

The Equations, Relations and Variables of SHM

Quantity	Symbol	Units	Relations with other quantities
Period	T	seconds	$T=1/\nu$, $T=2\pi/\omega$, $T^2=4\pi^2(m/k)$
Frequency	ν	Hertz	$\nu=1/T$, $\nu=\omega/(2\pi)$, $\nu^2=k/(4m\pi^2)$
Angular Frequency	ω	rad/sec	$\omega=2\pi\nu$, $\omega=2\pi/T$, $\omega^2=k/m$, $\omega^2=-a/\Delta x$
Phase	ϕ	rad	
Position	Δx	m	$\Delta x=-F/k$, $\Delta x=-a/\omega^2$
Force	F	N	$F=-k\Delta x$, $F=ma$
Acceler.	a	m/sec ²	$a=F/m$, $a=-(k/m)\Delta x$, $a=-\omega^2\Delta x$
Spring Constant	k	kg/sec ² or N/m	$k=-F/\Delta x$, $k=\omega^2m$, $k=-ma/\Delta x$

$$X(t) = x_m \cos(\omega t + \phi).$$

$$v(t) = -v_m \sin(\omega t + \phi).$$

$$v_m = \omega x_m.$$

$$v(t) = -\omega x_m \sin(\omega t + \phi)$$

$$a = -\omega^2 x$$

$$a(t) = -\omega^2 x_m \cos(\omega t + \phi)$$

Rotation Equations

$$L = mvr = I\omega$$

$$\Delta L = 0$$

$$T_{\text{rot}} = \frac{1}{2}I\omega^2$$

$$\Sigma T = I\alpha$$