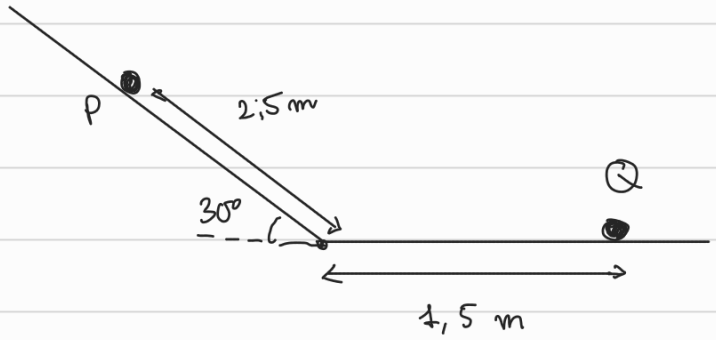
ĐỀ THI CUỐI KỲ HK II - 2021 - 2022

Câu 1:



Chọn mốc thế năng tại chân mpn

a) BTCN cho vật P, ta có:

$$m_1 g l \sin\alpha = \frac{1}{2} m_1 v_1^2 \Rightarrow v_1^2 = 2gl\sin\alpha$$

$$\Rightarrow v_{1P} \approx 4,95 \ (m/s)$$

b) Vận tốc của P ngay trước khi va chạm với Q:

$$W_2 - W_1 = A_{ms}$$

$$\frac{1}{2} m_1 v_{2P}^2 - \frac{1}{2} m_1 v_P^2 = -k m_1 g . s$$

$$v_{2P}^2 = v_{1P}^2 - 2kgs$$

$$\Rightarrow v_{2P} \simeq 4,64 \ (m/s)$$

c)

Vật P va chạm đàn hồi với vật Q:

BT ĐL:

$$m_1 \vec{v}_{2P} = m_1 \vec{v}_P' + m_2 \vec{v}_Q'$$

$$\Rightarrow m_1 v_{2P} = m_1 v_P' + m_2 v_Q' \ (\Rightarrow) \ m_1 (v_{2P} - v_P') = m_2 v_Q' \ (1)$$

BTCN:

$$\frac{1}{2} m_1 v_{2P}^2 = \frac{1}{2} m_1 v_P'^2 + \frac{1}{2} m_2 v_Q'^2$$

$$m_1 (v_{2P}^2 - v_P'^2) = m_2 v_Q'^2 \quad (2)$$

$\frac{(2)}{(1)}$:

$$v_{2P} + v_P' = v_Q'$$

$$m_1 (v_{2P} + v_P') = m_1 v_Q' \quad (3)$$

(1) + (3) $\Rightarrow$

$$2 m_1 v_{2P} = (m_1 + m_2) v_Q'$$

$$\Rightarrow v_Q' = \frac{2m_1}{m_1 + m_2} v_{2P} \simeq 5,568 \ (m/s)$$

$$\Rightarrow v_P' \simeq v_Q' - v_{2P} \simeq 5,568 - 4,64$$

$$= 0,928 \ (m/s)$$

$= 0,4\ 28\ (m/s)$

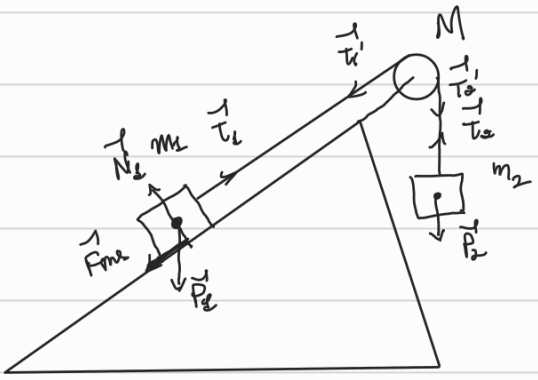
d) Quãng đg vật Q đi đc sau khi va chạm

$v_{2Q}'^2 - v_Q'^2 = 2a_2 s = 2(-kg)s$

$\Rightarrow s = \frac{v_Q'^2}{2kg} \approx 15,82\ (m)$

Câu 2:

a)



b)

Định luật II Newton:

Vật m_1: $\vec{P_1} + \vec{N_1} + \vec{T_1} + \vec{F_{ms}} = m_1\vec{a_1}$

$$\begin{cases} N_1 = gm_1\cos\alpha \\ t_1 - gm_1\sin\alpha - kmg\cos\alpha = m_1a_1 \quad (1) \end{cases}$$

Vật m_2: $\vec{T_2} + \vec{P_2} = m_2\vec{a_2}$

$$gm_2 - T_2 = m_2a_2 \quad (2)$$

Pt vật quay đối với ròng rọc:

$$T_2 - T_1 = \frac{1}{2}Ma \quad (3)$$

(1) + (2) + (3): $gm_2 - gm_1\sin\alpha - km_1g\cos\alpha = (m_1 + m_2 + \frac{M}{2})a$

$$\Rightarrow a = \frac{gm_2 - gm_1\sin\alpha - km_1g\cos\alpha}{m_1 + m_2 + \frac{M}{2}} \approx 3,25\ (m/s^2)$$

c)

$\beta = \frac{a}{r} \approx 65,01\ (rad/s^2)$

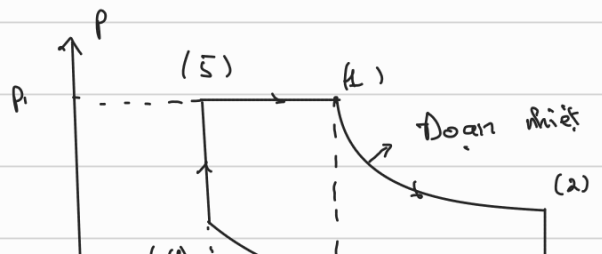
Tgian vật m_1 đi đc quãng đg h:

$h = \frac{1}{2}at^2 \Rightarrow t = \sqrt{\frac{2h}{a}}$

$\Rightarrow$ Vận tốc góc của ròng rọc tại thời điểm đó:

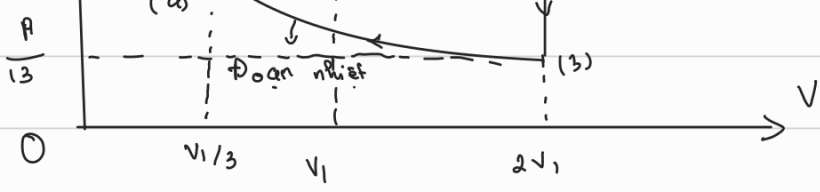
$\omega = \beta t = \frac{a}{r}\cdot\sqrt{\frac{2h}{a}} \approx 16,12\ (rad/s)$

Câu 3:



$p_1 = 5\ Pa$

$V_1 = 3.10^{-3}\ m^3$



a)

Công và

Xét nhiệt nhận của từng quá trình:

(1) - (2): Đoạn nhiệt

$$A_{12} = \Delta U_{12} = \frac{5}{2} nR(T_2 - T_1) = \frac{5}{2}(p_2V_2 - p_1V_1)$$

$$= \frac{5}{2}\left(\frac{p_1V_1^{\gamma}}{V_2^{\gamma-1}} - p_1V_1\right) = \frac{5}{2} p_1V_1 \left(\frac{V_1^{\gamma-1}}{V_2^{\gamma-1}} - 1\right) = \frac{5}{2} \cdot 5 \cdot 3 \cdot 10^{-3}\left(\left(\frac{1}{2}\right)^{2,5} - 1\right) \simeq -9,08 \cdot 10^{-3} \text{ (J)}$$

$$Q_{12} = 0$$

(2) - (3): Đẳng tích:

$$A_{23} = 0$$

$$Q_{23} = n C_V (T_3 - T_2) = \frac{5}{2} nR(T_3 - T_2) = \frac{5}{2}(p_3 - p_2)V_2 = \frac{5}{2}\left(\frac{p_1}{13} - \frac{p_1V_1^{\gamma}}{V_2^{\gamma}}\right) 2V_1 = 5p_1V_1\left[\frac{1}{13} - \left(\frac{1}{2}\right)^{\frac{7}{5}}\right]$$

$$\simeq -0,02265 \text{ (J)}$$

(3) - (4): Đoạn nhiệt: $p_4 = p_3\left(\frac{V_3}{V_4}\right)^{\gamma}$

$$A_{34} = \Delta U_{34} = \frac{5}{2} nR(T_4 - T_3) = \frac{5}{2}(p_4V_4 - p_3V_3) = \frac{5}{2} p_3V_3\left[\left(\frac{V_3}{V_4}\right)^{\gamma-1} - 1\right]$$

$$= \frac{5}{2} \frac{p_1}{13} \cdot 2V_1 \left(6^{2,5} - 1\right) \simeq 6,044 \cdot 10^{-3} \text{ (J)}$$

$$Q_{34} = 0$$

(4) - (5): Quá trình đẳng tích:

$$A_{45} = 0$$

$$Q_{45} = \frac{5}{2} nR(T_5 - T_4) = \frac{5}{2}(p_5 - p_4)V_4 = \frac{5}{2}\left(p_2 - 6^{\gamma}\frac{p_1}{13}\right)\frac{V_1}{3} = \frac{5}{6} p_1V_1\left(1 - \frac{6^{\gamma}}{13}\right) \simeq 0,0458 \text{ (J)}$$

(5) - (1): Đẳng áp:

$$A_{51} = -p_1(V_1 - V_5) = -p_1\left(V_1 - \frac{V_1}{2}\right) = -\frac{2p_1V_1}{3} \simeq -0,01 \text{ (J)}$$

$$Q_{51} = \frac{7}{2} nR(T_1 - T_5) = \frac{7}{2} p_1(V_1 - V_5) = \frac{7}{3} p_1V_1 = 0,035 \text{ (J)}$$

b)

$$H = \frac{A'}{Q} = \frac{-\frac{5}{2}\left(0,5^{\gamma-1} - 1\right) - \frac{5}{13}\left(6^{\gamma-1} - 1\right) + \frac{2}{3}}{\frac{5}{6}\left(1 - \frac{6^{\gamma}}{13}\right) + \frac{7}{3}}$$

$$\simeq 36,53\%$$