of S.H.M

06

Solution of Defferential eqn of S.H.M

07

The solution of eqn (1) will provide displacement (x) of the object at any instant of time 't' multiplying eqn (1)

08

both side by $2\frac{dx}{dt}$ we get

$$\frac{2dx}{dt}\frac{d^2x}{dt^2} + \omega^2 \frac{2dx}{dt} x = 0$$

APRIL 2012

M	T	W	T	F	S	S
30						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

MAY 2012

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

$$\frac{d}{dt}\left(\frac{dx}{dt}\right)^2 + \omega^2 \frac{d}{dt}(x^2) = 0$$

integrating both side w.r.t we get

$$\int \frac{d}{dt}\left(\frac{dx}{dt}\right)^2 dt + \omega^2 \int \frac{d}{dt}(x^2)\,dt = 0$$

$$\left(\frac{dx}{dt}\right)^2 + \omega^2 x^2 = c \quad — ②$$

At $x = a$, $V = 0$, $\frac{dx}{dt} = 0$

From eqn ②

$$0 + \omega^2 a^2 = c \quad — ③$$

$$c = \omega^2 a^2$$

using ③ in ② we get

$$\left(\frac{dx}{dt}\right)^2 + \omega^2 x^2 = \omega^2 a^2$$

$$\left(\frac{dx}{dt}\right)^2 = \omega^2 a^2 - \omega^2 x^2$$

$$\left(\frac{dx}{dt}\right)^2 = \omega^2 (a^2 - x^2)$$

$$\frac{dx}{dt} = \sqrt{\omega^2(a^2 - x^2)}$$

JUNE 2012

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

JULY

M	T	W	T	F	S
30	31				
2	3	4	5	6	7
9	10	11	12	13	14
16	17	18	19	20	21
23	24	25	26	27	28

$$\frac{dx}{dt} = \omega\sqrt{a^2 - x^2}$$

$$\frac{dx}{\sqrt{a^2 - x^2}} = \omega\, dt$$

Integrating both side we get

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \omega \int dt + \phi$$

$$\sin^{-1}\frac{x}{a} = \omega t + \phi$$

$$\frac{x}{a} = \sin(\omega t + \phi)$$

$$\boxed{x = a \sin(\omega t + \phi)}$$

This is the required solution of differential eq^n of S.H.M

———— x ————