

Q) A body describes simple harmonic motion with an amplitude of 5 cm and a period of 0.2 s. Find acceleration and velocity of the body when the displacement is (a) 5 cm (b) 3 cm (c) 0 cm.

$$A = 5 \text{ cm} = 0.05 \text{ m}$$

$$T = 0.2 \text{ s}$$

$$\omega = 2\pi/T = 2\pi/0.2 = 10\pi \text{ rad/s}$$

A) When displacement is y , then
acceleration, $a = -\omega^2 y$

$$\text{Velocity, } V = \omega \sqrt{r^2 - y^2}$$

Case (a). When

$$y = 5 \text{ cm} = 0.05 \text{ m}$$

$$a = -(10\pi)^2 \times 0.05 = -5\pi^2 \text{ m/s}^2$$

$$V = 10\pi \times \sqrt{(0.05)^2 - (0.05)^2} = 0$$

Case (b). When

$$y = 3 \text{ cm} = 0.03 \text{ m}$$

$$a = -(10\pi)^2 \times 0.03 = -3\pi^2 \text{ m/s}^2$$

$$V = 10\pi \times \sqrt{(0.05)^2 - (0.03)^2} = 10\pi \times 0.04 = 0.4\pi \text{ m/s}$$

Case (c). When $y = 0$

$$a = -(10\pi)^2 \times 0 = 0$$

$$V = 10\pi \times \sqrt{(0.05)^2 - 0^2} = 10\pi \times 0.05 = 0.5\pi \text{ m/s}$$