

OPCION A

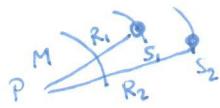
MODELO 6

$$\textcircled{1} \quad T_1 = 4'52 \text{ días} \quad R_1 = 5'27 \times 10^8 \text{ m} \quad G = 6'67 \times 10^{-11} \text{ N} \cdot \text{m}^2 \text{ kg}^{-2}$$

$$T_2 = 15'9 \text{ días}$$

$$\text{a) } F_g = F_c$$

$$\frac{G M \cdot m}{r^2} = \frac{mv^2}{r} = \frac{m\omega^2 r^2}{r} = \frac{m4\pi^2 r}{T^2}$$



$$\frac{G M \cdot m}{r^2} = \frac{m4\pi^2 r}{T^2} \rightarrow M = \frac{4\pi^2 r^3}{GT^2} \quad \begin{matrix} r = R_1 \\ T = T_1 \end{matrix}$$

$$M = \frac{4\pi^2 (5'27 \cdot 10^8)^3}{6'67 \cdot 10^{-11} \cdot (4'52 \cdot 24 \cdot 3600)^2} = 5'68 \cdot 10^{26} \text{ kg}$$

$$\text{b) } \frac{R_1^3}{T_1^2} = \frac{R_2^3}{T_2^2} \rightarrow \frac{(5'27 \cdot 10^8)^3}{(4'52)^2} = \frac{R_2^3}{(15'9)^2} \quad \boxed{R_2 = 1'22 \cdot 10^9 \text{ m}}$$

$$\text{c) } E_{PS_2} = E_{PS_1} + W \quad m = \text{masa del meteorito}$$

$$-G \frac{M \cdot m}{R_2} = -G \frac{M \cancel{m}}{R_1} + \frac{1}{2} mv^2$$

$$- \frac{6'67 \cdot 10^{-11} \cdot 5'68 \cdot 10^{26}}{1'22 \cdot 10^9} = - \frac{6'67 \cdot 10^{-11} \cdot 5'68 \cdot 10^{26}}{5'27 \cdot 10^8} + \frac{1}{2} v^2$$

$$-31053770'5 = -71889184'1 + \frac{1}{2} v^2 \quad \boxed{v = 9037'2 \text{ m/s}}$$

$$\textcircled{2} \quad m = 6'64 \cdot 10^{-26} \text{ kg}$$

$$\Delta V = 5025 \text{ V}$$

$$B = 0'1 \text{ T}$$

$$r = 45'68 \text{ cm} = 45'68 \cdot 10^{-2} \text{ m}$$

$$\text{a) } F_m = F_c$$

$$\vec{F}_m = q(\vec{v} \times \vec{B}) \quad \vec{v} \perp \vec{B}$$

$$qvB = \frac{mv^2}{r}$$

$$F = qvB \sin 90^\circ = qvB$$

$$q = \frac{mv}{rB} \quad \text{en principio}$$

Calculamos la v con la que entra el ion en el campo magnético

$$W = q\Delta V \quad \frac{1}{2} mv^2 = q\Delta V \quad v = \sqrt{\frac{2q\Delta V}{m}}$$

$$q = \frac{m\sqrt{\frac{2q\Delta V}{m}}}{rB} \rightarrow q^2 = \frac{m^2 \frac{2q\Delta V}{m}}{r^2 B^2}$$

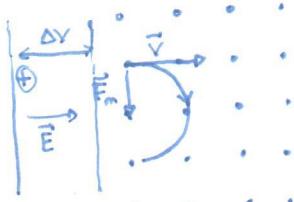
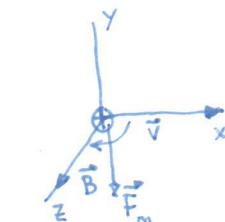
$$q = \frac{2m\Delta V}{r^2 B^2} \rightarrow q = \frac{2 \cdot 6'64 \cdot 10^{-26} \cdot 5025}{(45'68 \cdot 10^{-2})^2 \cdot 0'1^2} = 3'198 \cdot 10^{-19} \text{ C}$$

$$\boxed{q = 3'2 \cdot 10^{-19} \text{ C}}$$

$$\text{b) } E_C = W = q\Delta V = 3'2 \cdot 10^{-19} \cdot 5025$$

$$E_C = 1'608 \cdot 10^{-15} \text{ J}$$

$$\boxed{E_C = 1'61 \cdot 10^{-15} \text{ J}}$$



$$(3) V = 1000 \text{ MHz} = 10^9 \text{ Hz}$$

$$P = 1 \text{ kW} = 1000 \text{ W}$$

$$\text{a)} n = \frac{P}{E} \quad E = hV = 6.63 \cdot 10^{-34} \cdot 10^9 = 6.63 \cdot 10^{-25} \text{ J.}$$

$$n = \frac{1000}{6.63 \cdot 10^{-25}} = 1.5 \cdot 10^{27} \text{ fotoños/s}$$

$$\text{b)} I = \frac{P}{4\pi r^2} = \frac{1000}{4\pi \cdot (200 \cdot 10^3)^2} = 1.989 \cdot 10^{-9} \text{ W.}$$

$$\text{c)} \beta = 10 \log \frac{I}{I_0} \rightarrow 160 = 10 \log \frac{I}{10^{-12}} \quad 16 = \log \frac{I}{10^{-12}}$$

$$10^{16} = \frac{I}{10^{-12}} \quad \boxed{I = 10^4 \text{ W/m}^2}$$

$$(4) n = 1.5 \quad f = -20 \text{ cm} \Rightarrow \text{lente convergente} \Leftrightarrow \text{proyector}$$

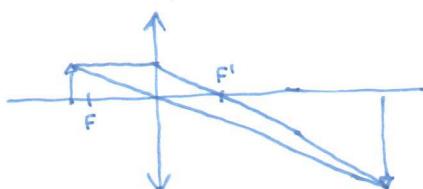


IMAGEN REAL, INVERTIDA
Y DE MAYOR TAMAÑO QUE EL
OBJETO.

$$\text{a)} n = \frac{c}{v} \rightarrow v = \frac{c}{n} = \frac{3 \cdot 10^8}{1.5} = 2 \cdot 10^8 \text{ m.s}^{-1}$$

$$\text{b)} \frac{1}{s} - \frac{1}{s'} = \frac{1}{f} = (1-n) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\begin{array}{lll} R_1 > 0 & \frac{1}{-20} = (1-1.5) \left(\frac{1}{-R_2} - \frac{1}{R_2} \right) \\ R_2 < 0 & \\ R_1 = -R_2 & \end{array}$$

$$\frac{1}{-20} = -0.5 \left(-\frac{2}{R_2} \right) \rightarrow \boxed{R_2 = -20 \text{ cm}} \\ \boxed{R_1 = 20 \text{ cm}}$$

$$\text{c)} s' = 4 \text{ m} = 400 \text{ cm}$$

$$\frac{1}{s} - \frac{1}{s'} = \frac{1}{-20}$$

$$\frac{1}{s} - \frac{1}{400} = -\frac{1}{20} \quad \frac{1}{s} = \frac{1}{400} - \frac{1}{20} = \frac{1-20}{400} = -\frac{19}{400}$$

$$\boxed{s = -21.05 \text{ cm}}$$

$$(5) \text{a)} m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{9.11 \cdot 10^{-31}}{\sqrt{1-(0.7c)^2}} = \frac{9.11 \cdot 10^{-31}}{\sqrt{1-0.49}} = 1.275 \cdot 10^{-30} \quad \boxed{m = 1.28 \cdot 10^{-30} \text{ kg}}$$

$$\text{b)} E_C = \frac{1}{2} m_0 v^2 = \frac{1}{2} m_0 (0.7c)^2 = \frac{1}{2} m_0 0.49 c^2$$

$$E_{Cr} = \Delta E = E - E_0 = mc^2 - m_0 c^2 = (m - m_0) c^2$$

$$\frac{E_C}{E_{Cr}} = \frac{\frac{1}{2} m_0 0.49 c^2}{(m - m_0) c^2} = \frac{\frac{1}{2} 9.11 \cdot 10^{-31} \cdot 0.49}{1.275 \cdot 10^{-30} - 9.11 \cdot 10^{-31}} = \frac{2.23 \cdot 10^{-31}}{3.64 \cdot 10^{-31}} = 0.6126$$

$$\boxed{\frac{E_C}{E_{Cr}} = 0.613}$$

OPCIÓN B

MODELO 6

$$\textcircled{1} \quad \left. \begin{array}{l} h_1 = 593 \text{ km} = 593000 \text{ m} \\ R_T = 6371 \text{ km} = 6371 \cdot 10^6 \text{ m} \end{array} \right\} r_1 = h_1 + R_T = 593 \cdot 10^5 + 6371 \cdot 10^6 = 6964000 \text{ m} = 6.964 \cdot 10^6 \text{ m.}$$

$$h_2 = 415 \text{ km} = 415000 \text{ m} \quad \left. \begin{array}{l} r_2 = h_2 + R_T = 415 \cdot 10^5 + 6371 \cdot 10^6 = 6786000 \text{ m} = 6.786 \cdot 10^6 \text{ m} \end{array} \right\}$$

$$\text{a) } F_g = P \rightarrow G \frac{Mm}{r^2} = mg \quad g = G \frac{M}{r^2} \quad r = r_1 \quad G, M_T, R_T$$

$$g = 6.67 \cdot 10^{-11} \cdot \frac{5.97 \cdot 10^{24}}{(6.964 \cdot 10^6)^2} = \underline{\underline{9.81 \text{ m.s}^{-2}}}$$

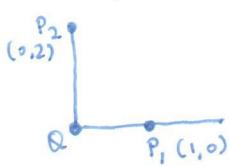
$$\text{b) } E_{m_H} = E_{m_{EE}} + W$$

$$-G \frac{Mm}{2r_1} = -G \frac{Mm}{2r_2} + W$$

$$- \frac{6.67 \cdot 10^{-11} \cdot 5.97 \cdot 10^{24} \cdot 100}{2 \cdot 6.964 \cdot 10^6} = - \frac{6.67 \cdot 10^{-11} \cdot 5.97 \cdot 10^{24} \cdot 100}{2 \cdot 6.786 \cdot 10^6} + W$$

$$-2.86 \cdot 10^9 = -2.93 \cdot 10^9 + W \quad \underline{\underline{W = 7.1 \cdot 10^7 \text{ J}}}$$

$$\textcircled{2} \quad Q = q = 3 \mu\text{C} \quad q_1 = 1 \mu\text{C}$$



$$\text{a) } V_{P_1} = k \frac{Q}{r_1} = 9 \cdot 10^9 \frac{3 \cdot 10^{-6}}{1} = 27000 \text{ V}$$

$$V_{P_2} = k \frac{Q}{r_2} = 9 \cdot 10^9 \cdot \frac{3 \cdot 10^{-6}}{2} = 13500 \text{ V}$$

$$V_{P_2} - V_{P_1} = 13500 - 27000 = \underline{\underline{-13500 \text{ V}}}$$

$$\text{b) } W_{P_1} = q_1 (V_{P_1} - V_{P_2}) = 10^{-6} (27000 - 13500) = \underline{\underline{1.35 \cdot 10^{-2} \text{ J}}}$$

$W > 0$ W realizado por las fuerzas del campo

$$\textcircled{3} \quad v = 3 \text{ m/s}$$

$$\begin{matrix} x=0 \\ t=0 \end{matrix} \quad y = A \sin \varphi_0$$

$$A = 0.12 \text{ m}$$

$$\nu = 23 \text{ Hz}$$

$$\text{a) } v = \frac{\lambda}{T} = \lambda \nu \rightarrow \lambda = \frac{v}{\nu} = \frac{3}{23} = \underline{\underline{0.13 \text{ m}}}$$

$$\text{b) } y = A \sin (\omega t - kx + \varphi_0) \quad y(0,0) = A = A \sin \varphi_0 \quad \sin \varphi_0 = 1 \quad \varphi_0 = \frac{\pi}{2}$$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{0.13} \text{ m}^{-1} = 15.33 \pi \text{ m}^{-1} \quad \omega = 2\pi\nu = 2\pi \cdot 23 = 46\pi \text{ rad/s}$$

$$\underline{\underline{y = 0.12 \sin (46\pi t - 15.33\pi x + \frac{\pi}{2})}}$$

$$\text{c) } v = \frac{dy}{dt} = 0.12 \cdot 46\pi \cos (46\pi t - 15.33\pi x + \frac{\pi}{2}) \quad t = 7 \text{ s} \quad x = 0.3 \text{ m}$$

$$v = 0.12 \cdot 46\pi \cos \left(46\pi \cdot 7 - 15.33\pi \cdot 0.3 + \frac{\pi}{2} \right) = \underline{\underline{16.5 \text{ m/s}}}$$

④

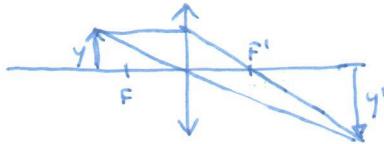
$$f = -15 \text{ cm}$$

a) $m = -2$

$$\frac{1}{s} - \frac{1}{s'} = \frac{1}{f} \rightarrow \frac{1}{s} - \frac{1}{s'} = \frac{1}{-15}$$

$$m = \frac{s'}{s} \rightarrow -2 = \frac{s'}{s} \rightarrow s' = -2s$$

$$\frac{1}{s} - \frac{1}{-2s} = \frac{1}{-15} \rightarrow \frac{1}{s} + \frac{1}{2s} = \frac{1}{-15} \rightarrow \frac{2+1}{2s} = \frac{1}{-15} \rightarrow \frac{2s}{3} = -15$$

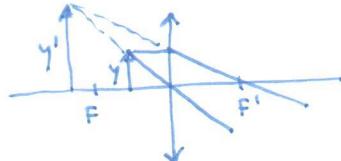


$$\boxed{s = -22.5 \text{ cm}}$$

b) $m = 2$

$$\frac{1}{s} - \frac{1}{s'} = \frac{1}{f} \rightarrow \frac{1}{s} - \frac{1}{s'} = \frac{1}{-15}$$

$$2 = \frac{s'}{s} \rightarrow s' = 2s \rightarrow \frac{1}{s} - \frac{1}{2s} = \frac{1}{-15} \rightarrow \frac{2-1}{2s} = \frac{1}{-15} \rightarrow 2s = -15$$



$$\boxed{s = -7.5 \text{ cm}}$$

⑤

$$^{18}\text{F} \quad \text{a)} \quad T_c = 110 \text{ min.} \quad \lambda = \frac{1}{T_c} = \frac{1}{110.60} = 1.515 \cdot 10^{-4} \text{ s}^{-1} \approx 1.52 \cdot 10^{-4} \text{ s}^{-1}$$

$$m_0 = 10 \mu\text{g} = 10 \cdot 10^{-6} = 10^{-5} \text{ g.}$$

$$N_0 = n N_A = \frac{10^{-5}}{18} \cdot 6.02 \cdot 10^{23} = 3.34 \cdot 10^{17} \text{ núcleos de } ^{18}\text{F}$$

$$A_0 = \lambda N_0 = 1.52 \cdot 10^{-4} \cdot 3.34 \cdot 10^{17} = 5.06 \cdot 10^{13} \text{ Bq}$$

$$\text{b)} \quad 1\% m_0 = \frac{1}{100} \cdot 10^{-5} = 10^{-7} \text{ g}$$

$$m = m_0 e^{-\lambda t} \rightarrow 10^{-7} = 10^{-5} e^{-1.515 \cdot 10^{-4} t}$$

$$1\% \quad 0.01 = e^{-1.515 \cdot 10^{-4} t} \\ \ln 0.01 = -1.515 \cdot 10^{-4} t$$

$$t = 30397.5 = \boxed{8144 \text{ h}}$$