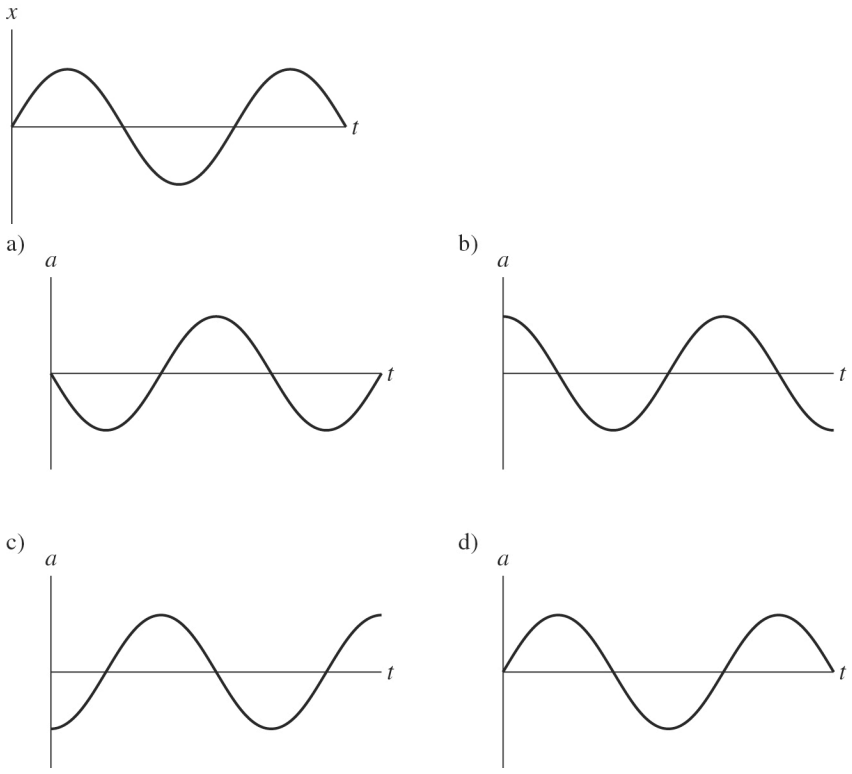
1) If we double the frequency of a system undergoing simple harmonic motion, which of the following statements about that system are true? (There could be more than one correct choice.)
   A) The amplitude is doubled.
   B) The period is reduced to one–half of what it was.
   C) The angular frequency is reduced to one–half of what it was.
   D) The angular frequency is doubled.
   E) The period is doubled.

2) The figure shows a graph of the position x as a function of time t for a system undergoing simple harmonic motion. Which one of the following graphs represents the acceleration of this system as a function of time?



A) graph a B) graph b C) graph c D) graph d

3) An object attached to an ideal spring executes simple harmonic motion. If you want to double its *total* energy, you could
   A) double the mass.
   B) double the amplitude of vibration.
   C) double both the amplitude and force constant (spring constant).
   D) double both the mass and amplitude of vibration.
   E) double the force constant (spring constant) of the spring.

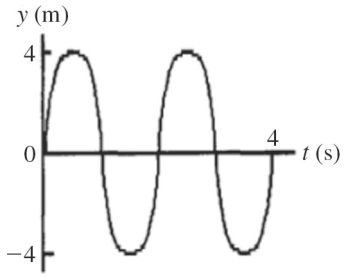
4) An object is attached to a vertical spring and bobs up and down between points A and B. Where is the object located when its kinetic energy is a minimum?
A) one–third of the way between A and B
B) midway between A and B
C) at either A or B
D) one–fourth of the way between A and B
E) at none of the above points

5) Two simple pendulums, A and B, are each 3.0 m long, and the period of pendulum A is T. Pendulum A is twice as heavy as pendulum B. What is the period of pendulum B?
A) T B) $T\sqrt{2}$ C) $T/2$ D) $2T$ E) $T/\sqrt{2}$

6) Grandfather clocks are designed so they can be adjusted by moving the weight at the bottom of the pendulum up or down. Suppose you have a grandfather clock at home that runs fast. Which of the following adjustments of the weight would make it more accurate? (There could be more than one correct choice.)
A) Remove some mass from the weight.
B) Lower the weight.
C) Add more mass to the weight.
D) Raise the weight.
E) Decrease the amplitude of swing by a small amount.

7) A pendulum of length L is suspended from the ceiling of an elevator. When the elevator is at rest the period of the pendulum is T. How does the period of the pendulum change when the elevator moves upward with constant velocity?
A) The period increases if the upward acceleration is more than $g/2$ but decreases if the upward acceleration is less than $g/2$.
B) The period increases.
C) The period becomes zero.
D) The period decreases.
E) The period does not change.

8) What is the frequency of the wave shown in the figure?



A) 0.5 Hz.
B) 2 Hz.
C) 4 Hz.
D) 1 Hz.
E) It cannot be determined from the given information.

9) When a certain string is under tension T, the speed of a wave in the string is v. What will be the speed of a wave in the string if the tension is increased to $2T$ without changing the mass or length of the string?
A) $2v$ B) $v/\sqrt{2}$ C) $4v$ D) $v\sqrt{2}$ E) $v/2$

10) The intensity of the waves from a point source at a distance d from the source is I. At what distance from the sources is the intensity equal to $2I$?

A) $d/4$ B) $d/2$ C) $d/\sqrt{2}$ D) $d/8$

11) A stretched string is observed to have four equal segments in a standing wave driven at a frequency of 480 Hz. What driving frequency will set up a standing wave with five equal segments?

A) 120 Hz B) 600 Hz C) 360 Hz D) 240 Hz

12) A guitar string is set into vibration with a frequency of 512 Hz. How many oscillations does it undergo each minute?

13) The position of a cart that is oscillating on a spring is given by the equation $x = (12.3\text{ cm})\cos[(1.26\text{ s}^{-1})t]$. When $t = 0.805$ s, what are the (a) velocity and (b) acceleration of the cart?

14) A package is oscillating on a spring scale with a period of 4.60 s. At time $t = 0.00$ s the package has zero speed and is at $x = 8.30$ cm. At what time after $t = 0.00$ s will the package first be at $x = 4.15$ cm?

15) If the frequency of the motion of a simple harmonic oscillator is doubled, by what factor does the maximum speed of the oscillator change?

16) A 0.150–kg air track cart is attached to an ideal spring with a force constant (spring constant) of 3.58 N/m and undergoes simple harmonic oscillations. What is the period of the oscillations?

17) A 51.8–kg bungee jumper jumps off a bridge and undergoes simple harmonic motion. If the period of oscillation is 11.2 s, what is the spring constant (force constant) of the bungee cord?

18) A block attached to an ideal spring of force constant (spring constant) 15 N/m executes simple harmonic motion on a frictionless horizontal surface. At time $t = 0$ s, the block has a displacement of –0.90 m, a velocity of –0.80 m/s, and an acceleration of +2.9 m/s^2 . The mass of the block is closest to

19) A ball is attached to an ideal spring and oscillates with a period T. If the mass of the ball is doubled, what is the new period?

20) A 0.50–kg object is attached to an ideal spring of spring constant (force constant) 20 N/m along a horizontal, frictionless surface. The object oscillates in simple harmonic motion and has a speed of 1.5 m/s at the equilibrium position. What are (a) the total energy and (b) the amplitude of vibration of the system?

21) A 34–kg child on an 18–kg swing set swings back and forth through small angles. If the length of the very light supporting cables for the swing is 4.9 m, how long does it take for each complete back–and–forth swing? Assume that the child and swing set are very small compared to the length of the cables.

22) A simple pendulum takes 2.00 s to make one compete swing. If we now triple the length, how long will it take for one complete swing?

23) An astronaut has landed on an asteroid and conducts an experiment to determine the acceleration of gravity on that asteroid. He uses a simple pendulum that has a period of oscillation of 2.00 s on Earth and finds that on the asteroid the period is 11.3 s. What is the acceleration of gravity on that asteroid?

24) What is the frequency of a pressure wave of wavelength 2.5 m that is traveling at 1400 m/s?

25) A piano wire of linear mass density 0.0050 kg/m is under a tension of 1350 N. What is the wave speed in this wire?

26) A 2.31–kg rope is stretched between supports that are 10.4 m apart, and has a tension in it of 49.2 N. If one end of the rope is slightly tweaked, how long will it take for the resulting disturbance to reach the other end?

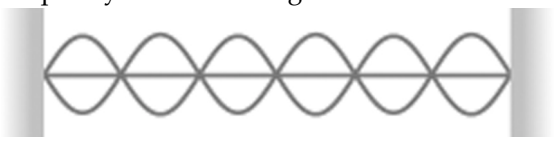
27) An earthquake generates three kinds of waves: surface waves (L–waves), which are the slowest and weakest, shear (S) waves, which are transverse waves and carry most of the energy, and pressure (P) waves, which are longitudinal waves and are the fastest. The speed of P waves is approximately 7 km/s, and that of S waves is about 4 km/s. People do not generally feel the P waves, but animals seem to be sensitive to them. If a person reports that her dog started barking 20 seconds "before the earthquake," then approximately how far was the origin of the earthquake?

28) What is the wave speed in a brass wire with a radius of 0.500 mm stretched with a tension of 125 N? The density of brass is 8.60×10^3 kg/m^3.

29) Calculate the light intensity 1.45 m from a light bulb that radiates 100 W equally in all directions.

30) Find the first three harmonics of a string of linear mass density 2.00 g/m and length 0.600 m when the tension in it is 50.0 N.

31) A string that is 2.0 meters long is fixed at both ends and tightened until the wave speed is 18 m/s. What is the frequency of the standing wave shown in the figure?



32) One of the harmonics of a string fixed at both ends has a frequency of 52.2 Hz and the next higher harmonic has a frequency of 60.9 Hz. What is the fundamental frequency of the string?

Answer Key
Testname: HW_CH11_OSCILLATION

1) B, D
2) A
3) E
4) C
5) A
6) B
7) E
8) A
9) D
10) C
11) B
12) 30,700
13) (a) –13.2 cm/s (b) –10.3 cm/s^2
14) 0.767 s
15) 2
16) 1.29 s
17) 16.3 N/m
18) 4.7 kg
19) $T\sqrt{2}$
20) (a) 0.56 J (b) 0.24 m
21) 4.4 s
22) 3.46 s
23) 0.307 m/s^2
24) 560 Hz
25) 520 m/s
26) 0.699 s
27) 200 km
28) 136 m/s
29) 3.78 W/m^2
30) 132 Hz, 264 Hz, 395 Hz
31) 27 Hz
32) 8.7 Hz