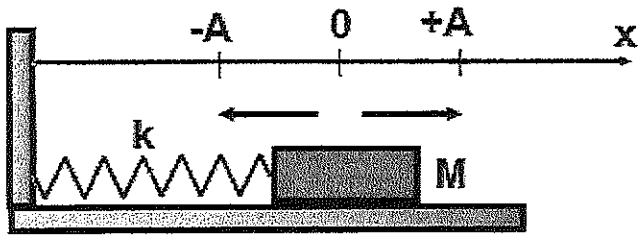
Simple Harmonic Motion
Practice Problems

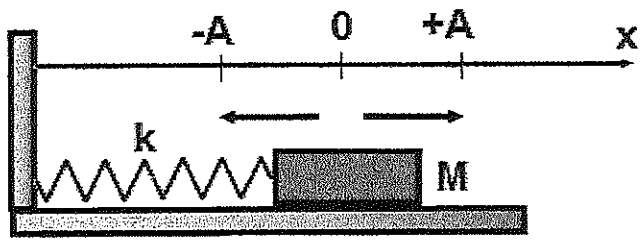
Name_____

Multiple Choice Questions



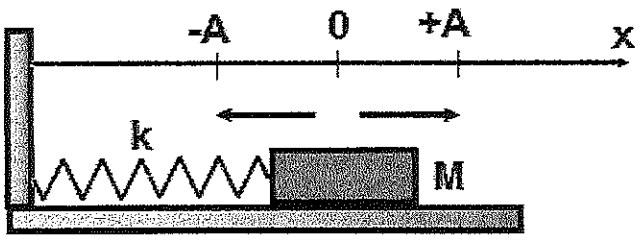
1. A block with a mass M is attached to a spring with a spring constant k. The block undergoes SHM. Where is the block located when its velocity is a maximum in magnitude?

A) x = 0 B) x = ±A C) x = +A/2 D) x = -A/2



2. A block with a mass M is attached to a spring with a spring constant k. The block undergoes SHM. Where is the block located when its potential energy is a maximum?

A) x = 0 B) x = ±A C) x = +A/2 D) x = -A/2



3. A block with a mass M is attached to a spring with a spring constant k. The block undergoes SHM. Where is the block located when its acceleration is a minimum in magnitude?

A) x = 0 B) x = ±A C) x = +A/2 D) x = -A/2

4. A mass-spring oscillating system undergoes SHM with a period T. What is the period of the system if the amplitude is doubled?

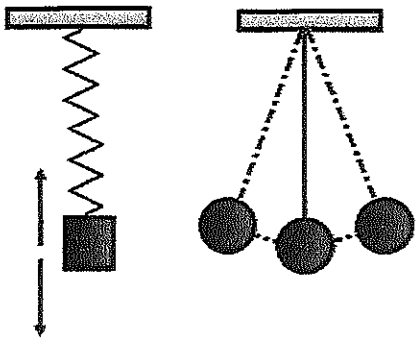
A) 2T B) 4T C) T D) T/2

5. A mass-spring oscillating system undergoes SHM with a period T when it is located on Earth. What is the period of the system when it is located on Moon?

A) 6T B) T/6 C) T D) $\sqrt{6}$ T

6. A block with a mass M is attached to a vertical spring with a spring constant k. When the block is displaced from equilibrium and released its period is T. A second identical spring k is added to the first spring in parallel. What is the period of oscillations when the block is suspended from two springs?

A) 2T B) $\sqrt{2}$ T C) T D) $\frac{T}{\sqrt{2}}$



7. Two oscillating systems: spring-mass and simple pendulum undergo SHM with an identical period T. If the mass in each system is doubled which of the following is true about the new period?

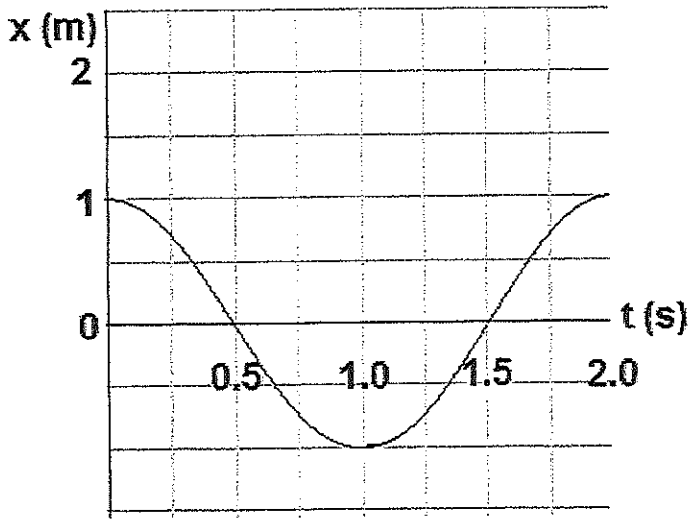
	Mass-spring	Simple pendulum
A)	T	$\frac{T}{\sqrt{2}}$
B)	$\frac{T}{\sqrt{2}}$	T
C)	$\sqrt{2}\,T$	T
D)	T	$\sqrt{2}\,T$

8. An object undergoes SHM and position as a function of time is presented by the following formula: $x = (0.1\ m)\ Sin(4\pi t)$. What is the period of oscillations?

A) 2 s B) 0.1 s C) 0.5 s D) 4 s

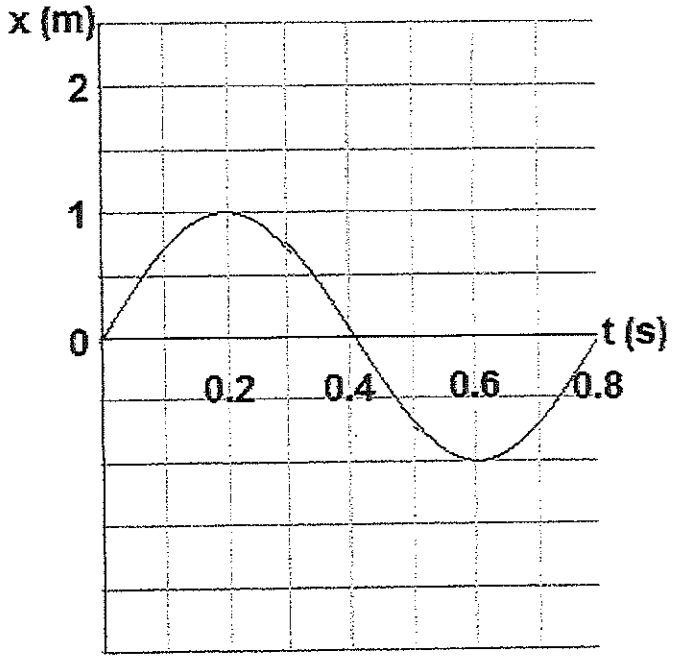
9. An object undergoes SHM and position as a function of time is presented by the following formula: $x = (0.5\ m)\ Cos(\pi t)$. What is the amplitude of oscillations?

A) 2 m B) 1 m C) 0.5 m D) 0.1 m



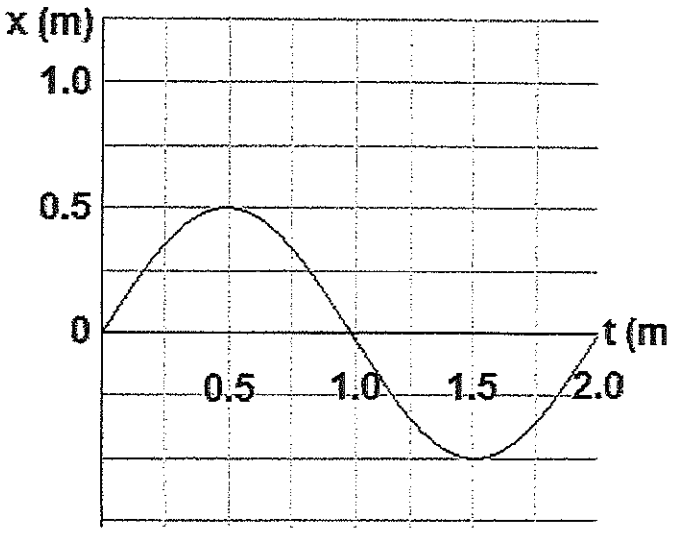
10. The position as a function of time of a mass-spring oscillating system is presented by the graph. Which of the following is true about velocity and acceleration at the time 1.5 s?

Velocity	Acceleration
A) $v > 0$	$a < 0$
B) $v = 0$	$a > 0$
C) $v < 0$	$a = 0$
D) $v > 0$	$a = 0$



11. A particle undergoes SHM represented by the graph. Which of the following is true about the amplitude and period of oscillations?

	Amplitude	Period
A)	1 m	0.8 s
B)	1 m	0.1 s
C)	1 m	0.4 s
D)	2 m	0.4 s



12. An object oscillates at the end of a spring. The position as a function of time is presented by the graph. Which of the following formulas represent the position and velocity of the object?

	Position	Velocity
A)	$x = (0.5)\ \mathrm{Sin}(\pi t)$	$v = (0.5\pi)\ \mathrm{Sin}(\pi t)$
B)	$x = (0.5)\ \mathrm{Sin}(\pi t)$	$v = (0.5\pi)\ \mathrm{Cos}(\pi t)$
C)	$x = (0.5)\ \mathrm{Cos}(\pi t)$	$v = (0.5\pi)\ \mathrm{Sin}(\pi t)$
D)	$x = (0.5\pi)\ \mathrm{Sin}(\pi t)$	$v = (0.5)\ \mathrm{Sin}(\pi t)$

13. A simple pendulum oscillates with a period T. If the mass of the pendulum is doubled what is the new period of the pendulum?

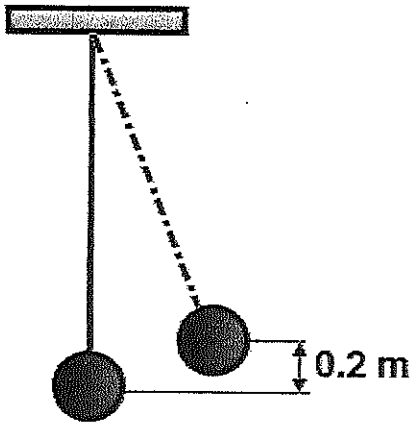
A) T/2 B) 2T C) T D) $\sqrt{2}$ T

14. A simple pendulum oscillates with a period T. If the length of the pendulum is doubled what is the new period of the pendulum?

A) 2T B) T C) $\sqrt{2}$ T D) $\frac{T}{\sqrt{2}}$

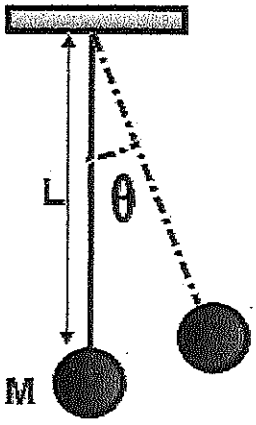
15. What is the length of a simple pendulum if it oscillates with a period of 2 s?

A) 2.0 m B) 1.0 m C) 0.5 m D) 0.4 m



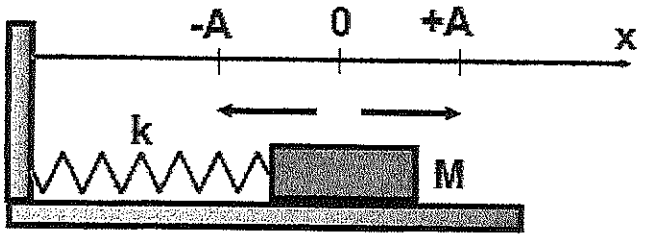
16. A simple pendulum consists of a mass M attached to a vertical string L. When the string is displaced to the right the ball moves up by a distance 0.2 m. When the ball is released from rest what is the maximum speed?

A) 1 m/s B) 2 m/s C) 3 m/s D) 4 m/s



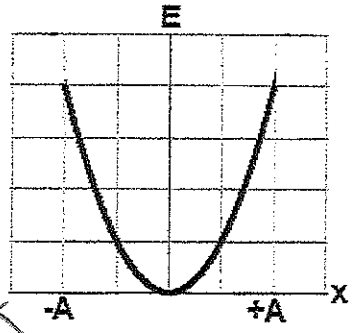
17. A simple pendulum consists of a mass M attached to a vertical string L. The string is displaced to the right by an angle Θ. When the pendulum is released from rest what is the speed of the ball at the lowest point?

A) 2 gL B) $\sqrt{2gL}$ C) $\sqrt{2gL\cos\theta}$ D) $\sqrt{2gL(1-\cos\theta)}$

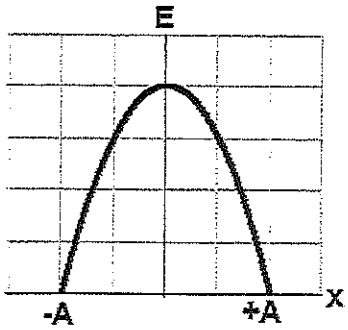


18. A block of mass M is attached to a horizontal spring k. The block undergoes SHM with amplitude of A. Which of the following graphs represents the elastic potential energy as a function of position x?

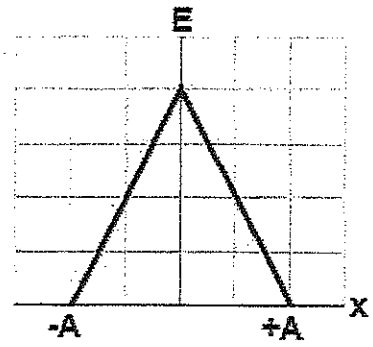
A)



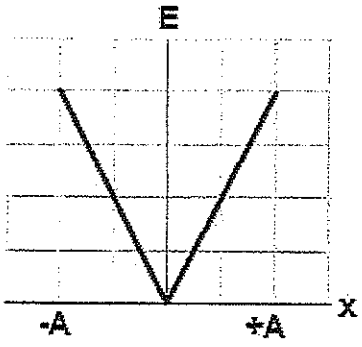
B)

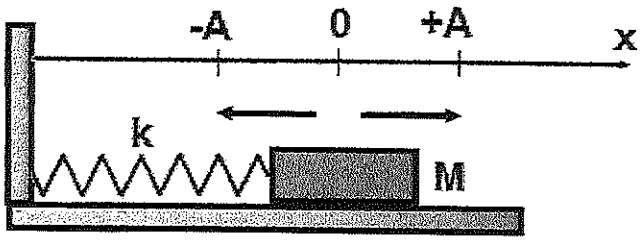


C)



D)

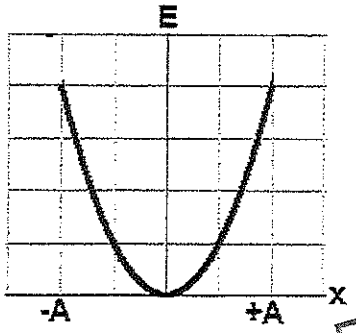




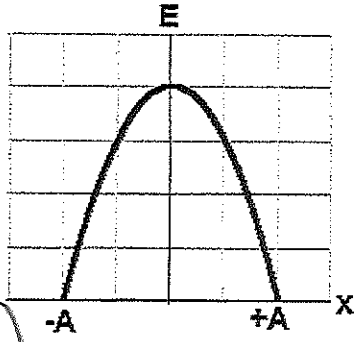
19. A block of mass M is attached to a horizontal spring k. The block undergoes SHM with amplitude of A. Which of the following graphs represents the kinetic energy as a function of position x?

B

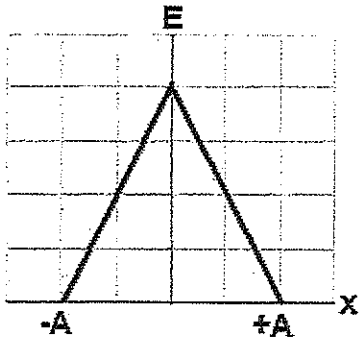
A)



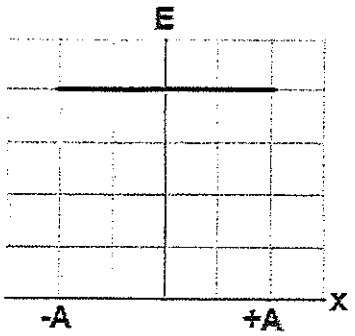
B)

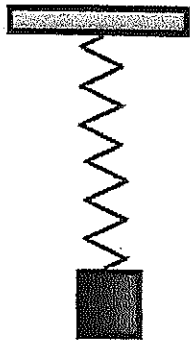


C)



D)





20. A 0.9 kg block is attached to an unstretched spring with a spring constant of 10 N/m. The block is released from rest. How long does it take for the block to return to its initial position?

A) 0.3π s B) 0.5π s C) 0.6π s D) 0.9π s

Multi Correct Questions

Directions: For each of the following, two of the suggested answers will be correct. Select the best two choices to earn credit. No partial credit will be earned if only one correct choice is selected.

21. A student wishes to determine the spring constant of a spring in a mass-spring oscillating system. Which of the following pieces of equipment will provide the measured quantities needed for this calculation?

B+C

A) Meterstick

B) Balance

C) Stopwatch

D) Accelerometer

22. When an object in simple harmonic motion reaches its maximum displacement, which of the following statements are true?

C+D

A) The acceleration of the object is zero.

B) The kinetic energy is at a maximum.

C) The velocity of the object is zero.

D) The potential energy is at a maximum.