2} = \frac{P}{4\pi\left(\frac{h}{2}\right)^2} = \frac{0{,}13}{4\pi\left(\frac{10{,}17}{2}\right)^2} = 4 \cdot 10^{-4}\, W/m^2$$

$$I_{B_T} = 10^{-4} + 4 \cdot 10^{-4} = 5 \cdot 10^{-4} \rightarrow \beta = 10 \log \frac{5 \cdot 10^{-4}}{10^{-12}} = 10 \log 5 \cdot 10^8 = 86{,}99\, dB$$

B3

a)

Como el campo se anula en (0,0), la carga se ha de colocar en la recta que pasa por (0,0) y (3,4). Es un problema unidimensional. $Q_2 = 4Q_1$.

$$E_{10} = k\frac{Q_1}{r_{1,0}^2} = k\frac{Q_2}{r_{2,0}^2} = E_{20}$$

$$r_{10} = \sqrt{3^2 + 4^2} = 5$$

$$k\frac{Q_1}{r_{1,0}^2} = k\frac{4Q_1}{r_{2,0}^2} \rightarrow \frac{1}{r_{1,0}^2} = \frac{4}{r_{2,0}^2} \rightarrow r_{2,0} = \sqrt{4r_{10}^2} = 2r_{10} = 2 \cdot 5 = 10\, m$$

$$\begin{cases} r_{2x} = -r_{20} \cdot \cos\alpha = -10 \cdot \frac{3}{5} = -6\,\vec{\imath}\, m \\ r_{2y} = -r_{20} \cdot sen\,\alpha = -10 \cdot \frac{4}{5} = -8\,\vec{\jmath}\, m \end{cases}$$

b)

$$V_{0,0} = 1{,}08 \cdot 10^4 = V_{10} + V_{20} = k\frac{Q_1}{r_{10}} + k\frac{Q}{r_{20}} = K\left(\frac{Q_1}{r_{10}} + \frac{4Q_1}{r_{20}}\right) =$$

$$= k\left(\frac{r_{20}Q_1 + r_{10}4Q_1}{r_{10}r_{20}}\right) = \frac{K}{r_{10}r_{20}}(r_{20} + 4r_{10})Q_1 \rightarrow Q_1 = \frac{V_{0,0}r_{10}r_{20}}{k(r_{20} + 4r_{10})} =$$

$$Q_1 = \frac{1{,}08 \cdot 10^4 \cdot 5 \cdot 10}{9 \cdot 10^9(10 + 4 \cdot 5)} = 2 \cdot 10^{-10}\, C$$

B4

a)

$$\lambda_v = 0{,}7\,\lambda_{aire} \rightarrow \frac{v_v}{f} = 0{,}7\frac{v_{aire}}{f} \rightarrow v_v = 0{,}7c \rightarrow \frac{c}{n_v} = 0{,}7c \rightarrow n_v = \frac{1}{0{,}7} = 1{,}43$$

b)

$$n_l \cdot sen\,30 = n_v \cdot sen\,\beta \,; n_v\, sen\,\beta = n_v\, sen\,\alpha = n_a\, sen\,90$$

$$n_l\, sen\,30 = n_a \rightarrow n_l = \frac{1}{sen\,30} = 2$$

B5

a)

$$E_{c_{e^-}} = E_\gamma = h\nu = h\frac{c}{\lambda} = 6{,}63 \cdot 10^{-34} \cdot \frac{3 \cdot 10^8}{5 \cdot 10^{-12}} = 3{,}98 \cdot 10^{-14}\, J = 248750\, eV$$

b)

$$E_c = (\gamma - 1)mc^2 = 3{,}98 \cdot 10^{-14}\, J \rightarrow \gamma - 1 = \frac{3{,}98 \cdot 10^{-14}}{9{,}1 \cdot 10^{-31} \cdot 3 \cdot 10^{8^2}} = 0{,}486$$

$$\gamma = 1{,}486$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \rightarrow \gamma^2 = \frac{1}{1 - \frac{v^2}{c^2}} \rightarrow v = c\sqrt{1 - \frac{1}{\gamma^2}} = 2{,}22 \cdot 10^8\, m/s$$