

Springs 1

1. A 2-kg mass is hung from a spring. The spring stretches 40 cm.
 - a. What is the spring constant for the spring?
 - b. What is the EPE of the spring?

The same spring is attached to the 2-kg mass. They are now resting on a frictionless horizontal surface. The mass is pulled out 20 cm from its equilibrium position.

- c. What is the period of the oscillation?
 - d. What is the frequency?
 - e. What is the total energy of the oscillator at any point?
 - f. What is the maximum KE? The maximum EPE?
 - g. What is the maximum speed?
 - h. When the block is 10 cm from the center, find its speed, EPE, and acceleration.
 - i. What is the maximum acceleration of the block?
 - j. What is the acceleration at the center?
 - k. What is the ratio of KE to EPE when the position is 5, 10, and 15 cm?
2. A simple harmonic oscillator has a period of 2 seconds and an amplitude of 50 cm. Find the maximum speed and acceleration of the oscillator.
3. A spring with $k = 50 \text{ N/m}$ is compressed by 10 cm. A 2-kg block is placed in front of the spring on a horizontal, frictionless surface. The spring is released.
 - a. Find the maximum speed of the block.
 - b. How far along a frictionless incline of 36.87° will the block slide before coming to a stop?

(Hint: Use work and energy for both parts.)

Answers:

1.
 - a. 50 N/m
 - b. 4 J
 - c. $0.4\pi \text{ s} = 1.26 \text{ s}$
 - d. 0.796 Hz
 - e. 1 J
 - f. 1 J, 1 J
 - g. 1 m/s
 - h. .25 J, 0.866 m/s , 2.5 m/s²
 - i. 5 m/s²
 - j. 0 m/s
 - k. 15, 3, 0.78
2. $0.5 \pi^2 \text{ m/s}^2 = 4.93 \text{ m/s}^2$,
 $0.5 \pi \text{ m/s} = 1.57 \text{ m/s}$
3.
 - a. 0.5 m/s
 - b. 2.08 cm