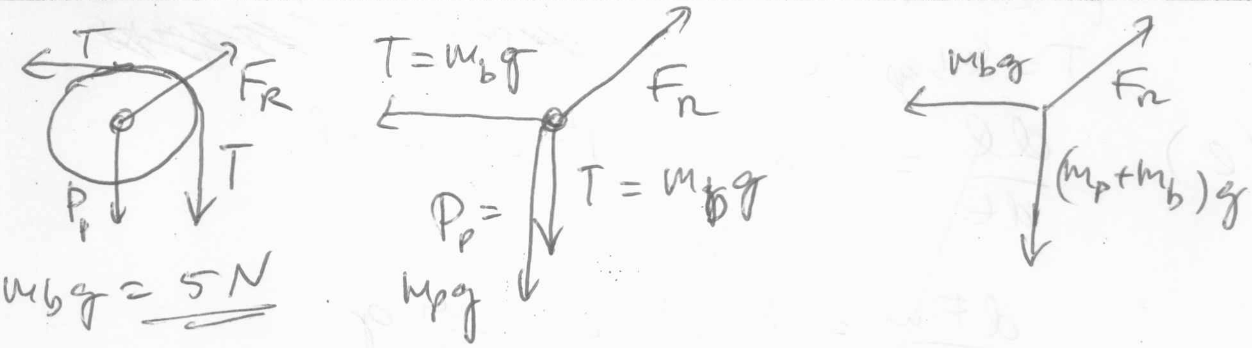
INSTITUTO DE FÍSICA - USP NOTA **2**

NOME: Gabarito Sub Física I - IO

PROFESSOR: ∅

DATA: [illegible] 2013

(a)



$T = m_b g = 5N$

$F_{Rx} = m_b g = 5N$ $\qquad F_R = \sqrt{25 + 49} = 8{,}6N$

$F_{Ry} = (m_p + m_b) g = 7N$

$\vec{F}_R = 5\hat{x} + 7\hat{y}$

(b) $\frac{1}{2} m v_1^2 = \frac{1}{2} m v_0^2 + mgh \qquad v^2 = v_0^2 + 2gh$

$v_1 = \sqrt{2 + 20 \times 19{,}9} = 20 m/s$

(c) $K_f = K_i + W_{tot} = \underbrace{K_i + mgh}_{K_i} + W_{at} \qquad v_f = 10{,}1 m/s$

$K_f = \frac{1}{2} m v_f^2 = \frac{1}{2} m v_i^2 + W_{at}$

$W_{at} = \frac{1}{2} m (v_f^2 - v_i^2) = \frac{1}{2} \cdot 1 \cdot (10{,}1^2 - 400)$

$W_{at} = -\frac{1}{2}(400 - 102{,}1) = \frac{-298{,}9}{2} = -149{,}45\ J\ (p/1kg)$

$P = \frac{|dW|}{dt} = \frac{|W_{at}|}{\Delta t} \qquad \Delta t \frac{dm}{dt} = 1kg \qquad \Delta t = \frac{1}{902} s$

$P = |W_{at}| \cdot \frac{dm}{dt} = 149{,}45 \times 0{,}02 = 2{,}989\ W \approx 3W$

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d) $J = -\Delta p = -\Delta m_a (v_b - v_a) = \Delta m_a (v_a - v_b)$

$$\langle F \rangle = \frac{J}{\Delta t} = \frac{\Delta m_a}{\Delta t}(v_a - v_b) = \frac{dm}{dt}(v_a - v_b)$$

$$\langle F \rangle = 0{,}02 \times (10{,}1 - 0{,}1) = 0{,}2\ N$$

$$T = (m_a + m_b)\,g + \langle F \rangle$$

$$\frac{dT}{dt} = \frac{dm}{dt}\,g = 0{,}02 \times 10 = 0{,}2\ N/s$$

e) $dT = k\,dx$

$$k\frac{dx}{dt} = \frac{dT}{dt} = k v_b \qquad \left(\frac{dx}{dt} = v_b\right)$$

$$k = \frac{1}{v_b}\frac{dT}{dt} = 0{,}2 / 0{,}1 = 2\ N/m$$

f) $K_{TOT} = \frac{1}{2} I_z \Omega^2 + \frac{1}{2}(m_b + m_a)\left(\frac{dx}{dt}\right)^2$

$$I_z = \frac{1}{2} m_p R^2 \qquad \Omega^2 = \frac{1}{R^2}\left(\frac{dx}{dt}\right)^2$$

$$K_{TOT} = \frac{1}{2}\left(\frac{1}{2} m_p + m_b + m_a\right)\left(\frac{dx}{dt}\right)^2$$

$$m_{ef} = \frac{1}{2} m_p + m_b + m_a = 0{,}1 + 0{,}5 + m_a$$

$$m_{ef} = 0{,}6\,kg + m_a$$

g) $\omega = \sqrt{\frac{k}{m_{ef}}} = \sqrt{\frac{2}{0{,}6kg + m_a}} = 0{,}5 \text{ rad/s}$

$(0{,}6kg + m_a)\,0{,}25 = 2 \qquad m_a = 8 - 0{,}6 = \underline{7{,}4 \text{ kg}}$

h) $e^{-\frac{\gamma}{2} t_{1/2}} = \frac{1}{2} \qquad \ln\frac{1}{2} = -\frac{\gamma}{2} t_{1/2}$

$\frac{\gamma}{2} = \frac{\ln 2}{t_{1/2}} \qquad \gamma = \frac{2\ln 2}{t_{1/2}} = \underline{0{,}046}$

i) $E_{mec} = \frac{1}{2} k x_0^2 + \frac{1}{2} m_{ef} v_0^2 = \frac{1}{2} k A_0^2$

$x_0 = \frac{\langle F \rangle}{k} = \frac{0{,}2}{2} = 0{,}1 \text{ m}$ (dist ao pt de equilíbrio)

$m_{ef} = 0{,}6 + m_a = 0{,}6 + 7{,}4 = 8 \text{ kg}$

$A_0^2 = \frac{2E_{mec}}{k} = \frac{1}{2} 2 (0{,}1)^2 + \frac{1}{2} 8 \times (0{,}1)^2$

$A_0^2 = 0{,}01 + 4 \times 0{,}01 = 0{,}05$

$\underline{A_0 = 0{,}22 \text{ m}}$