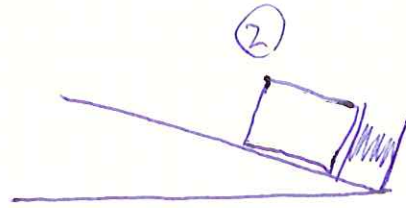
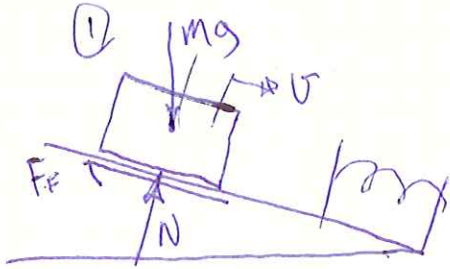


PROB. 13-69

$m = 50 \text{ kg}$, $k = 3 \times 10^4 \frac{\text{N}}{\text{m}}$, $\Delta x_1 = 0.05 \text{ m}$, $v_1 = 2 \frac{\text{m}}{\text{s}}$ @ 8 m ,

$\mu_k = 0.2$, FIND Δx WHEN $v_2 = 0$.



$$T_1 + V_1 + U_2 = T_2 + V_2$$

$$T_1 + (V_e)_1 + (V_g)_1 + U_2 = T_2 + (V_e)_2 + (V_g)_2$$

POINT 1: $v_1 = 2 \frac{\text{m}}{\text{s}}$, $h_1 = 8 \cdot \sin 20^\circ = 2.736 \text{ m}$,

$$\Delta x_1 = 0.05 \text{ m}$$

$$T_1 = \frac{1}{2} m v_1^2, (V_e)_1 = \frac{1}{2} k (\Delta x_1)^2, (V_g)_1 = m g h_1$$

POINT 2: $v_2 = 0$, $\Delta x_2 = \Delta x_1 + \Delta x$, $h_2 = -\Delta x \cdot \sin 20^\circ$

$$T_2 = 0, (V_e)_2 = \frac{1}{2} k (\Delta x_1 + \Delta x)^2, (V_g)_2 = -m g \Delta x \cdot \sin 20^\circ$$

$$U_2 = F_f \cdot \cos \alpha \cdot \Delta x = -\mu_k m g \cdot \cos 20^\circ (8 + \Delta x)$$

$$\frac{1}{2} m v_1^2 + \frac{1}{2} k (\Delta x_1)^2 + m g h_1 - \mu_k m g \cos 20^\circ (8 + \Delta x)$$

$$= 0 + \frac{1}{2} k (\Delta x_1 + \Delta x)^2 - m g \Delta x \cdot \sin 20^\circ$$

$$\frac{1}{2} (50 \text{ kg}) \left(2 \frac{\text{m}}{\text{s}} \right)^2 + \frac{1}{2} \left(3 \times 10^4 \frac{\text{N}}{\text{m}} \right) (0.05 \text{ m})^2 + (50 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) (2.736 \text{ m})$$

$$- (0.2) (50 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) \cos 20^\circ (8 + \Delta x) = \frac{1}{2} \left(3 \times 10^4 \frac{\text{N}}{\text{m}} \right) (0.05 + \Delta x)^2$$

$$- (50 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) \cdot \sin 20^\circ \cdot \Delta x$$

PROB. 13-69 CONT.

$$100 + 37.5 + 1342 - 92.18(8 + \Delta x) = 1.5 \times 10^4 (0.05 + \Delta x)^2 - 167.8 \Delta x$$

$$742 - 92.18 \Delta x = 37.5 + 1500 \Delta x + 1.5 \times 10^4 (\Delta x)^2 - 167.8 \Delta x$$

$$1.5 \times 10^4 (\Delta x)^2 + 1424 (\Delta x) - 704.5 = 0$$

$$\Delta x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Delta x = \frac{-1424 \pm \sqrt{1424^2 - 4(1.5 \times 10^4)(-704.5)}}{2(1.5 \times 10^4)}$$

$$\Delta x = -0.04747 \pm 0.2218 \quad \boxed{= 0.1744^m}$$