Closed book. No work needs to be shown for multiple-choice questions.

1. Consider a mass on a spring that is undergoing simple harmonic motion. In this simple harmonic motion system, the magnitude of the acceleration is greatest when:

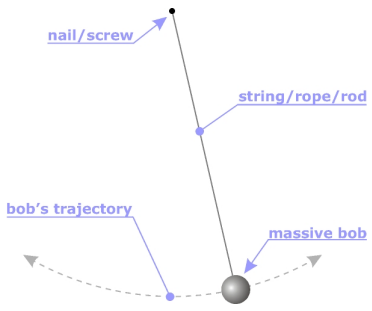
a. the displacement is maximum.
b. the displacement is zero.
c. the speed is maximum.
d. the force is zero.
e. the speed is exactly half of its maximum value.

2. In an engine, a piston oscillates with simple harmonic motion so that its position varies according to the expression: $x(t) = (7.5\text{ cm})\cos(4.0t + \pi/2)$, where x is in centimeters and t is in seconds. At $t = 0$ seconds, the magnitude of the velocity of the piston is:

a. zero.
b. 7.5 cm/s.
c. 30 cm/s.
d. 120 cm/s.
e. 0.21 cm/s.

3. A pendulum consists of a massive bob at the end of a string (as shown to the right). If the mass of the bob is doubled, what happens to the period of the pendulum?

a. The period of the pendulum will decrease.
b. The period of the pendulum will increase.
c. The period of the pendulum will remain the same.



4. A mass on a spring is undergoing simple harmonic motion with a frequency of 0.20 Hz. At time $t = 0$ it is at the equilibrium point. At which one of the ***following*** times is it furthest in distance from the equilibrium point?

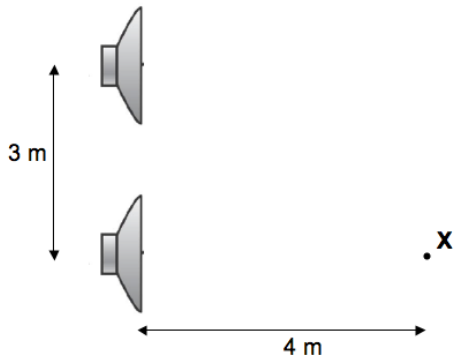
a. $t = 7.5$ seconds.
b. $t = 3.5$ seconds.
c. $t = 5.0$ seconds.
d. $t = 7.0$ seconds.
e. $t = 2.5$ seconds.

5. A Physics 1C student is creating water waves by throwing pebbles with a frequency of 2.0 Hz into a pool of water. If she now decreases the frequency of throwing the pebbles, what will happen to the velocity and the wavelength of the resulting water waves?

a. The wavelength of the water waves will increase and the velocity of the water waves will remain the same.
b. The wavelength of the water waves will decrease and the velocity of the water waves will remain the same.
c. The wavelength of the water waves will remain the same and the velocity of the water waves will increase.
d. The wavelength of the water waves will remain the same and the velocity of the water waves will decrease.
e. Both the wavelength of the water waves and the velocity of the water waves will remain the same.

6. Two small identical speakers are connected to the same source (*i.e.* they are in phase with one another). The speakers are 3.0 meters apart and at ear level. An observer stands at point X, 4.0 meters in front of one speaker as shown in the diagram. The sound she hears will be least intense (*i.e.* destructive interference) if the wavelength of the sound waves is:

a. 5.0 meters.
b. 4.0 meters.
c. 3.0 meters.
d. 2.0 meters.
e. 1.0 meters.



7. In a transverse wave on a spring, the coils of the spring vibrate:

a. in directions parallel to the length of the spring.
b. in directions anti-parallel to the length of the spring.
c. in directions perpendicular to the length of the spring.
d. only at the nodes.
e. in directions parallel and anti-parallel to the length of the spring.

8. The period of a simple pendulum on Earth is 1.00 seconds. When brought to another planet where g is one tenth that on Earth, its period becomes:

a. 1.00 seconds.
b. 0.316 seconds.
c. 0.100 seconds.
d. 10.0 seconds.
e. 3.16 seconds.

9. While standing at a crosswalk, you hear a frequency of 560 Hz from an approaching police car. After the police car passes and is moving away from you, you hear a frequency of 480 Hz. What is the speed of the police car (assume you are at room temperature)?

a. 13.1 m/s
b. 17.4 m/s
c. 21.1 m/s
d. 28.8 m/s
e. 26.3 m/s.

10. A block attached to a spring undergoes simple harmonic motion on a horizontal frictionless surface. Its total energy is 50.0 J. When the displacement is half the amplitude, the kinetic energy is:

a. 3.13 J.
b. 12.5 J.
c. 25.0 J.
d. 37.5 J.
e. 46.9 J.