

## Simple Harmonic Motion (Springs)

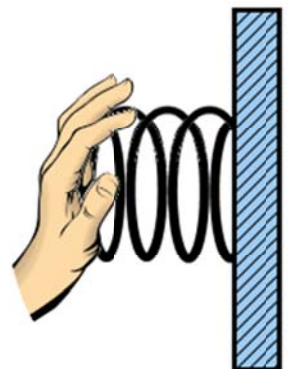
### Solve the following problems

1. In your own words, what is amplitude?
2. A mass oscillates on a spring with a period of 0.83 s between the 12cm and the 2cm on a scale. What is the frequency of this oscillation? What is the amplitude of the system?
3. A spring with spring constant of 40N/m is pulled down with a force of 15N. If it is released, what will the amplitude of the oscillations be?
4. If an oscillating spring has an amplitude of 0.6cm and the spring constant is 30N/m, what force must have been applied to the spring to get the spring moving?
5. (Serway, p. 381, #1) A mass of 0.30 kg is attached to a spring and is set into vibration with a period of 0.24 s. What is the spring constant of the spring?
6. (Serway, p. 381, #2) When a mass of 25 g is attached to a certain spring, it makes 20 complete vibrations in 4.0 s. What is the spring constant of the spring?
7. (Serway, p. 381, #3) A 125 N object vibrates with a period of 3.56 s when hanging from a spring. What is the spring constant of the spring?

8. (Serway, p. 381, #5) A spring of spring constant  $30.0 \text{ N/m}$  is attached to different masses, and the system is set in motion. Find the period and frequency of vibration for masses of the following magnitudes:  $2.3 \text{ kg}$ ,  $15 \text{ g}$ ,  $1.9 \text{ kg}$
9. (Walker, p. 413, #27) A  $0.32\text{-kg}$  mass attached to a spring undergoes simple harmonic motion with a period of  $0.65 \text{ s}$ . What is the force constant of the spring?
10. (Walker, p. 413, #29) When a  $0.50\text{-kg}$  mass is attached to a vertical spring, the spring stretches by  $15 \text{ cm}$ . How much mass must be attached to the spring to result in a  $0.75\text{-s}$  period of oscillation?
11. (Walker, p. 413, #32) A  $0.85\text{-kg}$  mass attached to a vertical spring of force constant  $150 \text{ N/m}$  oscillates with a maximum speed of  $0.35 \text{ m/s}$ . Find the following quantities related to the motion of the mass: **(a)** the period, **(b)** the amplitude.
12. (Walker, p. 413, #33) When a  $0.213\text{-kg}$  mass is attached to a vertical spring it causes the spring to stretch a distance  $d$ . If the mass is now displaced slightly from equilibrium, it is found to make  $102$  oscillations in  $56.7 \text{ s}$ . Find the spring constant  $k$ . Find the stretch distance,  $d$ .
13. (Walker, p. 413, #34) The springs of a  $511\text{-kg}$  motorcycle have an effective force constant of  $9130 \text{ N/m}$ . **(a)** If a person sits on the motorcycle, does its period of oscillation increase, decrease, or stay the same? **(b)** By what percent and in what direction does the period of oscillation change when a  $112\text{-kg}$  person rides the motorcycle?

14. The spring constant of the spring shown below is  $640 \text{ N/m}$ . Suppose the spring is compressed by a distance of  $0.25\text{-m}$ .

a. How much force was required to compress the spring?



b. How much work was done to compress the spring?

15. A 5.0-kg mass is held against a spring that has a spring constant of 820 N/m. The spring has been compressed by 0.75-m.

a. How much work will the spring do on the mass when it is released?

b. How fast will the mass travel once it is released?

