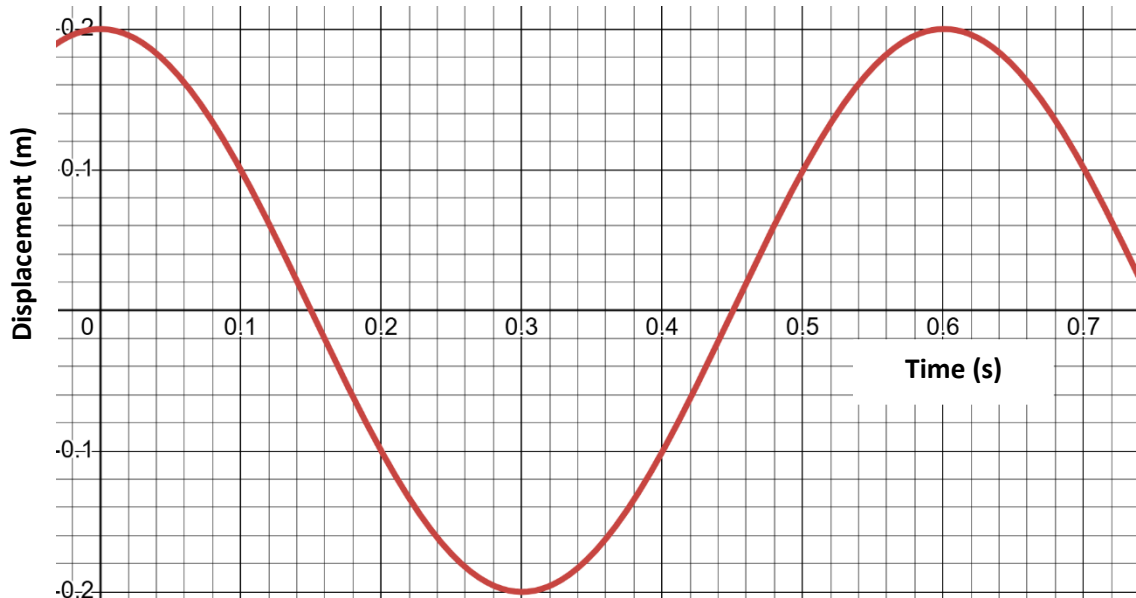


Assignmet-1 : Spring 25 (PHY-105/2105)

Last Date of Submission 08/04/2025

1. Graph 01 illustrates the position vs. displacement graph for a mass spring system oscillating in Simple Harmonic Oscillation. The mass of the mass-spring system is 0.25 kg.



- Calculate the equation of displacement vs. time
- Calculate the velocity at $t = 2$ sec.
- Determine the potential energy at $t = 0.25$ sec.

2. The equation of displacement of a mass-spring system is,

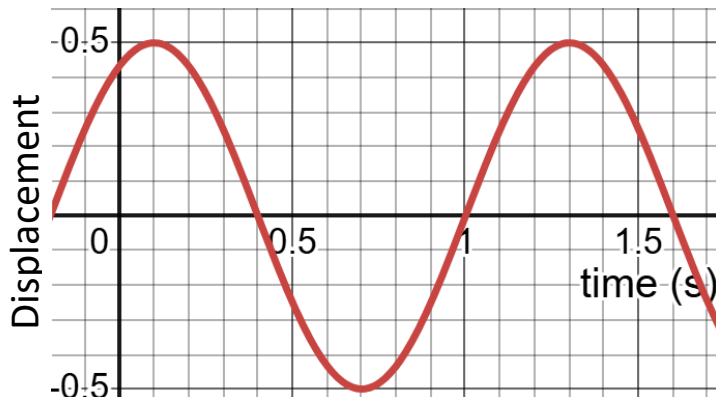
$$y = 10\cos(2t+\pi)$$

The mass attached to spring is 500 g. Consider the units in S. I. system.

Calculate

- Potential Energy at $t = 0.75$ s,
- Kinetic energy at $t = 0.3$ s
- Maximum velocity

3. Construct the equation of displacement from graph 2 which illustrates the displacement vs. time graph for a mass spring system oscillating in simple harmonic motion. Calculate the potential energy of the system at $t = 0.25$ sec if the mass of the system is 500g.



Graph 2

4. A body of mass 50 g is attached with a spring of spring constant 20.5 N/m. The body is displaced by 70 cm from its equilibrium position and released at $t = 0$. Then the body executes simple harmonic motion.

Calculate

- (i) velocity at $t = 0.2$ s
- (ii) acceleration at $t = .25$ s
- (iii) kinetic energy at $t = 0.7$ s

5. In an electric shaver, the blade moves back and forth over 5 mm in simple harmonic motion, with a frequency of 240 Hz.

Find

- (i) Displacement at $t = 0.2$ s
- (ii) the maximum blade speed
- (iii) the magnitude of the maximum acceleration of blade

6. An oscillator consists of a block attached to a spring ($k = 460$ N/m). At some time t , the position (measured from the system's equilibrium location), velocity, and acceleration of the block are $x = 0.150$ m, $v = -15$ m/s, and $a = -125$ m/s². Calculate (i) the frequency of oscillation, (ii) the mass of the block, and (iii) the amplitude of the motion.

7. A particle executes SHM of amplitude 8 m when the particle is 4 m from its mean position, its acceleration is found to be 80 m/s². Find (i) velocity (ii) time period and (iii) maximum velocity.

8. Find whether the discharge of capacitor through the following inductive series circuit is oscillatory or not. Given, $C = 0.8$ nF, $L = 20$ mH, and $R = 290 \Omega$. If oscillatory, find the frequency of oscillation and resonant frequency. If it is parallel circuit, then find out the similar characteristics of that circuit.

9. For a damped oscillator $m = 220$ gm, $k = 82$ N/m and $b = 63$ gm/s.

- (i) What is the period of the motion?
- (ii) How long does it take for the amplitude of the damped oscillations to drop to half its initial value?
- (iii) How many oscillations does it complete in life time?
- (iv) What is its life time?
- (v) The maximum displacement of undamped oscillator is 35 cm. If the damping is stopped after 20 cycles, What is the damping energy?
- (vi) What is the ratio of the oscillation amplitude to the initial oscillation amplitude at this cycle?