Examen Selectividad Física Madrid 2019

Geek Minds
Centro de estudios

Opción B

Pregunta 1:

$m = 5.900\ kg$; $T = 24h = 86.400(s)$

a) $\frac{m \cdot V^2}{r} = \frac{G \cdot M_T \cdot m}{r^2} \rightarrow V^2 = \frac{G \cdot M_T}{r} \rightarrow V = \sqrt{\frac{G \cdot M_T}{r}}$ (1)

$V = \frac{2\pi r}{T} \rightarrow T = \frac{2\pi r}{V} \rightarrow T^2 = \left(\frac{2\pi r}{V}\right)^2 = \left(\frac{4\pi^2 r^2}{\frac{G M_T}{r}}\right) =$

$= \frac{4\pi^2 r^3}{G \cdot M_T} = T^2 \rightarrow r^3 = \frac{T^2 \cdot G \cdot M_T}{4\pi^2} \rightarrow r = \sqrt[3]{\frac{T^2 \cdot G \cdot M_T}{4\pi^2}} =$

$= \sqrt[3]{\frac{(86400\ s)^2 \cdot (6'67 \cdot 10^{-11}\ N \cdot m^2/kg^2) \cdot (5'97 \cdot 10^{24}\ kg)}{4\pi^2}} = \sqrt[3]{7'492 \cdot 10^{22}\ s^2 \cdot \frac{kg \cdot m}{s^2} \cdot \frac{m^2}{kg}} =$

$= 4'22 \cdot 10^7\ m = r$

$h = r - r_T = 4'22 \cdot 10^7\ m - 6'37 \cdot 10^6\ m = \boxed{3'58 \cdot 10^7\ m = h}$

(1) $V = \sqrt{\frac{G \cdot M_T}{r}} = \sqrt{\frac{6'67 \cdot 10^{-11}\ \frac{N \cdot m^2}{kg^2} \cdot 5'97 \cdot 10^{24}\ kg}{4'22 \cdot 10^7\ m}} = \sqrt{9'388 \cdot 10^6\ \frac{m^2}{s^2}} =$

$= \boxed{3064\ m/s = V}$

b) $F_c = G \cdot \frac{M_T \cdot m}{r^2} = 6'67 \cdot 10^{-11}\ \frac{N \cdot m^2}{kg^2} \cdot \frac{5'97 \cdot 10^{24}\ kg \cdot 5900\ kg}{(4'22 \cdot 10^7\ m)^2} = \boxed{1319'25\ N = F_c}$

$E = E_p + E_c$

$F_c = F_c \rightarrow \frac{m \cdot V^2}{r} = \frac{G \cdot M_T \cdot m}{r^2} \rightarrow \underbrace{\frac{1}{2} m \cdot V^2}_{E_c} = \frac{1}{2} \underbrace{G \cdot \frac{M_T \cdot m}{r}}_{-E_p} \rightarrow E_c = \frac{-1}{2} E_p$

$E = E_p - \frac{1}{2} E_p = \frac{1}{2} E_p = -\frac{1}{2} G \cdot \frac{M_T \cdot m}{r} =$

$= -\frac{1}{2} \cdot \left(6'67 \cdot 10^{-11}\ \frac{N \cdot m^2}{kg^2}\right) \cdot \frac{5'97 \cdot 10^{24}\ kg \cdot 5900\ kg}{(4'22 \cdot 10^7\ m)} = \boxed{-2'78 \cdot 10^{10}\ J = E}$

Pregunta 2: $f = 0'25\ Hz \quad \lambda = 2m$

$x = 0'5m$; $t = 2s \rightarrow y = 0m$; $v_y < 0 \rightarrow \alpha = \frac{\pi}{2}$ ($\xrightarrow{x}$)

$t = 3s$; $y = -0'2m$

a)

$\omega = 2\pi . f = 2\pi . 0'25 = \frac{\pi}{2}\ (rad/s) = \omega$

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

$\alpha = \frac{\pi}{2} t - \pi . x + \alpha_0$

- $t = 2\ s$; $x = 0'5m \rightarrow \alpha = \frac{\pi}{2} . 1 - \pi . 0'5 + \alpha_0 = \frac{\pi}{2} + \alpha_0$; $\alpha = \frac{\pi}{2}$ } $\alpha_0 = 0$
- $t = 3\ s$; $x = \frac{1}{2} \rightarrow \alpha = \frac{\pi}{2} . 3 - \pi . \frac{1}{2} = \frac{2\pi}{2} = \pi = \alpha$

$y = A . \cos(\omega t - \pi . x + \alpha_0) = A . \cos(\frac{\pi}{2} t - \pi x)$

$-0'2m = A . \cos(\frac{\pi}{2} . 3 - \pi . \frac{1}{2}) = A . \cos \pi \rightarrow A = 0'2m$ ($\cos \pi = -1$)

$$\boxed{y = 0'2 . \cos(\tfrac{\pi}{2} . t - \pi . x)}$$

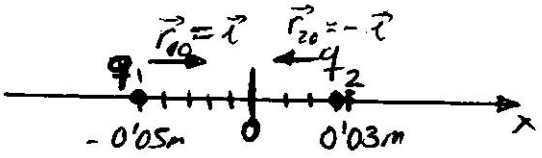
b) $v_{máx} = A . \omega = 0'2m . \frac{\pi}{2}\ rad/s = \boxed{0'314\ m/s = v_{máx}}$

$\Delta\alpha = k . \Delta x = \pi\ rad/m . 0'75m = \boxed{\frac{3\pi}{4}(rad) = \Delta\alpha}$

Pregunta 3: $q_1 = -4\,nC$; $q_2 = +2\,nC$

$P_1(-5,0)$; $P_2(3,0)$ (cm)

a)



$\vec{E}_0 = \vec{E}_{10} + \vec{E}_{20}$

$\vec{E}_{10} = \frac{K \cdot q_1}{r_{10}^2} \cdot \vec{r}_{10} = \frac{9\cdot 10^9\ N\cdot m^2/C^2\,(-4\cdot 10^{-9}\ C)}{(0'05\ m)^2} \cdot \vec{i} = -14.400\ V/m\ \vec{i} = \vec{E}_{10}$

$\vec{E}_{20} = \frac{K \cdot q_2}{r_{20}^2} \cdot \vec{r}_{20} = \frac{9\cdot 10^9\ N\cdot m^2/C^2 \cdot 2\cdot 10^{-9}\ C}{(0'03\ m)^2}(-\vec{i}) = -20.000\ V/m\ \vec{i} = \vec{E}_{20}$

$\vec{E}_0 = (-14.400 - 20.000)\vec{i}\ V/m = \boxed{-34.400\,\vec{i}\,(V/m) = \vec{E}_0}$

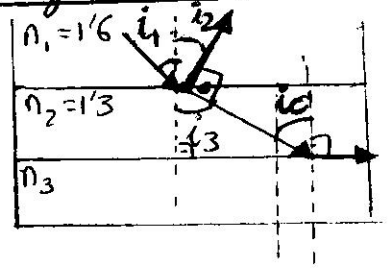
b) $0 = \frac{K \cdot q_1}{r_{10}+x} + \frac{K \cdot q_2}{r_{20}-x} \rightarrow \frac{-K \cdot q_1}{r_{10}+x} = \frac{K \cdot q_2}{r_{20}-x} \rightarrow$

$\rightarrow \frac{-(+4\cdot 10^{-9}\ C)}{0'05 + x\ (m)} = \frac{2\cdot 10^{-9}\ C}{0'03 - x\ (m)} \rightarrow \frac{4}{0'05+x} = \frac{2}{0'03-x} \rightarrow$

$\rightarrow 2\,(0'03 - x) = 0'05 + x \rightarrow 0'06 - 2x = 0'05 + x \rightarrow$

$\rightarrow 0'06 - 0'05 = 3x \rightarrow \boxed{x = 3'33\cdot 10^{-3}\ m = 3'33\ mm}$

Pregunta 4:



a) $i_2 + 90° + i_3 = 180° \rightarrow i_2 + i_3 = 90°$

$i_1 = i_2$

$i_c = i_3$

$n_1 \cdot \operatorname{Sen} i_1 = n_2 \operatorname{Sen} i_3 \rightarrow \frac{n_1}{n_2} = \frac{\operatorname{Sen} i_3}{\operatorname{Sen} i_1} \rightarrow$

$\rightarrow \frac{n_1}{n_2} = \frac{\operatorname{Sen} i_c}{\operatorname{Sen} i_2} = \frac{\operatorname{Sen} i_c}{\operatorname{Sen}(90 - i_3)} = \frac{\operatorname{Sen}(i_c)}{\operatorname{Sen}(90 - i_c)} = \frac{\operatorname{Sen}(i_c)}{\cos(i_c)} = \operatorname{tg}(i_c)$

$\operatorname{tg}(i_c) = \frac{n_1}{n_2} \rightarrow i_c = \operatorname{arctg}\left(\frac{n_1}{n_2}\right) = \operatorname{arctg}\left(\frac{1'6}{1'3}\right) = \boxed{50'91° = i_c}$

$i_1 = i_2 = 90° - i_3 = 90° - i_c = 90° - 50'91° = \boxed{39'09° = i_1}$