Simple Harmonic Motion

1. A loudspeaker produces a musical sound by means of the oscillation of a diaphragm whose amplitude is limited to 1.00μm . (a) At what frequency is the magnitude *a* of the diaphragm's acceleration equal to *g*? (b) For greater frequencies, is *a* greater than or less than *g*?

2. The position function x = (6.0 m) cos[(3π rad/s)t +p/3 rad] gives the simple harmonic motion of a body. At t =2.0 s, what are the (a) displacement, (b) velocity, (c) acceleration, and (d) phase of the motion? Also, what are the (e) frequency and (f) period of the motion?

3. An oscillating block–spring system takes 0.75 s to begin repeating its motion. Find (a) the period, (b) the frequency in hertz, and (c) the angular frequency in radians per second.

4. An oscillator consists of a block of mass 0.500 kg connected to a spring. When set into oscillation with amplitude 35.0 cm, the oscillator repeats its motion every 0.500 s. Find the (a) period, (b) frequency, (c) angular frequency, (d) spring constant, (e) maximum speed, and (f) magnitude of the maximum force on the block from the spring.

5. An oscillator consists of a block attached to a spring (k =400 N/m). At some time t, the position (measured from the system's equilibrium location), velocity, and acceleration of the block are x =0.100 m, v=13.6 m/s, and a=123 m/s2. Calculate (a) the frequency of oscillation, (b) the mass of the block, and (c) the amplitude of the motion.

6. When the displacement in SHM is one-half the amplitude *A.* what fraction of the total energy is (a) kinetic energy and (b) potential energy? (c) At what displacement, in terms of the amplitude, is the energy of the system half kinetic energy and half potential energy?

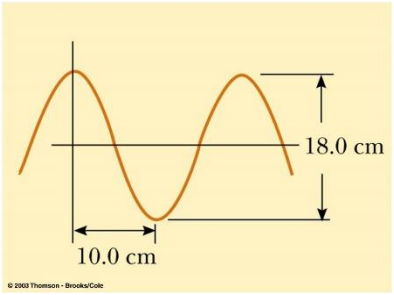
7. An oscillating block–spring system has a mechanical energy of 1.00 J, an amplitude of 10.0 cm, and a maximum speed of 1.20 m/s.Find (a) the spring constant, (b) the mass of the block, and (c) the frequency of oscillation.

8. A 5.00 kg object on a horizontal frictionless surface is attached to a spring with k =1000 N/m. The object is displaced from equilibrium 50.0 cm horizontally and given an initial velocity of 10.0m/s back toward the equilibrium position.What are (a) the motion's frequency, (b) the initial potential energy of the block–spring system, (c) the initial kinetic energy, and (d) the motion's amplitude?

Wave Equation

1. The equation of a travelling wave is $y = 4.0\sin(0.10x - 2t)$. Find (i) amplitude, (ii) wavelength, (iii) speed, and (iv) frequency of wave.
2. At time t=0 the displacement of a particle in a medium is $y = 4.0\sin 2\pi(\frac{x}{100})$ the velocity of wave 30cm/s. Find the displacement equation when t = 3s.

3. A wave traveling in the positive *x* direction has a frequency of *f* = 25.0 Hz as shown in the figure. Find out the (i) amplitude, (ii) wavelength, (iii) speed, and (iv) time period.



Damped harmonic Motion

4. In oscillatory circuit L= 0.4h, C = 0.0020μF. What is maximum value of resistance(R) for the circuit to be oscillatory?
5. A series RLC circuit has the following parameters: R= 1 kΩ, L=1 H, and C=10 nF. (i) What type of damping does this circuit exhibit? (ii) In the same circuit if L is changed to 1mH, then what will be the damping nature?

6. Find whether the discharge of capacitor through the following inductive circuit is oscillatory. C = 0.1μF, L = 10mh, R 200 Ω. If Oscillatory, find the frequency of oscillation and resonant frequency.

7. A condenser of capacity 1 μF, an inductance of 0.2 H and a resistance of 800 Ω are joined in series. Is the circuit oscillatory? What is the natural frequency?
8. . Find whether the discharge of capacitor through the following inductive circuit is oscillatory. C = 0.1μF, L = 10mh, R 200 Ω. If Oscillatory, find the frequency of oscillation and resonant frequency.

9. For a damped oscillator m =250gm, k = 85N/m and b = 70gm/s. (a) What is the period of the motion? (b) How long does it take for the amplitude of the damped oscillations to drop to half its initial value?