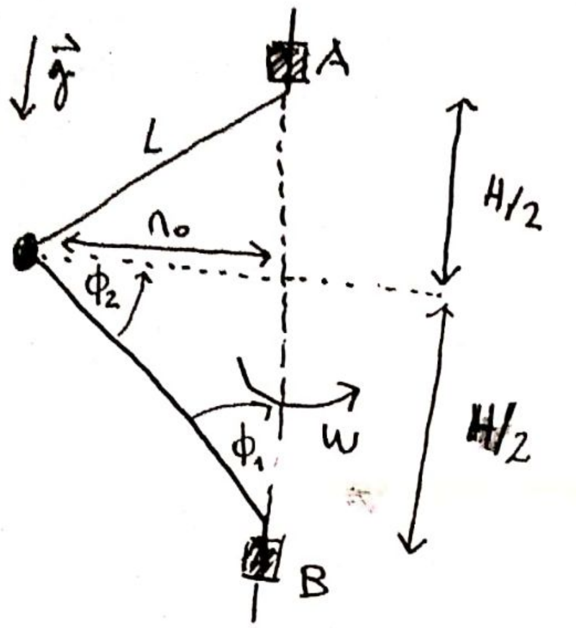
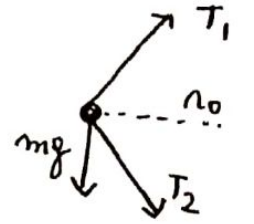
Pauta P2 AUX #4



1) DCL: (coordenadas cilíndricas)



a) $\vec{r} = r_0 \hat{\rho}$ $\quad (r_0 = cte \Rightarrow \dot{r}_0 = \ddot{r}_0 = 0)$

$\vec{v} = r_0 w \hat{\theta}$ $\quad (w = cte \Rightarrow \dot{\theta} = \ddot{\theta} = 0)$

$\vec{a} = -r_0 w^2 \hat{\rho}$ $\quad \left(\frac{d\vec{r}}{dt} = \vec{v} \;;\; \frac{d\vec{v}}{dt} = \vec{a} \right)$

$(z = cte \Rightarrow \dot{z} = \ddot{z} = 0)$

Se hace sumatoria de FZA. en $\hat{\rho}$

$\vec{F}_\rho = -\sin\phi_1 T_1 - \sin\phi_1 T_2$

$\Rightarrow \underline{\hat{\rho}}$ $-m r_0 w^2 = -\sin\phi_1 (T_1 + T_2)$

pero $\phi_1 = \frac{r_0}{L}$ y asumimos $\measuredangle$ pequeño.

$m w^2 = -\frac{\cancel{r_0}}{L}(T_1 + T_2) \quad (1)$

$\sum F_{za}$ en z:

$F_z = -mg + T_1 \sin\phi_2 - T_2 \sin\phi_2$

pero ϕ_2 es $\frac{H/2}{L}$ y asumimos $\measuredangle$ pequeño.

$\hat{z}]\ \cancel{m\ddot{z}}_{0} = -mg + \frac{H}{2L}(T_1 - T_2)$

$\Rightarrow T_1 = \frac{2L}{H}\left(T_2 \frac{H}{2L} + mg \right) (2)$

suponemos (2) en (1)

$-mLw^2 = -T_2 - \frac{2L}{H} mg - T_2$

$-mw^2 = -\frac{2}{L} T_2 - \frac{2}{H} mg$

$\Rightarrow T_2 = Lmw^2/2 - L/H\, mg$

para que se cumpla que la masa tenga un movimiento circular uniforme $T_2 > 0$

$$\Rightarrow Lm\frac{w^2}{2} - \frac{L}{H}mg > 0$$

$$\frac{w^2}{2} > \frac{g}{H} \Rightarrow \boxed{w > \sqrt{\frac{2g}{H}}}$$

b) Tenemos que $\dot{L} = -v_0 \Rightarrow \ddot{L} = 0$

Ocupamos pitagoras:

$$r^2 + \left(\frac{H}{2}\right)^2 = L^2 \quad / d/dt \quad (1)$$

$$2r\dot{r} = 2L\dot{L} \quad / d/dt \quad (2)$$

$$\cancel{2}\dot{r}^2 + \cancel{2}r\ddot{r} = \cancel{2}\dot{L}^2$$

$$\ddot{r} = \frac{\dot{L}^2 - \dot{r}^2}{r} \quad (3)$$

de (2) $\cancel{2}r\dot{r} = \cancel{2}L\dot{L}$

$$\dot{r} = -\frac{Lv_0}{r} \quad (4)$$

$\Rightarrow$ (4) en (3)

$$\ddot{r} = \frac{v_0^2 - \frac{L^2 v_0^2}{r^2}}{r} = \frac{\frac{v_0}{r^2}(r^2 - L^2)}{r}$$

$$\ddot{r} = \frac{v_0}{r^3}(r^2 - L^2) \qquad \text{de } (1) \rightarrow -\left(\frac{H}{2}\right)^2 = r^2 - L^2$$

$$\ddot{r} = \frac{-v_0 H^2}{4} \cdot \frac{1}{r^3}$$

$\Rightarrow$ La cte. para que $\ddot{r} \propto \frac{1}{r^3}$ es

$$-\frac{v_0 H^2}{4}$$

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