

Q) The harmonic oscillation has a point mass 10 gm and amplitude 5 cm and its energy of oscillation is  $3.1 \times 10^{-5}$  joule. If the initial phase is  $60^\circ$ , write down the equation of motion.

Ans The energy of oscillation =  $\frac{1}{2} k a^2$

and  $\frac{k}{m} = \omega^2 \quad \therefore E = \frac{1}{2} m \omega^2 a^2$

$$\therefore \omega = \sqrt{\frac{2E}{ma^2}} = \frac{1}{a} \sqrt{\frac{2E}{m}}$$

Here  $E = 3.1 \times 10^{-5}$  joule = 310 ergs

$$m = 10 \text{ gm}$$

$$a = 5 \text{ cm}$$

$$\therefore \omega = \frac{1}{5} \sqrt{\frac{2 \times 310}{10}} = \frac{\sqrt{62}}{5} = 1.57 \text{ rad/sec}$$

The equation of S.H.M is given as  $x = a \sin(\omega t + \phi)$

Here  $a = 5 \text{ cm}$ ,  $\phi = 60^\circ = \pi/3$  radians

$$\omega = 1.57 \text{ rad/sec}$$

$$\therefore x = 5 \sin \left( 1.57t + \frac{\pi}{3} \right) \text{ cm}$$