

## AP Physics 1 Multiple Choice Questions - Chapter 9

1 If an object of mass  $m$  attached to a light spring is replaced by one of mass  $9m$ , the frequency of the vibrating system changes by what multiplicative factor?

- a  $1/9$
- b  $1/3$
- c 3
- d 9
- e 6

9.1

2 A mass of 0.40 kg, hanging from a spring with a spring constant of 80.0 N/m, is set into an up-and-down simple harmonic motion. If the mass is displaced from equilibrium by 0.10 m and released from rest, what is its speed when moving through the equilibrium point?

- a 0 m/s
- b 1.4 m/s
- c 2.0 m/s
- d 3.4 m/s
- e 4.2 m/s

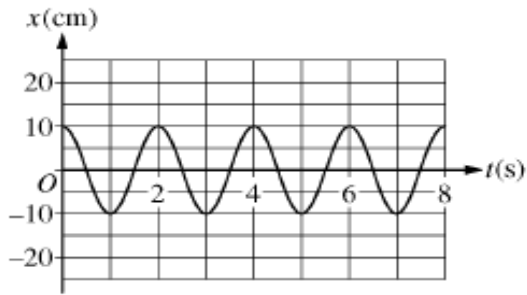
9.1

3 An object of mass 0.40 kg, hanging from a spring with a spring constant of 8.0 N/m, is set into an up-and-down simple harmonic motion. What is the magnitude of the acceleration of the object when it is at its maximum displacement of 0.10 m?

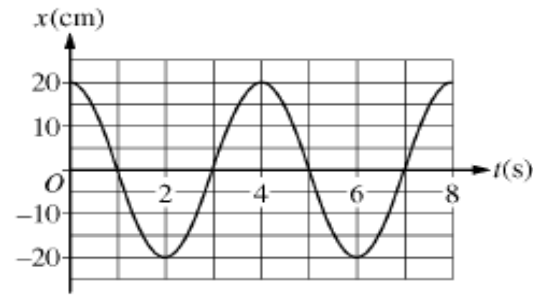
- a  $0 \text{ m/s}^2$
- b  $0.45 \text{ m/s}^2$
- c  $1.0 \text{ m/s}^2$
- d  $2.0 \text{ m/s}^2$
- e  $2.40 \text{ m/s}^2$

9.1

## AP Physics 1 Multiple Choice Questions - Chapter 9



Block A



Block B



9.2

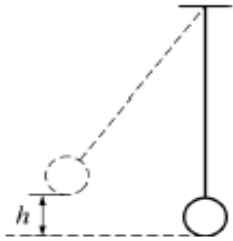
- 1 Two blocks are connected to identical ideal springs and are oscillating on a horizontal frictional surface. Block A has mass  $m$ , and its motion is represented by the graph of position as a function of time shown above on the left. Block B's motion is represented above on the right. Which of the following statements comparing block B to block A is correct?
- a Because block B covers more distance per cycle than block A, block B takes more time to complete each cycle
  - b Because the spring attached to block B is initially stretched a greater distance, the spring constant is smaller and therefore block B has a slower average speed than block A has
  - c Because block B has more mass, it has a slower average speed than block A does
  - d Because block B has more mass, its acceleration is smaller than that of block A at any given displacement from the equilibrium position.



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- 1 A pendulum consisting of a sphere suspended from a light string is oscillating with a small angle with respect to the vertical. The sphere is then replaced with a new sphere of the same size but greater density and is set into oscillation with the same angle. How do the period, maximum kinetic energy, and maximum acceleration of the new pendulum compare to those of the original pendulum?

- |   | <u>Period</u> | <u>Max KE</u> | <u>Min Accel</u> |
|---|---------------|---------------|------------------|
| a | Larger        | Larger        | Smaller          |
| b | Smaller       | Larger        | Smaller          |
| c | The Same      | The Same      | The Same         |
| d | The Same      | Larger        | The Same         |



- 2 The pendulum shown in the figure above reaches a maximum height  $h$  above the equilibrium position as it oscillates. Assuming friction and air resistance are negligible, which of the following is true about the total energy of the Earth-pendulum system as the pendulum oscillates?
- a It is at a maximum when the pendulum is at its lowest point
  - b It is at a maximum when the pendulum is at its maximum height  $h$
  - c It is constant throughout the pendulum's motion
  - d It is at a minimum when the pendulum is somewhere between its lowest and highest positions



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1 The distance between the crest of a water wave and the next trough is 2.0 m. If the frequency of a particular wave is 2.0 Hz, what is the speed of the wave?

- a 4.0 m/s
- b 1.0 m/s
- c 8.0 m/s
- d 2.0 m/s
- e Impossible to determine with information given

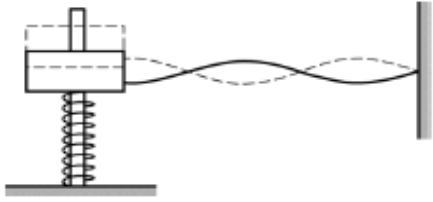
2 What is the frequency of a photon of red light of wavelength 700. nm?

- a  $4.29 \times 10^{14}$  Hz
- b  $4.29 \times 10^5$  Hz
- c  $4.29 \times 10^8$  Hz
- d  $4.29 \times 10^{44}$  Hz
- e 4.29 Hz

3 What is the frequency of a wavelength with a velocity of 35 m/s and a period of 5.0 seconds?

- a 175 Hz
- b 7 Hz
- c 0.0057 Hz
- d 0.2 Hz
- e 0.14 Hz

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- 1 The figure above shows a pole with a spring around it and a 0.10 kg block with a hole in the middle on top of the spring. A light horizontal string is attached to the block and a wall. When the block is oscillating at 5.0 Hz, the standing wave shown is formed.

What additional measurement is needed to determine the speed of the wave on the string?

- a The mass of the string
- b The effective spring constant of the spring
- c The distance between the wall and the block
- d The amplitude of the block's oscillation

- 2 The distance between two successive minima of a transverse wave is 2.76 m. Five crests of the wave pass a given point along the direction of travel every 14.0 seconds. Find the speed of the wave.

- a 3.55 m/s
- b 0.99 m/s
- c 0.54 m/s
- d 2.31 m/s

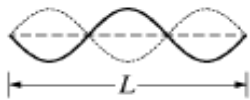
- 3 A harmonic wave is traveling along a rope. It is observed that the oscillator that generates the wave completes 40.0 vibrations in 30.0 seconds. Also, a given maximum travels 425 cm along the rope in 10.0 seconds. What is the wavelength of the wave?

- a 57 cm
- b 75 cm
- c 67 cm
- d 45 cm

## AP Physics 1 Multiple Choice Questions - Chapter 9



9.6



- 1 A guitar string of length  $L$  can vibrate with three antinodes, as shown above. The straight dashed line shows the equilibrium position of the string. The wave pattern is most likely formed by the superposition of which of the following pulses or waves?



- (C) Two periodic waves of wavelength  $L/3$ , one moving to the left and one moving to the right
- (D) Two periodic waves of wavelength  $2L/3$ , one moving to the left and one moving to the right



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2 Two wave pulses are created simultaneously at opposite ends of a string and move toward the center of the string, as shown in the top figure above. Both pulses have the same width. The labeled figures show possible shapes of the string at different moments in time. Which of the following indicates a correct time order for the shape of the string as the pulses move along the string, come together, and move apart?

- a Figure X, Figure W, Figure X
- b Figure X, Figure W, Figure Y
- c Figure X, Figure Z, Figure X
- d Figure X, Figure Z, Figure Y

3 Waves that meet crest to crest and trough to trough on interfering waves experience \_\_\_\_\_ interference while waves that meet crest to trough and trough to crest experience \_\_\_\_\_ interference.

- a Destructive, Constructive
- b No, Destructive
- c Constructive, No
- d Constructive, Destructive



9.6