1. A mass m oscillates on a spring of spring constant k with an amplitude A. What is the maximum velocity of the mass?

   A) A

   B) $A\,(k/m)$

   C) $A\,(m/k)$

   D) $A\,(k/m)^{\frac{1}{2}}$

   E) $A\,(m/k)^{\frac{1}{2}}$

2. A mass of 0.25 kg is hung vertically from an ideal spring, stretching it a distance of 0.05 m. The values of the spring constant for this spring is most nearly

   A) 5 N/m

   B) 20 N/m

   C) 50 N/m

   D) 200 N/m

   E) 2000 N/m

3. After a block of mass m is attached to a spring, the spring is compressed to a distance x_0 from its equilibrium position. The spring is released, when it reaches the equilibrium position it detaches. What is the speed of the block when it is released?

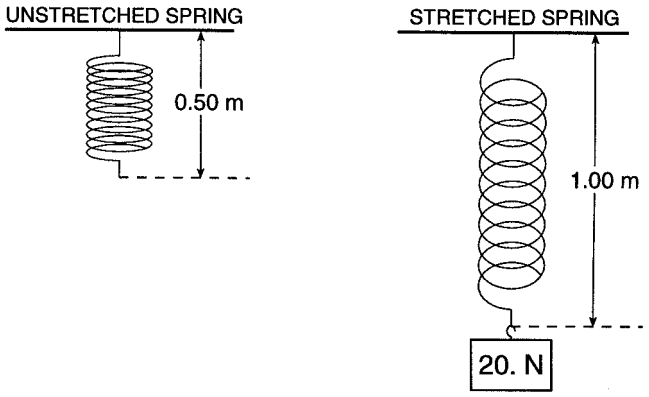
   A) $\sqrt{gx_0}$

   B) $\frac{k}{mg}x_0$

   C) $\frac{k}{m}x_0$

   D) $x_0\sqrt{\frac{k}{m}}$

   E) $x_0\sqrt{\frac{m}{k}}$

4. 

   What is the spring constant of the spring shown in the picture above?

   A) 40 N/m

   B) 20 N/m

   C) 10 N/m

   D) 0.5 N/m

   E) 0.025 N/m

5. A spring with a spring constant 4000 N/m is hung from a ceiling with a mass of 10.0 kg attached to its end. In this configuration, the spring has a length l_1. The mass is detached, and the spring comes to rest with a length l_2. The difference $l_1 - l_2$ is most nearly

   A) 0.025 cm

   B) 0.25 cm

   C) 2.5 cm

   D) 25 cm

   E) 250 cm

6. A spring with length 1.2 m is hung from the ceiling and is at rest. A mass of 0.5 kg is hung from the spring, and the spring comes to rest with a length of 1.4 m. The spring constant of the spring is most nearly

   A) 2.5 N/m

   B) 3.6 N/m

   C) 25 N/m

   D) 36 N/m

   E) 250 N/m

7. When a block with a mass of 4 kg is hung from a spring, the spring stretches 12 cm. If a mass of 3 kg is then added to the spring, the spring will stretch an additional

   A) 9 cm

   B) 12 cm

   C) 15 cm

   D) 18 cm

   E) 21 cm

8. The position of a simple harmonic oscillator is given by the equation $x = A\sin(\omega t - \ddot{u})$, where x is in meters and t is in seconds. What is the maximum speed of the oscillator?

   A) A/ω

   B) $A\omega$

   C) $A\omega^2$

   D) A^2/ω

   E) $A^2\omega$

9. The position of a spring-block system in simple harmonic motion is given by the equation $x = 3\sin 5t$, where x is in meters and t is in seconds. What is the velocity of the system at $t = \pi/3$ s?

   A) Zero

   B) $-\frac{5}{3}$ m/s

   C) $\frac{5}{3}$ m/s

   D) $-\frac{3}{2}$ m/s

   E) $\frac{3}{2}$ m/s

10. The position of a simple harmonic oscillator is given by the equation $x = 0.5\sin(4t - \pi/3)$, where x is in meters and t is in seconds. What is its acceleration at $t = \pi$ s?

    A) -8 m/s^2

    B) $-4\sqrt{3}$ m/s^2

    C) 2 m/s^2

    D) $2\sqrt{3}$ m/s^2

    E) $4\sqrt{3}$ m/s^2

11. The velocity of a simple harmonic oscillator is given by the equation $v = 3\cos(2t + \pi/4)$, where v is in meters per second and t is in seconds. What is its position at $t = \frac{5}{8}\pi$ if its position is $x = \frac{2}{3}$ m at $t = \pi/8$ s?

    A) -3 m

    B) $-\frac{3}{2}$ m

    C) Zero

    D) $\frac{3}{2}$ m

    E) 3 m

12. The velocity of a simple harmonic oscillator is given by the equation $v = A\omega\cos(\omega t)$, where v is in meters per second and t is in seconds. What is its acceleration at $t = 2$ s?

A) $-A\omega^2\sin 2\omega$

B) $A\omega\sin 2\omega$

C) $A\omega^2\sin 2\omega$

D) $-A\omega\sin 2\omega$

E) $A\omega\cos 2\omega$

13. The acceleration of a simple harmonic oscillator is given by the equation $a = -A\omega^2\sin(\omega t - \pi/4)$, where a is in meters per second squared and t is in seconds. A and ω are constants. What is its maximum displacement?

A) $A\omega^2$

B) $A\omega$

C) $A^2\omega$

D) A

E) ω

14. An object of mass m moves along the x-axis according to the equation $x(t) = A\cos 2t$. What is an equation for its kinetic energy in terms of t?

A) $0.5mA^2\sin 2t$

B) $0.5mA^2\sin t$

C) $mA\cos t$

D) $2mA\cos^2 2t$

E) $2mA\sin^2 2t$

15. A simple harmonic oscillator has the position given by $x(t) = A\sin(2t)$, where x is in meters and t is in seconds. What is the maximum magnitude of its velocity?

A) $\frac{A}{2}$

B) A

C) $2A$

D) $A + 2$

E) $4A$

16. A simple harmonic oscillator has the position given by $x(t) = A\sin(2t)$, where x is in meters and t is in seconds. What is the maximum magnitude of its acceleration?

A) $\frac{A}{4}$

B) $\frac{A}{2}$

C) A

D) $2A$

E) $4A$

17. A simple harmonic oscillator has the position given by $x(t) = A\sin(2t)$, where x is in meters and t is in seconds. What is the difference between its maximum and minimum velocity?

A) A

B) $2A$

C) $\frac{5A}{2}$

D) $4A$

E) $8A$

18. A simple harmonic oscillator has the position given by $x(t) = A\sin(3t)$, where x is in meters and t is in seconds. What is its acceleration at $t = \pi/6$ s?

A) $-9A$

B) $-3A$

C) 0

D) $3A$

E) $9A$

19. A spring-mass system moves according to the position function $x(t) = A\sin t$. What is the average velocity in the period $0 \% t \% 2?$ s?

A) $-A$

B) $-\frac{A}{2}$

C) 0

D) $\frac{A}{2}$

E) A

20. Which of the following is true of a damped simple pendulum in which the amplitude of motion decreases exponentially?

A) Its period decreases through time.

B) The total energy of the pendulum remains the same.

C) The maximum kinetic energy decreases through time.

D) The maximum potential energy increases through time.

E) It is not influenced by external forces.

21. A ideal spring with natural length 10 cm and spring constant 100 N/m is kept at its natural length as a 2 kg mass is hung from it. When the spring is released, how far will the mass fall before its velocity becomes 0?

A) 10 cm

B) 20 cm

C) 40 cm

D) 80 cm

E) 100 cm

Answer Key
Spring Constant MC Questions [Mar 28, 2011]

1. D
2. C
3. D
4. A
5. D
6. C
7. A
8. B
9. E
10. B
11. B
12. A
13. D
14. E
15. C
16. E
17. D
18. A
19. C
20. C
21. C

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