United International University

School of Science and Engineering

Assignment-1; Year 2021; Semester: Summer

Course: PHY 105; Title: Physics, Section: A

1. An object undergoing simple harmonic motion takes 0.25 s to travel from one point of zero velocity to the next such point. The distance between those points is 36 cm. Calculate the (a) period, (b) frequency, and (c) amplitude of the motion.

2. A 0.12 kg body undergoes simple harmonic motion of amplitude 8.5 cm and period 0.20 s. (a) What is the magnitude of the maximum force acting on it? (b) If the oscillations are produced by a spring, what is the spring constant?

3. A simple harmonic oscillator consists of a block of mass 2.00 kg attached to a spring of spring constant 100 N/m. When t = 1.00 s, the position and velocity of the block are x = 0.129 m and v =3.415 m/s. (a) What is the amplitude of the oscillations? What were the (b) position and (c) velocity of the block at t = 0 s?

4. 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/s^2. Calculate (a) the frequency of oscillation, (b) the mass of the block, and (c) the amplitude of the motion.

5. A body of mass 25gm is attached with a spring of spring constant 400dyns/cm. The body is displaced by 10cm from its equilibrium position and released. Then the body executes simple harmonic motion. Calculate (i) the time period, (ii) frequency, (iii) angular frequency and (iv) maximum velocity.

6. A hydrogen atom has a mass of 1.68×10^{-27}kg, when it attach to a certain massive molecule, it oscillate as classical oscillator with frequency of 10^{14} Hz and with amplitude of 10^{-10}m. Calculate force acting on the hydrogen atom.

7. A body executes SHM such that its velocity at mean position is 1m/s and acceleration at one extremity is 1.57m/s^2. Calculate time period of oscillation.

8. A particle executes SHM of amplitude 5m when the particle is 3m from its mean position, its acceleration is found to be 48m/s^2. Find (i) velocity (ii) time period (iii) Maximum velocity.

9. A mass oscillates with an amplitude of 4.00 m, a frequency of 0.5 Hz and a phase angle of pi/4.
   (i)What is the period T?

   (i)Write an equation for the displacement of the particle.

   (iii)Calculate the velocity and acceleration of the object at time t=5s..

10. A 2.00 kg block is attached to a spring and force constant of the spring is $\boldsymbol{k}$ = 196 N/m.The block is held a distance of 5.00 cm from equilibrium and released at $\boldsymbol{t}$ = 0.
    (a) Find the angular frequency $\boldsymbol{w}$, the frequency $\boldsymbol{f}$, and the period $\boldsymbol{T}$.

(b) Write an equation for ***x*** vs. time.

11. Draw displacement vs time graph for $\omega/\gamma = 10$, $\omega/\gamma = 0.5$ and $\omega/\gamma = 0.03$.

12. Draw displacement vs time graph for $\omega/\gamma = 5$, $\omega/\gamma = 15$ and $\omega/\gamma = 20$.

13. In oscillatory circuit L= 0.4h, C = 0.0020μF. What is maximum value of resistance(R) for the circuit to be oscillatory?

14. 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? (c) How many oscillations does it complete in life time? (d) What is its life time?

15. 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.

16. 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? What is its resonant frequency?

17. Determine the length and frequency of a simple pendulum that will swing back and forth in simple harmonic motion with a period of 5.00 s.

18. Draw the following Lissajoue's figure: (i) $x = a\sin(\omega t + \frac{2\pi}{6})$ and $y = b\sin\omega t$, (ii) $x = a\sin(\omega t + \frac{5\pi}{4})$ and $y = b\sin\omega t$, (iii) $x = a\sin(\omega t + \frac{11\pi}{8})$ and $y = b\sin\omega t$, (iv) $x = a\sin(\omega t + \frac{14\pi}{8})$ and $y = b\sin\omega t$, and (v) $x = a\sin(\omega t + 45)$ and $y = b\cos(\omega t + 270)$.