



Applied Physics (NS-1001)

Quiz # 4

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CLO2

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Q.1: Figure shows a position versus time graph for a particle in SHM. What are (a) the amplitude A , (b) the angular frequency ω , and (c) the phase constant ϕ_0 ? Explain. (3+3+4)

Solution:

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(a) $A = 10 \text{ cm} = 0.1 \text{ m}$

(b) $\omega = \frac{2\pi}{T} = \frac{2\pi}{0.5} = 3.14 \text{ rad/s}$

(c) The position of an object in SHM at any given time is

$$x(t) = A \cos(\omega t + \phi_0) \quad \text{--- (1)}$$

at $t=0$ s, $x(0) = \frac{A}{2} = 5 \text{ cm}$

putting values in eq (1)

$$x(0) = 10 \cos(0 + \phi_0)$$

$$5 = 10 \cos \phi_0$$

$$\phi_0 = \cos^{-1}(5/10) = \cos^{-1}(1/2) = \cos^{-1}(0.5)$$

$$\phi_0 = \pm \pi/3 = \pm 60^\circ$$

At $t=0$ s, $x = \frac{A}{2}$ particle is approaching the mean position. The particle is moving to the left at $t=0$ and it is in the upper half of the circular motion diagram. So,

$$\phi_0 = + \frac{\pi}{3} \text{ rad}$$

