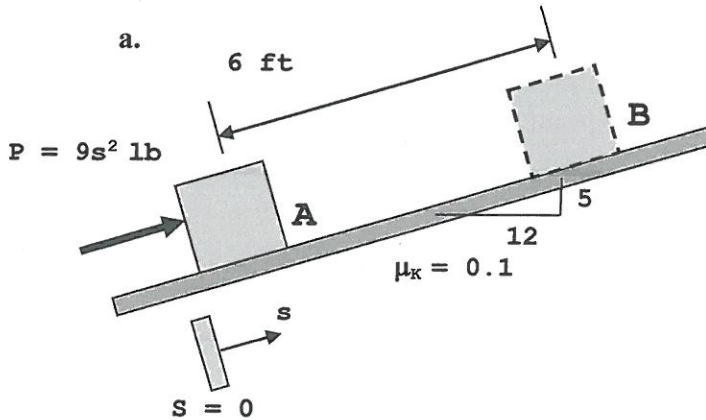


Engineering Mechanics - Dynamics

Work Energy I - Problem 1

Calculate the total work done by all the forces acting on the body between position A and position B. For each part, the block weighs 13 lbs, and the unstretched length of the spring is 5 feet and it has a spring constant, k , of 10 lb/ft.



WEIGHT

$$U_w = -13 \text{ lbs} \left(\frac{5}{13} (6') \right) = -30 \text{ Ft} \cdot \text{lb}$$

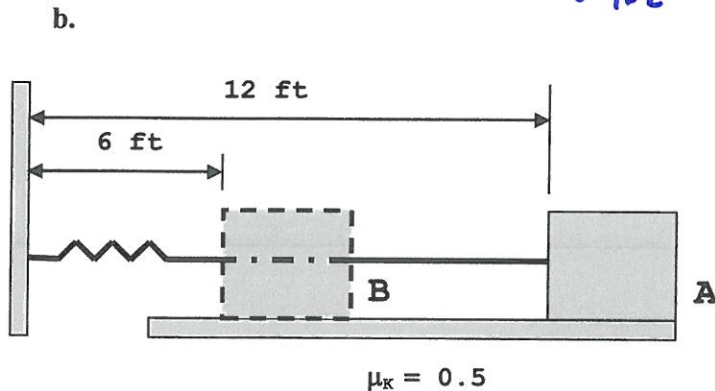
FORCE

$$U_p = \int_0^6 9s^2 ds = 3s^3 \Big|_0^6 = 648 \text{ Ft} \cdot \text{lb}$$

FRICTION

$$U_{fr} = -\mu_k N d = -(.1) \left(\frac{12}{13} \cdot 13 \right) (6) = -7.2 \text{ Ft} \cdot \text{lb}$$

$$U_{1-2} = -30 + 648 - 7.2 = \underline{\underline{611 \text{ Ft} \cdot \text{lb}}}$$



SPRING

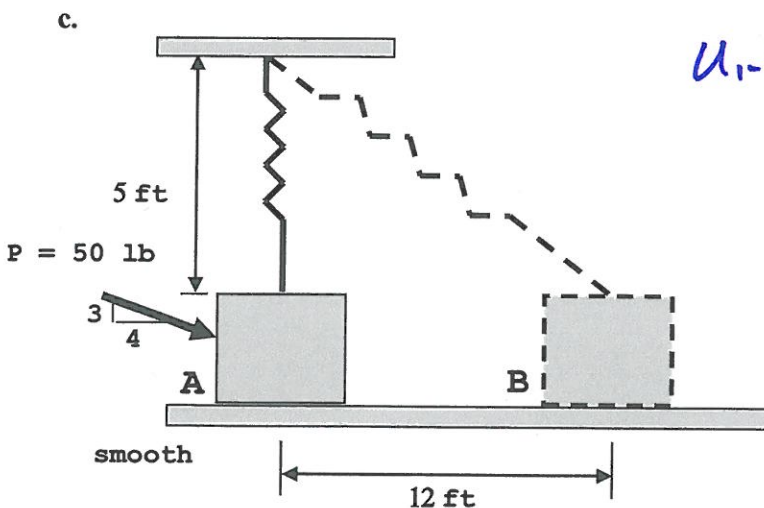
$$U_s = -\frac{1}{2} k (s_2^2 - s_1^2) \quad \begin{matrix} s_2 = 6 - 5 = 1 \\ s_1 = 12 - 5 = 7 \end{matrix}$$

$$= -\frac{1}{2} (10) (1^2 - 7^2) = 240 \text{ Ft} \cdot \text{lb}$$

FRICTION

$$U_{fr} = -\mu_k N d = -(0.5) (13) (6) = -39 \text{ Ft} \cdot \text{lb}$$

$$U_{1-2} = 240 - 39 = \underline{\underline{201 \text{ Ft} \cdot \text{lb}}}$$



FORCE

$$U_p = \frac{4}{5} (50) (12) = 480 \text{ Ft} \cdot \text{lb}$$

SPRING

$$U_s = -\frac{1}{2} k (s_2^2 - s_1^2) \quad \begin{matrix} s_2 = 13 - 5 = 8 \\ s_1 = 5 - 5 = 0 \end{matrix}$$

$$= -\frac{1}{2} (10) (8^2 - 0^2) = -320 \text{ Ft} \cdot \text{lb}$$

$$U_{1-2} = 480 - 320 = \underline{\underline{160 \text{ Ft} \cdot \text{lb}}}$$