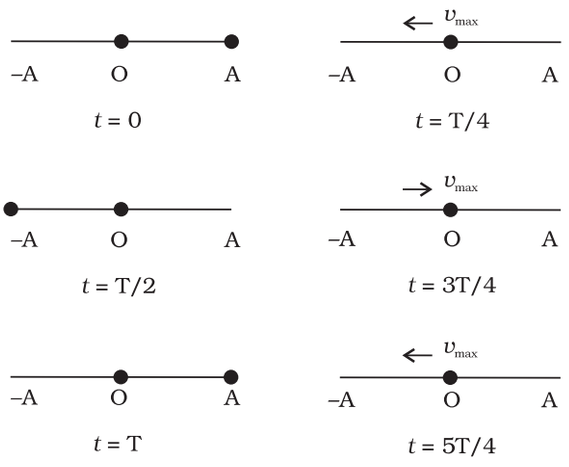

Fig. 14.4 *The location of the particle in SHM at the discrete values t = 0, T/4, T/2, 3T/4, T, 5T/4. The time after which motion repeats itself is T. T will remain fixed, no matter what location you choose as the initial (t = 0) location. The speed is maximum for zero displacement (at x = 0) and zero at the extremes of motion.*

of motion. Fig. 14.5 plots the graph of x versus t, which gives the values of displacement as a continuous function of time. The quantities A, ω and ϕ which characterize a given SHM have standard names, as summarised in Fig. 14.6. Let us understand these quantities.

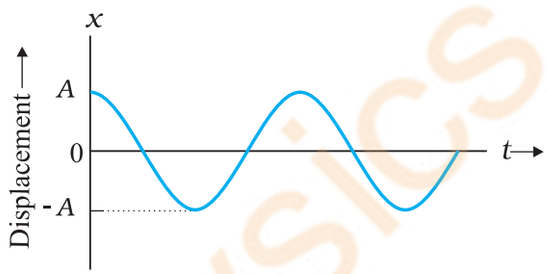

Fig. 14.5 *Displacement as a continuous function of time for simple harmonic motion.*

$x\,(t)$	:	displacement x as a function of time t
A	:	amplitude
ω	:	angular frequency
$\omega t + \phi$	:	phase (time-dependent)
ϕ	:	phase constant

Fig. 14.6 *The meaning of standard symbols in Eq. (14.4)*

The amplitutde A of SHM is the magnitude of maximum displacement of the particle. [Note, A can be taken to be positive without any loss of generality]. As the cosine function of time varies from +1 to –1, the displacement varies between the extremes A and – A. Two simple harmonic motions may have same ω and ϕ but different amplitudes A and B, as shown in Fig. 14.7 (a).

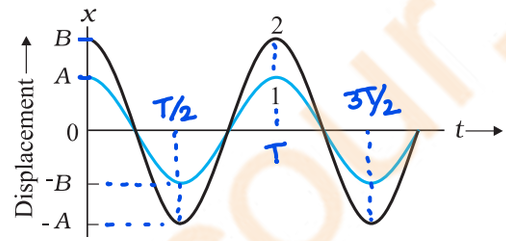

Fig. 14.7 (a) *A plot of displacement as a function of time as obtained from Eq. (14.4) with $\phi = 0$. The curves 1 and 2 are for two different amplitudes A and B.*

While the amplitude A is fixed for a given SHM, the state of motion (position and velocity) of the particle at any time t is determined by the argument $(\omega t + \phi)$ in the cosine function. This time-dependent quantity, $(\omega t + \phi)$ is called the *phase* of the motion. The value of plase at $t = 0$ is ϕ and is called the *phase constant* (or *phase angle*). If the amplitude is known, ϕ can be determined from the displacement at $t = 0$. Two simple harmonic motions may have the same A and ω but different phase angle ϕ, as shown in Fig. 14.7 (b).

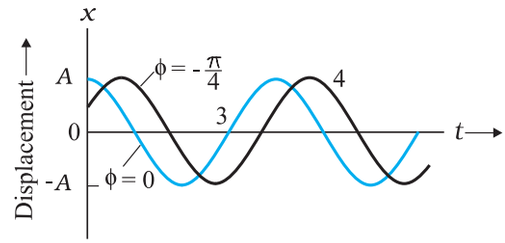

Fig. 14.7 (b) *A plot obtained from Eq. (14.4). The curves 3 and 4 are for $\phi = 0$ and $-\pi/4$ respectively. The amplitude A is same for both the plots.*