

Physics 10154 - Quiz 10B

A 2.45-kg mass is attached to a horizontally-oriented spring ($k_s = 385 \text{ N/m}$) on a frictionless table. The spring is compressed by a maximum distance of 16.2 cm and the mass is released from rest at that position.

- What is the speed of the mass when it passes through the equilibrium position of the spring?
- What is the mechanical energy of the system?
- What is the distance, x , from the equilibrium position of the spring when the kinetic energy represents 80.0% of the total mechanical energy of the system?

$$\begin{aligned} \text{a) } \Sigma W_F &= W_{\text{spr}} = \Delta K \\ \frac{1}{2} k x^2 &= \frac{1}{2} m v^2 - 0 \end{aligned}$$

max displacement
↓

$$v = \sqrt{\frac{k}{m}} x \quad \text{or} \quad \sqrt{\frac{k}{m}} A$$

$$\boxed{v = 2.03 \text{ m/s}}$$

$$\begin{aligned} \text{b) } E &= \frac{1}{2} k A^2 = \frac{1}{2} (385) (.162)^2 = \boxed{5.05 \text{ J}} \\ \text{or } \frac{1}{2} m v_{\text{max}}^2 &= \frac{1}{2} (2.45) (2.03)^2 = 5.05 \text{ J} \end{aligned}$$

$$\text{c) IF } K = 0.8E, \text{ then } U = 0.2E$$

$$\text{so } \frac{1}{2} k x^2 = 0.2 \left(\frac{1}{2} k A^2 \right)$$

$$x = \sqrt{.2} A$$

$$= \boxed{7.25 \text{ cm}}$$