

Q A particle executes SHM of period 3.14 second and amplitude is 5cm. calculate maximum velocity and maximum acceleration?

Ans equation S.H.M

$$x = a \sin(\omega t + \phi) \quad \text{--- (1)}$$

$$\text{velocity} = \frac{dx}{dt} = a \cos(\omega t + \phi) \omega$$

$$v = \frac{dx}{dt} = a \omega \cos(\omega t + \phi) \quad \text{--- (2)}$$

$$\text{Max value of } \cos(\omega t + \phi) = 1$$

$$v = \frac{dx}{dt} = a \omega (1)$$

$$v = \frac{dx}{dt} = a \cdot \frac{2\pi}{T} \quad \left\{ \begin{array}{l} T = 3.14 \text{ sec} \\ a = 5 \text{ cm} \end{array} \right.$$

$$v = \frac{5 \times 2 \times 3.14}{3.14}$$

$$v = 10 \text{ cm/sec (Maximum Velocity)}$$

from eqn (2)

$$\text{Acceleration} = \ddot{x} = \frac{dv}{dt} = a \omega \{-\sin(\omega t + \phi)\} \omega$$

$$\frac{dv}{dt} = -a \omega^2 \sin(\omega t + \phi)$$

$$a_{\text{max}} = 5 \times \left[\frac{2 \times 3.14}{3.14} \right]^2 \quad (\sin(\omega t + \phi) = 1)$$

$$= 5 \times 4$$

$$a_{\text{max}} = 20 \text{ cm/sec}$$