atividade: Resolução de Prova
instituição: Universidade Lusíada (Famalicão)
disciplinas: Física Geral II
tipologia: Miniteste PL
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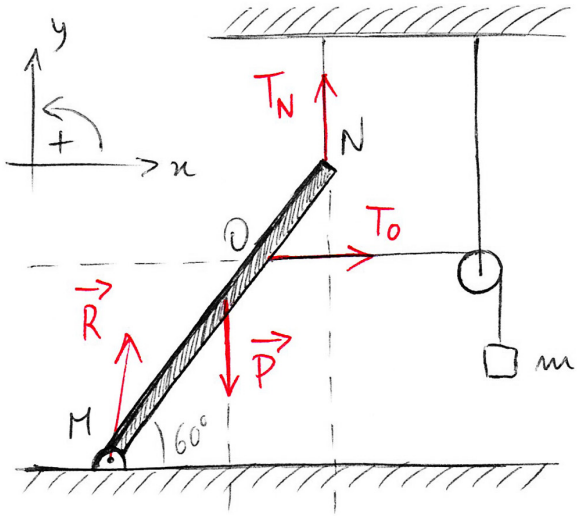
1.



$\overline{MN} = \ell = 12\ m$

$m_B = 50\ kg$

$\overline{MO} = 9\ m$

$m = 3,8\ kg$

$T_0 = mg = 3,8 \times 9,8 = 37,24\ N$

$P = m_B g = 50 \times 9,8 = 490\ N$

$$\begin{cases} \sum F_x = 0 \\ \sum F_y = 0 \\ \sum M_M = 0 \end{cases} \quad \begin{cases} R_x + T_0 = 0 \\ R_y - P + T_N = 0 \\ -6\cos 60° \cdot P - 9 \sin 60°\ T_0 + 12 \cos 60\ T_N = 0 \end{cases}$$

$$\begin{cases} R_x = -37,2\ N \\ R_y = 490 - T_N \\ 12 \cos 60°\ T_N = 6 \cos 60° \times 490 + 9 \sin 60° \times 37,24 \end{cases} \quad \begin{cases} R_x = -37,2\ N \\ R_y = 196,6\ N \\ T_N = 293,4\ N \end{cases}$$

1.1 $T_N = 293,4\ N$

1.2 $R = \sqrt{R_x^2 + R_y^2} = \sqrt{(-37,2)^2 + 196,6^2} \cong 200,1\ N$

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2. $L_0 = 1{,}2\ m$

$F = +10^5\ N$

$\Delta L = 2\ mm = 2\times10^{-3}\ m$

$Y = 0{,}8\times10^{10}\ N/m^2$

$\sigma = 0{,}35$

2.1 $\frac{F}{A} = Y\frac{\Delta L}{L_0} \Leftrightarrow A = \frac{F}{Y}\frac{L_0}{\Delta L}$

$A = \frac{10^5}{0{,}8\times10^{10}} \times \frac{1{,}2}{2\times10^{-3}} = 0{,}0075\ m^2$

2.2 $\sigma = -\frac{\delta_T}{\delta_L} = -\frac{\frac{\Delta d}{d_0}}{\frac{\Delta L}{L_0}} \Leftrightarrow$

$\left.\begin{array}{l} \frac{\Delta d}{d_0} = -\sigma\frac{\Delta L}{L_0} \Leftrightarrow \Delta d = -\sigma\frac{\Delta L}{L_0}d_0 \\ A = \pi\frac{d_0^2}{4} \Leftrightarrow d_0^2 = \frac{4A}{\pi} \Leftrightarrow d_0 = \sqrt{\frac{4A}{\pi}} \end{array}\right\} \Rightarrow$

$\Delta d = -\sigma\frac{\Delta L}{L_0}\sqrt{\frac{4A}{\pi}} = -0{,}35\times\frac{2\times10^{-3}}{1{,}2}\sqrt{\frac{4\times0{,}0075}{\pi}}$

$\Delta d \cong -5{,}7\times10^{-5}\ m = -57\ \mu m$

2.3 $S = \frac{Y}{2(1+\sigma)} = \frac{0{,}8\times10^{10}}{2(1+0{,}35)} \cong 2{,}96\times10^9\ Pa$

$\frac{F}{A} = S\frac{\Delta x}{h} \Leftrightarrow \Delta x = \frac{F}{A}\frac{h}{S} = \frac{F}{A}\frac{L_0}{S} \Leftrightarrow$

$\Delta x = \frac{2\times10^5}{0{,}0075} \times \frac{1{,}2}{2{,}96\times10^9} = 0{,}0108\ m = 10{,}8\ mm$

3. $m = 1200\ kg$

$a = 6{,}0\ m\,s^{-2}$

3.1 $\left.\begin{array}{l} F_g = G\dfrac{M_T m}{r^2} \\ F_g = ma \end{array}\right\} \Rightarrow ma = G\dfrac{M_T m}{r^2} \Leftrightarrow$

$\Leftrightarrow r^2 = \dfrac{GM_T}{a} \Leftrightarrow r = \sqrt{\dfrac{GM_T}{a}} \left(= 8{,}15\times10^6\ m\right)$

$\Leftrightarrow R_T + h = \sqrt{\dfrac{GM_T}{a}}$

$\Leftrightarrow h = \sqrt{\dfrac{GM_T}{a}} - R_T = \sqrt{\dfrac{6{,}67\times10^{-11}\times5{,}98\times10^{24}}{6{,}0}} - 6{,}38\times10^6$

$\Leftrightarrow h = 1{,}77\times10^6\ m \simeq 1770\ km$

3.2 $v_{orb} = \sqrt{\dfrac{GM}{r}} \Leftrightarrow v^2 = \dfrac{GM}{r} \Leftrightarrow r = \dfrac{GM}{v^2}$

$\left(v_{orb} = 3300\ m/s\right) \Leftrightarrow r = \dfrac{6{,}67\times10^{-11}\times5{,}98\times10^{24}}{3300^2} = 36{,}6\times10^6\ m$

$\Delta E = E_{orb,f} - E_{orb,i} = \left(-\dfrac{GMm}{2r_f}\right) - \left(-\dfrac{GMm}{2r_i}\right) =$

$= -\dfrac{GMm}{2}\left(\dfrac{1}{r_f} - \dfrac{1}{r_i}\right) =$

$= -\dfrac{6{,}67\times10^{-11}\times5{,}98\times10^{24}\times1200}{2}\left(\dfrac{1}{36{,}6\times10^6} - \dfrac{1}{8{,}15\times10^6}\right)$

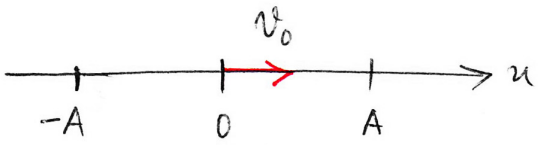
$= 2{,}28\times10^{10}\ J = 22{,}8\ GJ$

4. $m = 1{,}5\ kg$

$T = 2{,}0\ s$

$v_0 = +1\ m\,s^{-1}$

$x_0 = 0$



4.1 $\omega^2 = \frac{K}{m} \Leftrightarrow K = m\omega^2$

$\omega = \frac{2\pi}{T} = \frac{2\pi}{2} = \pi\ rad/s$

$\Rightarrow K = 1{,}5 \times \pi^2 = 14{,}8\ N/m$

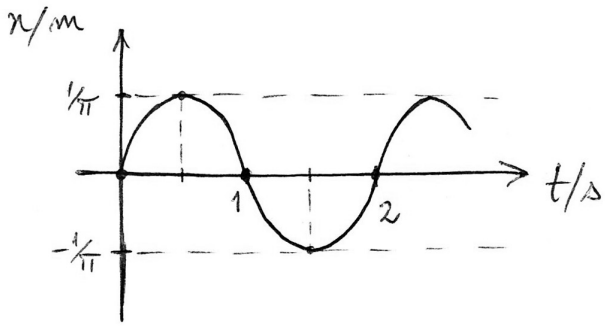
4.2 $x = A\cos(\omega t + \phi) = \frac{1}{\pi}\cos\left(\pi t - \frac{\pi}{2}\right)\ (m)$

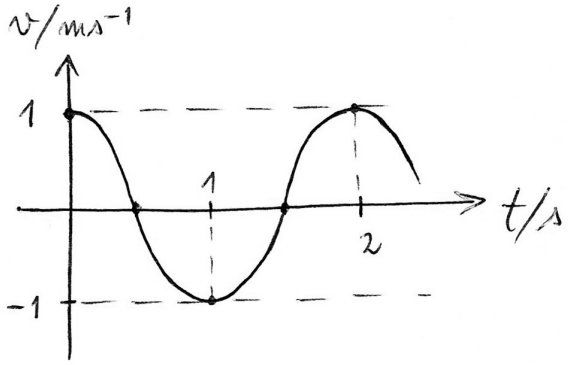
$v = -A\omega\sin(\omega t + \phi) = -\sin\left(\pi t - \frac{\pi}{2}\right)\ (m\,s^{-1})$

$A = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2} = \sqrt{0^2 + \left(\frac{1}{\pi}\right)^2} = \frac{1}{\pi} \approx 0{,}318\ m$

$v_0 = -A\omega\sin\phi \Leftrightarrow$

$1 = -\frac{1}{\pi} \times \pi \sin\phi \Leftrightarrow \sin\phi = -1 \Rightarrow \phi = -\frac{\pi}{2}$





4.3 $x(3{,}2\,s) = \frac{1}{\pi}\cos\left(3{,}2\pi - \frac{\pi}{2}\right) = -0{,}187\ m$

$F = -Kx = -14{,}8 \times -0{,}187 = 2{,}77\ N$

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