Chapter 15 (Oscillations)

1- A simple pendulum has a period of 3.0 s on the earth. What would its period be on the moon where g(moon) = 1.67 m/s^2? (A: 7.3 s)

2- An oscillatory mass-spring system has a total mechanical energy of 1J, amplitude of 10 cm and a maximum speed of 1 m/s. Neglecting friction, what is the mass? (A: 2 kg)

3- A 5-kg mass attached to a spring executes a simple harmonic motion with a period of 2.0 s. If the total energy of the system is 10 J, the amplitude of oscillation (in m) is: (A: 0.637)

4- A 0.4-kg mass attached to a spring of force constant 40 N/m vibrates with a simple harmonic motion of amplitude 10 cm. Calculate the shortest time that is taken by the mass to move from x = 0 to x = 10 cm. (A: 0.157 s)

5- A mass of 1.0 kg connected to a light spring of force constant 30 N/m oscillates on a horizontal frictionless surface with magnitude 3 cm. Find the kinetic energy of the system when the displacement equals 2 cm. (A: 7.5×10^{-3} J)

6- A simple pendulum has a length of 3.00 m. Determine the change in its period if it is taken from a point where g=9.80 m/s^2 to a higher elevation, where the acceleration due to gravity g=9.75 m/s^2. (A: increases by 8.9 ms)

7- A 200 g mass is attached to a spring and executes simple harmonic motion with a period of 0.25 s. If the total energy of the system is 2 J, Find the amplitude of motion. (A: 18 cm)

8- If the amplitude of a system moving with simple harmonic motion is doubled, the total energy will be: (A: 4 times larger)

9- A particle at the end of a spring executes simple harmonic motion with amplitude of 4.0 cm. At what displacement (x) will its speed be equal to one half its maximum speed? (A: 3.46 cm)

10- A particle of mass m=0.14 kg at the end of a spring executes a simple harmonic motion according to the equation: x=0.2 cos(10t + pi/2) Find the maximum potential energy of the spring.? (A: 0.28 J)

11- At a certain instant, the displacement of a particle executing simple harmonic motion is 2.0 m, and its acceleration is - 6.0 m/s^2. Find its frequency of oscillation. (A: 0.28 Hz)

12- A simple pendulum of length 1.30 m makes 50.0 complete oscillations in 100 seconds on a certain planet. Find the acceleration due to gravity on this planet. (A: 12.8 m/s^2)

13- A 0.5-kg box, connected to a light spring of force constant 20 N/m, oscillates on a horizontal frictionless surface. The amplitude of the motion is 3.0 cm. Find the speed of the box when its displacement x = 2.6 cm. (A: 0.09 m/s)

14- A 3-kg block, attached to a spring, executes simple harmonic motion on a horizontal frictionless surface according to x = 2 cos(50 t + 3.14) where x is in meters and t is in seconds. Find the value of the spring constant. (A: 7500 N/m)

Summary of Chapter 15 topics

1- Understanding the Simple Harmonic Motion (SHM), Energy in SHM
2- Understanding the Pendulums, Circular Motion