

Honors Physics SHM HW, part 1 (Homework)

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1.

A **0.50** kg mass is attached to a spring with a spring constant **151** N/m so that the mass is allowed to move on a horizontal frictionless surface. The mass is released from rest when the spring is compressed **0.18** m. Find

- (a) the force on the mass and
- (b) its acceleration at this instant

2.

A load of 50 N attached to a spring hanging vertically stretches the spring 5.0 cm. The spring is now placed horizontally on a table and stretched 11 cm.

- (a) What force is required to stretch the spring by this amount?
- (b) Plot a graph of force (on the y axis) versus spring displacement from the equilibrium position along the x axis. (Do this on paper. Your instructor may ask you to turn in this graph.)

Graph not included w/ answers.

3.

A slingshot consists of a light leather cup containing a stone that is pulled back against two rubber bands. It takes a force of 30 N to stretch the bands 1.0 cm.

- (a) What is the potential energy stored in the bands when a **44** g stone is placed in the cup and pulled back **0.24** m from the equilibrium position?
- (b) With what speed does the stone leave the slingshot?

4.

An archer pulls her bow string back **0.300** m by exerting a force that increases uniformly from zero to **260** N.

- (a) What is the equivalent spring constant of the bow?
- (b) How much work is done in pulling the bow?

5.

A child's toy consists of a piece of plastic attached to a spring (Fig. P13.7). The spring is compressed against the floor a distance of **2.00** cm, and the toy is released. If the toy has a mass of

120 g and rises to a maximum height of 50.0 cm, estimate the force constant of the spring.

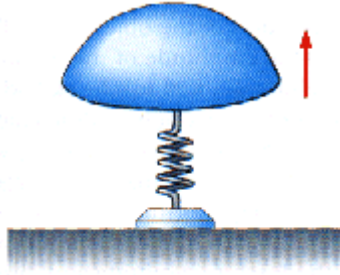


Figure P13.7.

6.

The spring constant of the spring in Figure P13.9 is 19.6 N/m, and the mass of the object is 4.0 kg. The spring is unstretched and the surface is frictionless. A constant 20 N force is applied horizontally to the object as shown. Find the speed of the object after it has moved a distance of 0.80 m.

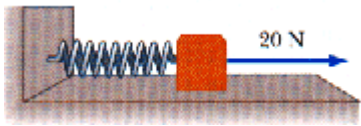


Figure P13.9.

7.

A mass of 0.35 kg connected to a light spring with a spring constant of 21.8 N/m oscillates on a frictionless horizontal surface. If the spring is compressed 4.0 cm and released from rest, determine the following.

- the maximum speed of the mass
- the speed of the mass when the spring is compressed 1.5 cm
- the speed of the mass when the spring is stretched 1.5 cm
- For what value of x does the speed equal one-half the maximum speed?

8.

At an outdoor market, a bunch of bananas is set into oscillatory motion with an amplitude of 20.0 cm on a spring with a spring constant of 16.0 N/m. It is observed that the maximum speed of the bunch of bananas is 45.0 cm/s. What is the weight of the bananas in newtons?

9.

A 60.0 g mass is attached to a horizontal spring with a spring constant of 10.0 N/m and released from rest with an amplitude of 30.0 cm. What is the velocity of the mass when it is halfway to the equilibrium position if the surface is frictionless?

10.

A 190 g mass is attached to a spring and executes simple harmonic motion with a period of 0.250 s. If the total energy of the system is 2.50 J, find

- the force constant of the spring and
- the amplitude of the motion.

11.

A spring stretches 3.5 cm when a 6 g mass is hung from it. If a total mass of 25 g attached to this spring oscillates in simple harmonic motion, calculate the period of motion.

12.

The motion of an object is described by the equation

$$x = (0.90 \text{ m}) \cos(\pi t/6)$$

Find

- (a) the position of the object at $t = 0$ and at $t = 0.60$ s
- (b) the amplitude of the motion,
- (c) the frequency of the motion, and
- (d) the period of the motion.

13.

A spring of negligible mass stretches 3.00 cm from its relaxed length when a force of 7.30 N is applied. A 2.000-kg particle rests on a frictionless horizontal surface and is attached to the free end of the spring. The particle is pulled horizontally so that it stretches the spring 5.00 cm and is then released from rest at $t = 0$.

- (a) What is the force constant of the spring?
- (b) What are the period, frequency, and angular frequency (ω) of the motion?
- (c) What is the total energy of the system?
- (d) What is the amplitude of the motion?
- (e) What are the maximum velocity and the maximum acceleration of the particle.
- (f) Determine the displacement, x , of the particle from the equilibrium position at $t = 0.500$ s.