A.P. "C" SHM Practice

1. A mass m hanging on a spring with a spring constant k has simple harmonic motion with a period T. If the mass is doubled to 2m, the period of oscillation

   a. increases by a factor of 2.
   b. decreases by a factor of 2.
   c. increases by a factor of $\sqrt{2}$.
   d. decreases by a factor of $\sqrt{2}$.
   e. is not affected.

2. If F is the force, x the displacement, and k a particular constant, for simple harmonic motion we must have

   a. $F = -k/x^2$
   b. $F = k/x$
   c. $F = (k/x^2)^{1/2}$
   d. $F = -kx^2$
   e. none of these.

3. A particle moving with a simple harmonic motion has its maximum displacement of +18 cm at time t = 0. The frequency of the motion is 10 s^{-1}. At a time t = 0.65 s, the position of the particle is

   a. +18 cm
   b. zero
   c. -13 cm
   d. -18 cm
   e. +7.3 cm

4. The instantaneous speed of a mass undergoing simple harmonic motion on the end of a spring depends on

   a. the amplitude of oscillation.
   b. the frequency of oscillation.
   c. the period of oscillation.
   d. the time at which the speed is measured.
   e. all of these.

5. A particle moving in simple harmonic motion with a period T = 1.5 s passes through the equilibrium point at time $t_0 = 0$ with a velocity of 1.00 m/s to the right. A time t later, the particle is observed to move to the left with a velocity of 0.50 m/s. (Note the change in direction of the velocity.) The smallest possible value of the time t is

   a. 0.17 s
   b. 0.33 s
   c. 0.50 s
   d. 0.25 s
   e. 0.82 s

6. A particle with a mass of 65 g is moving with simple harmonic motion. At time t = 0, the particle is at its extreme positive displacement of 18.0 cm. The period of the motion is 0.600 s. At time t = 1.35 s, the velocity of the particle is

   a. -1.9 m/s
   b. zero
   c. 0.84 m/s
   d. +1.9 m/s
   e. -0.84 m/s

7. A body moves with simple harmonic motion according to the equation

$$x = (2/\pi)\sin(4\pi t + \pi/3)$$

   where the units are SI. At t = 2 s, the speed of the body is

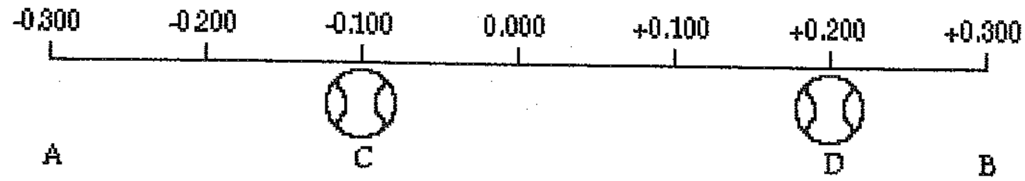
   a. m/s
   b. $1/\pi$ m/s
   c. $\sqrt{3}/\pi$ m/s
   d. 4 m/s
   e. $4\sqrt{3}$ m/s

8. A spring vibrates in simple harmonic motion according to the equation

$$x = 0.15 \cos \pi t$$

where the units are SI. The period of the motion is

a. 0.67 s b. 1.0 s c. 2.0 s d. π s e. 3.2 s

9. 

A ball moves with simple harmonic motion between points A and B. The magnitude of the acceleration of the ball at point C is 5.00 m/s². The magnitude of the acceleration of the ball at point D is

a. 1.25 m/s^2 b. 2.50 m/s^2 c. 5.00 m/s^2 d. 7.50 m/s^2 e. 10.0 m/s^2

10. A particle moves in one dimension with simple harmonic motion according to the equation

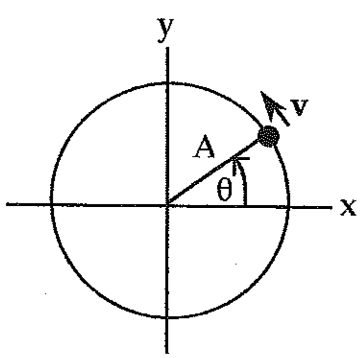
$$d^2x/dt^2 = -4\pi^2 x$$

where the units are SI. Its period is

a. $4\pi^2$ s b. 2π s c. 1 s d. $1/(2\pi)$ s e. $1/(4\pi^2)$ s

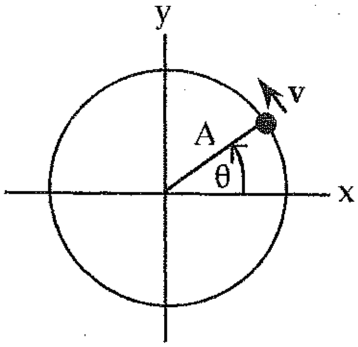
11. A particle moving in a circle of radius 15 cm makes 33.3 rev/min. If the particle starts on the positive x axis at time t = 0, what is the x component of the particle's velocity at time t = 1.2 s?

a. 45 cm/s b. -3.8 cm/s c. 26 cm/s d. -45 cm/s e. 13 cm/s

12. 

The object in the diagram is in circular motion with frequency f. At t = 0 it was at (A, 0). The y component of its velocity is given by

a. $v_y^2 = v_{0y}^2 + 2a(y - y_0)$ b. $v_y = 2\pi fA \cos 2\pi ft$ c. $v_y = A \sin ft$
d. $v_y = 2\pi fA \sin 2\pi ft$ e. $v_y = A \cos ft$

13. 

The object in the diagram is in circular motion with frequency f. At t = 0 it was at (A, 0). The y component of its acceleration is given by

a. $a_y = (v_y - v_{0y})/t$
b. $a_y = -(2\pi f)^2 A \cos 2\pi ft$
c. $a_y = -(2\pi)^2 A \sin 2\pi t$
d. $a_y = -(2\pi f)^2 A \sin 2\pi ft$
e. $a_y = -(2\pi)^2 A \cos 2\pi t$

14. A body of mass M is executing simple harmonic motion with an amplitude of 8.0 cm and a maximum acceleration of 100 cm/s^2. When the displacement of this body from the equilibrium position is 6.0 cm, the magnitude of the acceleration is approximately

a. 8.7 cm/s^2
b. 21 cm/s^2
c. 35 cm/s^2
d. 17 cm/s^2
e. 1.3 m/s^2

15. The energy of a simple harmonic oscillator could be doubled by increasing the amplitude by a factor of

a. 0.7
b. 1.0
c. 1.4
d. 2.0
e. 4.0

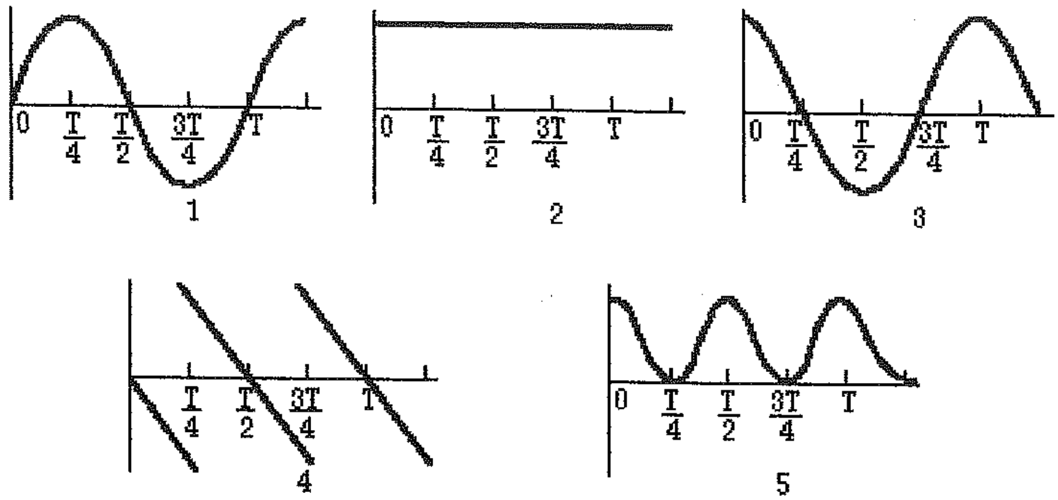
16. A 2.5-kg object is attached to a spring of force constant k = 4.5 kN/m. The spring is stretched 10 cm from equilibrium and released. What is the kinetic energy of the mass–spring system when the mass is 5.0 cm from its equilibrium postion?

a. 5.6 J
b. 11 J
c. 17 J
d. 14 J
e. 42 J

17. The displacement in simple harmonic motion is a maximum when the

a. acceleration is zero.
b. velocity is a maximum.
c. velocity is zero.
d. kinetic energy is a maximum.
e. potential energy is a minimum.

18.



The kinetic energy of a body executing simple harmonic motion is plotted against time expressed in terms of the period T. At $t = 0$, the displacement is zero. Which of the graphs most closely represents these conditions?

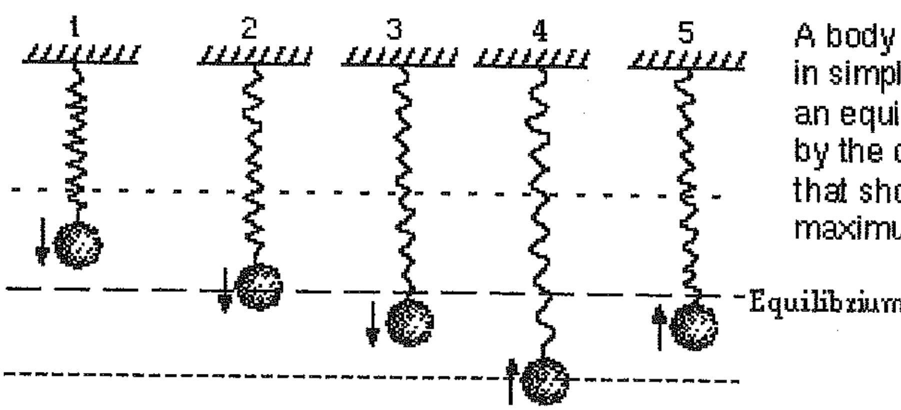
a. 1 b. 2 c. 3 d. 4 e. 5

19. A 2-kg mass oscillates in one dimension with simple harmonic motion on the end of a massless spring on a horizontal frictionless table according to

$$x = (6/\pi)\cos\left(\frac{1}{2}\pi t + 3\pi\right)$$

where the units are SI. The total mechanical energy of this system is

a. 1 J b. 3 J c. 5 J d. 7 J e. 9 J

20. 

A body on a spring is vibrating in simple harmonic motion about an equilibrium position indicated by the dashed line. The figure that shows the body with maximum acceleration is

a. 1 b. 2 c. 3 d. 4 e. 5

21. To double the period of a pendulum, the length

a. must be increased by a factor of 2.
b. must be decreased by a factor of 2.
c. must be increased by a factor of $\sqrt{2}$.
d. must be increased by a factor of 4.
e. need not be affected.

22. What must be the length of a simple pendulum with a period of 2.0 s if $g = 9.8\ m/s^2$?

a. 99 cm

b. 97 m

c. 6.2 cm

d. 3.1 m

e. 2.0 m