Prova scritta di Fisica 1 - 26.3.2025

Soluzioni

1. $y_B(t) = v_0 t - g\frac{t^2}{2}$, $\quad v_B(t) = v_0 - gt$

$y_A(t) = h - g\frac{t^2}{2}$, $\quad v_A(t) = -gt$

1a: $y_A(t^*) = y_B(t^*) = h/2$

A $\Rightarrow h - g\frac{t^{*2}}{2} = \frac{h}{2} \Rightarrow g\frac{t^{*2}}{2} = \frac{h}{2} \Rightarrow t^* = \sqrt{\frac{h}{g}}$

B $\Rightarrow v_0 t^* - g\frac{t^{*2}}{2} = v_0\sqrt{\frac{h}{g}} - \frac{\cancel{g}}{2}\cdot\frac{h}{\cancel{g}} = h/2$

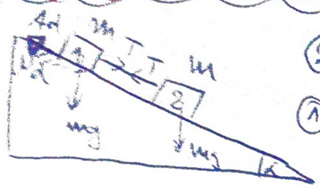
$\Rightarrow v_0\cdot\sqrt{\frac{h}{g}} = h \Rightarrow \boxed{v_0 = \sqrt{hg}}$

1b: $v_A(t^*) = -v_B(t^*)$ e $y_A(t^*) = y_B(t^*)$

$v_0 - gt^* = gt^* \Rightarrow v_0 = 2gt^* \Rightarrow \boxed{t^* = \frac{v_0}{2g}}$ $\quad h - \cancel{g\frac{t^{*2}}{2}} = v_0 t^* - \cancel{g\frac{t^{*2}}{2}} \Rightarrow v_0\cdot t^* = h$

$\Rightarrow v_0\cdot\frac{v_0}{2g} = h \Rightarrow \boxed{v_0 = \sqrt{2hg}}$

2.



② $ma = mg\sin\alpha - T$

① $ma = mg\sin\alpha + T - \mu_d mg\cos\alpha$

$mg\sin\alpha - T = mg\sin\alpha + T - \mu_d mg\cos\alpha \Rightarrow \boxed{T = \frac{\mu_d mg\cos\alpha}{2}}$

$v = cost \Leftrightarrow a = 0 \Rightarrow$ ② $0 = mg\sin\alpha - T \Rightarrow T = mg\sin\alpha$

$\Rightarrow$ ① $0 = \cancel{mg}\sin\alpha + \cancel{mg}\sin\alpha - \mu_d\cancel{mg}\cos\alpha \Rightarrow \boxed{tg\alpha = \frac{\mu_d}{2}}$

3.

$I_{tot}\frac{d^2\theta}{dt^2} = -m_{tot}\cdot g\cdot d_{cm}\cdot\underbrace{\sin\theta}_{\simeq\theta}$, $\quad d_{cm} = L/4$, $\quad I_{tot} = M\left(\frac{L}{4}\right)^2 + M\left(\frac{3L}{4}\right)^2 = \frac{5}{8}ML^2$

$m_{tot} = 2M$

$\Rightarrow \frac{d^2\theta}{dt^2} + \overbrace{\frac{2\cancel{M}gL/4}{\frac{5}{8}\cancel{M}L^{\cancel{2}}}}^{\Omega_0^2}\cdot\theta = 0$ $\quad \frac{2\cancel{M}gL/4}{\frac{5}{8}\cancel{M}L^{\cancel{2}}} = \frac{4}{5}g/L$

$\Rightarrow \Omega_0 = \sqrt{\frac{4g}{5L}} \Rightarrow \boxed{T = 2\pi\sqrt{\frac{5L}{4g}}}$

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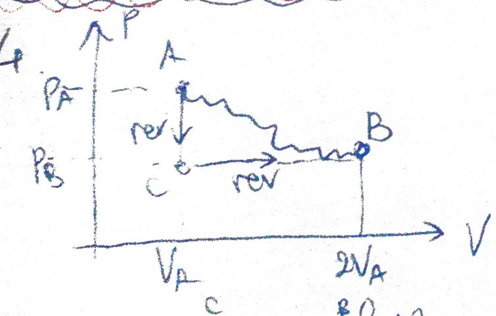

	P	V	T
A	P_A	V_A	T_A
B	$\frac{3}{4}P_A$	$2V_A$	$\frac{3}{2}T_A$
C	$\frac{3}{4}P_A$	V_A	$\frac{3}{4}T_A$

$\Delta S_{AB} = \int_{A\,rev}^{C}\frac{dQ}{T} + \int_{C\,rev}^{B}\frac{dQ}{T} = \int_{A\,rev}^{C}\frac{nc_v dT}{T} + \int_{C\,rev}^{B} nc_p\frac{dT}{T} = nc_v\ln\frac{T_C}{T_A} + nc_p\ln\frac{T_B}{T_C} =$

$= 3\cdot\frac{3}{2}R\cdot\ln\frac{3}{4} + 3\cdot\frac{5}{2}R\cdot\ln 2$