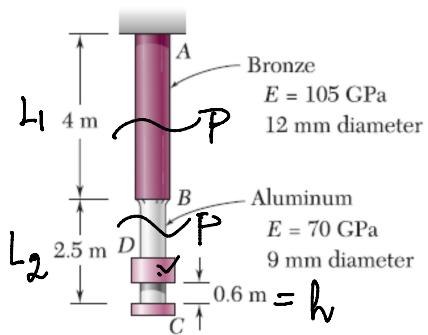


$$\frac{1}{2} m v_0^2 = \int_0^L \frac{P^2}{2EA} dx = \frac{P^2 L}{2EA}$$

$$P^2 = \frac{m v_0^2 E A}{L} \Rightarrow P = \sqrt{\frac{m v_0^2 E A}{L}}$$

$$\nabla_{\cdot} = \frac{P}{A}, \quad \Delta = \sqrt{\frac{m v_0^2 E A}{L}} \times \frac{L}{E A}$$

$$= \frac{1}{A} \sqrt{\frac{m v_0^2 E A}{L}}$$



$$mg(h + \delta_m) = \int_0^L \frac{P_m^2}{2EA} dx = \frac{P_m^2}{2} \int_0^{L_1} \frac{dx}{E_1 A_1} + \frac{P_m^2}{2} \int_{L_1}^{L_1+L_2} \frac{dx}{E_2 A_2}$$

$$= \frac{P_m^2}{2} \left(\frac{L_1}{E_1 A_1} + \frac{L_2}{E_2 A_2} \right)$$

Energy balance at max deflection at C

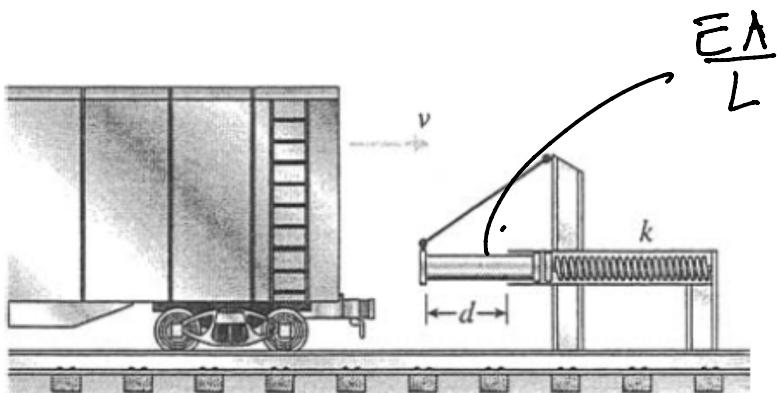
$$\delta = \frac{P}{E_1 A_1} \left(\frac{L_1}{E_1 A_1} + \frac{L_2}{E_2 A_2} \right) \rightarrow \text{force vs displacement at C}$$

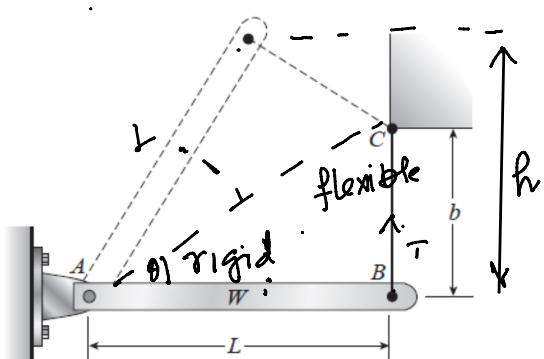
$$mg \left[h + P_m \left(\frac{L_1}{E_1 A_1} + \frac{L_2}{E_2 A_2} \right) \right] = \frac{P_m^2}{2} \left(\frac{L_1}{E_1 A_1} + \frac{L_2}{E_2 A_2} \right)$$

Solve for P_m (+ve root)

$$\Delta_{m1} = \frac{P_m}{A_1}, \quad \Delta_{m2} = \frac{P_m}{A_2}$$

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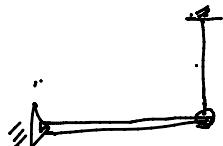
$$\tan \theta = \frac{b}{L}, \quad 2\theta = ? \quad \text{use } \sin 2\theta \text{ formula}$$

$$h = L \sin 2\theta = L \times \frac{2b}{1 + (b/L)^2}$$

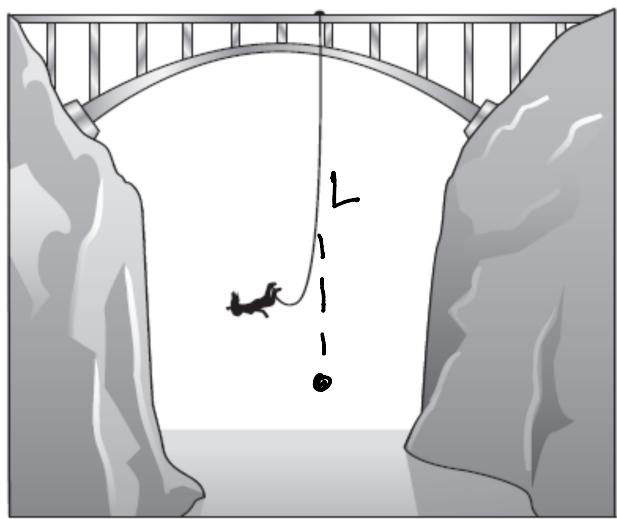
C.m. loses $\frac{h}{2}$ height

$$mg \left(\frac{h}{2} + \delta_m \right) = \frac{T_m^2 b}{2EA}$$

$$\delta_m = \frac{T_b}{EA} \Rightarrow T_m = \frac{EA}{b}$$

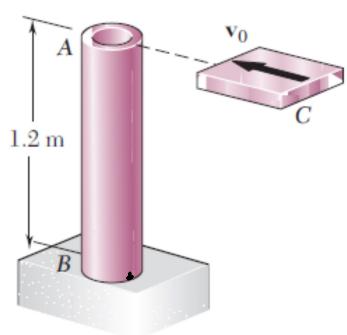


$$mg \left(\frac{h}{2} + \frac{T_m b}{EA} \right) = \frac{T_m^2 b}{2EA}$$



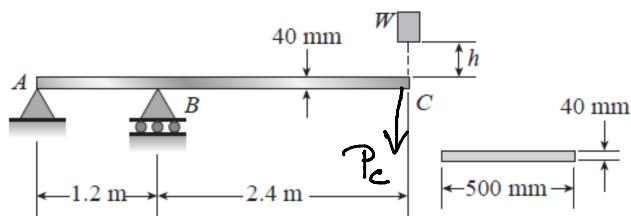
$$mg(L + \delta_m) = \frac{TL^2}{2EA}$$

$$\delta = \frac{TL}{EA}$$



$$\frac{1}{2}mv_0^2 = \int_s^L \frac{Mx}{2EI} dx = \int_0^L \frac{\frac{P}{m}(L-x)^2}{2EI} dx$$

$$\frac{PL^3}{3EI} = \delta, \quad \Delta_B = \frac{M_B y}{I} = \frac{P_m L y}{EI}$$

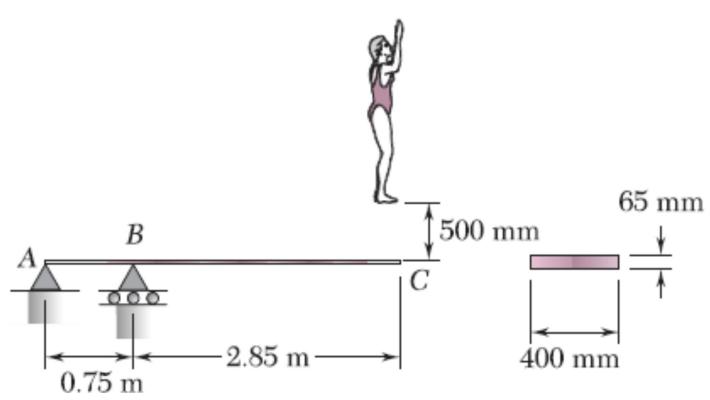


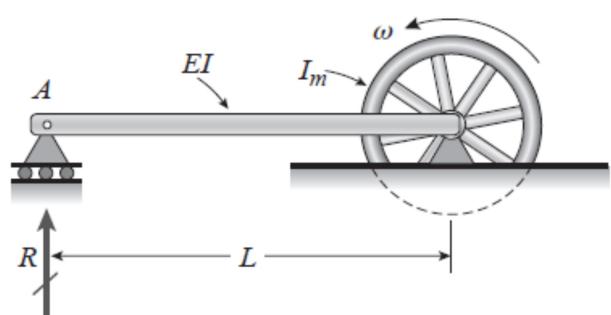
$$mg(h + \delta_{c,\max}) = \int_0^L \frac{M^2}{2EI} dx$$

$$\delta_c \rightarrow P_c.$$

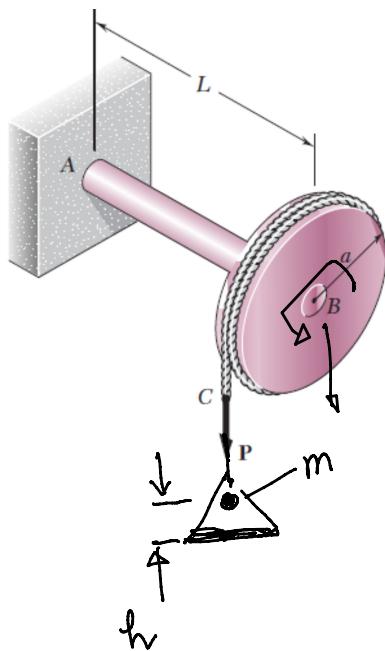
1. Find $M(x)$ in terms of P_c \rightarrow Energy balance eqn
2. Find δ_c in terms of P_c \rightarrow Substitute for δ_c in above eqn

Real life version





$$\frac{1}{2} \dot{t} m \omega^2 = \int_0^L \frac{M^2}{2EI} dx.$$



$$\frac{1}{2}P\delta = \frac{T^2}{2GJ} + \int_0^L \frac{\rho P(L-x)^2}{2EI} dx = U_{\text{total}}$$

$\Rightarrow T = P_n$

$$mg(h + \delta_m) = U_{\text{total}}$$

$$\frac{1}{2}P\delta = \frac{Pa^2L}{2GJ} + \frac{PL^3}{2EI} \Rightarrow \delta = P \left(\frac{a^2L}{2GJ} + \frac{L^3}{3EI} \right)$$

$$mg(h + \delta_m) = \frac{Pa^2L}{2GJ} + \frac{P_m L^3}{2EI}$$