W8.01

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 (use a horizontal spring-mass) oscillator has a period of 2 seconds and amplitude of 50 cm. Find the maximum speed and acceleration of the oscillator.

3. A spring with k = 50 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. 0.4π s = 1.26 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/s^2
   i. 5 m/s^2
   j. 0 m/s
   k. 15, 3, 0.78

2. $0.5\ \pi^2$ m/s^2 = 4.93 m/s^2,
   $0.5\ \pi$ m/s = 1.57 m/s

3.
   a. 0.5 m/s
   b. 2.08 cm

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