Classroom Response System Questions

Chapter 15 Oscillations

Reading Questions
15.2.1. Which one of the following units is used for frequency?

a) oersted
b) second
c) farad
d) hertz
e) gauss
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a) oersted

b) second

c) farad

d) hertz

e) gauss
15.2.2. What is the difference between periodic motion and simple harmonic motion?

a) Periodic motion only happens for short periods of time and simple harmonic motion happens continually.

b) In periodic motion, the frequency of the motion is continually changing, but in simple harmonic motion, the frequency is constant.

c) In periodic motion, the period of the motion is continually changing, but in simple harmonic motion, the period is constant.

d) In periodic motion, the amplitude varies with time, but in simple harmonic motion, the position of the object varies with time.

e) Periodic and simple harmonic motion refer to the same type of motion.
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d) In periodic motion, the amplitude varies with time, but in simple harmonic motion, the position of the object varies with time.

e) Periodic and simple harmonic motion refer to the same type of motion.
15.2.3. A block is hung vertically at the end of a spring. When the block is displaced and released, it moves in simple harmonic motion. Which one of the following statements is true concerning the block?

a) The maximum acceleration of the block occurs when its velocity is zero.

b) The velocity of the block is never zero m/s.

c) If the velocity of the block is zero m/s, its acceleration is zero m/s².

d) The maximum velocity occurs when the maximum acceleration occurs.
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15.2.4. Consider the graph shown for the position of a ball attached to a spring as it oscillates in simple harmonic motion. At which of the following times does the ball have its greatest speed?

a) 1 s  
b) 2 s  
c) 4 s  
d) 6 s  
e) both 2 s and 6 s
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15.2.6. An object is in simple harmonic motion. The rate at which the object oscillates may be described using the period $T$, the frequency $f$, and the angular frequency $\omega$. If the angular frequency decreases, what is the effect on the period and the frequency?

a) The frequency would decrease, but the period would remain the same.

b) The period would increase, but the frequency would remain the same.

c) Both the period and the frequency would decrease.

d) Both the period and the frequency would increase.

e) The period would increase, but the frequency would decrease.
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e) The period would increase, but the frequency would decrease.
15.2.7. An object in simple harmonic motion is observed to move between a maximum position and a minimum position. The minimum time that elapses between the object being at its maximum position and when it returns to that maximum position is equal to which of the following parameters?

a) frequency

b) angular frequency

c) period

d) amplitude

e) wavelength
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a) frequency

b) angular frequency

c) period

d) amplitude

e) wavelength
15.3.1. Which one of the following statements concerning simple harmonic motion is false?

a) The displacement versus time graph for an object in simple harmonic motion resembles the sine or cosine function.

b) A restoring force acts on an object in simple harmonic motion that is directed in the same direction as the object’s displacement.

c) The amplitude of the object in simple harmonic motion is the maximum distance the object moves from its equilibrium position.

d) During simple harmonic motion, the net force on the object is zero newtons when it is at its equilibrium position.

e) A restoring force acts on the object that is proportional to the object’s displacement from its equilibrium position.
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15.3.2. Consider the graph shown for the position of a ball attached to a spring as it oscillates in simple harmonic motion. At which of the following times is the ball at its equilibrium position?

a) 0 s only
b) 2 s only
c) 4 s only
d) at 0 s and 8 s
e) at 0 s, 4 s, and 8 s
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a) 0 s only
b) 2 s only
c) 4 s only
d) at 0 s and 8 s
e) at 0 s, 4 s, and 8 s
15.3.3. An object that obeys Hooke’s law is displaced a distance $x$ by a net force $F$. Which one of the following statements correctly describes the resulting acceleration of the object?

a) The magnitude of the acceleration is constant.

b) The acceleration increases as $x$ increases and it decreases as $x$ decreases.

c) The acceleration is always in the positive $x$ direction.

d) The acceleration is only dependent on the mass of the object.
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15.3.4. A ball of mass $m$ is attached to the end of a spring with a spring constant $k$. When the ball is displaced from its equilibrium position and released, it moves in simple harmonic motion. Consider the relationship between the angular frequency, the mass, and the spring constant given in the text. Which one of the following statements concerning that relationship is true?

a) Increasing the spring constant causes the angular frequency to increase.

b) Increasing the mass of the ball causes the angular frequency to increase.

c) Increasing the initial displacement before releasing the ball causes the angular frequency to increase.

d) Increasing the period of the ball’s motion causes the angular frequency to increase.
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d) Increasing the period of the ball’s motion causes the angular frequency to increase.
15.3.5. A block of mass $M$ is attached to one end of a spring that has a spring constant $k$. The other end of the spring is attached to a wall. The block is free to slide on a frictionless floor. The block is displaced from the position where the spring is neither stretched nor compressed and released. It is observed to oscillate with a frequency $f$. Which one of the following actions would increase the frequency of the motion?

a) Decrease the mass of the block.

b) Increase the length of the spring.

c) Reduce the spring constant.

d) Reduce the distance that the spring is initially stretched.

e) Increase the distance that the spring is initially stretched.
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a) The block’s acceleration is constant.

b) The period of its motion depends on its amplitude.

c) The block’s acceleration is greatest when the spring returns to its equilibrium position.

d) The block’s velocity is greatest when it reaches its maximum displacement.

e) The block’s acceleration is greatest when the mass has reached its maximum displacement.
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e) The block’s acceleration is greatest when the mass has reached its maximum displacement.
15.4.1. A block is attached to the end of a spring. The block is then displaced from its equilibrium position and released. Subsequently, the block moves in simple harmonic motion without any losses due to friction. Which one of the following statements concerning the total mechanical energy of the block-spring system this situation is true?

a) The total mechanical energy is dependent on the amplitude of the motion.

b) The total mechanical energy is at its maximum when the block is at its equilibrium position.

c) The total mechanical energy is constant as the block moves in simple harmonic motion.

d) The total mechanical energy is only dependent on the spring constant and the mass of the block.
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d) The total mechanical energy is only dependent on the spring constant and the mass of the block.
15.4.2. Which one of the following statements concerning the elastic potential energy of a ball attached to a spring is false when the ball is moving in simple harmonic motion?

a) The elastic potential energy is at its minimum when the spring is in its equilibrium position.

b) The elastic potential energy is smaller when the ball is at $-x$ than when it is at $+x$.

c) The elastic potential energy can be expressed in units of watts.

d) The elastic potential energy is at its maximum when the velocity of the ball is a maximum.

e) The elastic potential energy is at its minimum when the acceleration of the ball is a maximum.
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e) The elastic potential energy is at its minimum when the acceleration of the ball is a maximum.
15.4.3. A ball is attached to a vertical spring. The ball is initially supported at a height $y$ so that the spring is neither stretched nor compressed. The ball is then released from rest and it falls to a height $y - h$ before moving upward. Consider the following quantities: translational kinetic energy, gravitational potential energy, elastic potential energy. When the ball was at a height $y - (h/2)$, which of the listed quantities has values other than zero joules?

a) translational kinetic energy only

b) gravitational potential energy only

c) elastic potential energy only

d) translational and elastic potential energies only

e) translational kinetic, gravitational potential, and elastic potential energies
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a) translational kinetic energy only

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c) elastic potential energy only

d) translational and elastic potential energies only

e) translational kinetic, gravitational potential, and elastic potential energies
15.4.4. Which one of the following statements concerning the mechanical energy of a harmonic oscillator at a particular point in its motion is true?

a) The mechanical energy depends on the acceleration at that point.

b) The mechanical energy depends on the velocity at that point.

c) The mechanical energy depends on the position of that point.

d) The mechanical energy does not vary during the motion.

e) The mechanical energy is equal to zero joules if the point is the equilibrium point.
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15.6.1. A simple pendulum consists of a ball of mass $m$ suspended from the ceiling using a string of length $L$. The ball is displaced from its equilibrium position by an angle $\theta$ and released. What is the magnitude of the restoring force that moves the ball toward its equilibrium position and produces simple harmonic motion?

a) $kx$

b) $mg$

c) $mg \cos \theta$

d) $mg \sin \theta$

e) $mgL \sin \theta$
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a) $kx$

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c) $mg \ (\cos \theta)$

d) $mg \ (\sin \theta)$

e) $mgL \ (\sin \theta)$
15.6.2. A simple pendulum consists of a ball of mass $m$ suspended from the ceiling using a string of length $L$. The ball is displaced from its equilibrium position by a small angle $\theta$ and released. Which one of the following statements concerning this situation is correct?

a) If the mass were increased, the period of the pendulum would increase.

b) The frequency of the pendulum does not depend on the acceleration due to gravity.

c) If the length of the pendulum were increased, the angular frequency of the pendulum would decrease.

d) The period of the pendulum does not depend on the length of the pendulum.

e) The angular frequency would double if the angle $\theta$ were doubled.
15.6.2. A simple pendulum consists of a ball of mass \( m \) suspended from the ceiling using a string of length \( L \). The ball is displaced from its equilibrium position by a small angle \( \theta \) and released. Which one of the following statements concerning this situation is correct?

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15.6.3. What is the period of a simple pendulum consisting of a ball suspended from a 2.0-m string?

a) 2.0 s

b) 2.8 s

c) 3.6 s

d) 4.4 s

e) 5.2 s
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15.6.4. Under which one of the following conditions does the motion of a simple pendulum approximate simple harmonic motion?

a) when the pendulum swings rapidly

b) when the pendulum swings slowly

c) when the pendulum swings through a small angle

d) when the pendulum swings through a large angle

e) when the length of the pendulum is more than twice the diameter of the bob
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15.6.5. A simple pendulum that swings through a very large angle is not in simple harmonic motion because of which of the following reasons?

a) The restoring force depends on the sine of the angle.

b) The component of the gravitational force that acts as the restoring force is only linear if the maximum angle is small.

c) The angular acceleration does not vary linearly with the angle.

d) All of the above reasons are valid explanations.
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15.8.1. What type of motion is represented by the graph shown?

a) simple harmonic motion
b) damped harmonic motion
c) special harmonic motion
d) squeezed harmonic motion
e) depleted harmonic motion
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a) simple harmonic motion

b) damped harmonic motion

c) special harmonic motion

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e) depleted harmonic motion
15.9.1. Complete the following sentence: In harmonic motion, resonance occurs when

a) the energy in the system is proportional to the square of the motion's amplitude.

b) the driving frequency is the same as the natural frequency of the system.

c) the energy in the system is a minimum.

d) the system is damped.

e) the driving frequency is varying.
15.9.1. Complete the following sentence: In harmonic motion, resonance occurs when

a) the energy in the system is proportional to the square of the motion's amplitude.

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e) the driving frequency is varying.
15.9.2. What is the term used to describe the situation in which an external driving force is applied to a system with a frequency that equals the natural frequency of the system?

a) symbiosis

b) synergy

c) resonance

d) somnoluminescence

e) bonnechance
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