TEST

JEE Mains PYQs Oscillations (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 30 Questions

Section 1 : Section A - 30 Questions

SECTION INSTRUCTIONS

This section contains 25 MCQs. +4 for every correct answer, -1 for every incorrect answer.

1 Two simple harmonic motions are represented by the equations:

$x_1=5\sin\left(2\pi t+\frac{\pi}{4}\right) \wedge x_2=5\sqrt{2}(\sin 2\pi t+\cos 2\pi t)$.

The amplitude of second motion is___times the amplitude of krst motion.

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4

Correct: +4 · Incorrect: -1

2 A particle performs simple harmonic motion with a period of 2 second, The time taken by the particle to cover a displacement equal to half of its amplitude from the mean position is $\frac{1}{a}$ s. The value of 'a' to the nearest integer is ___

- ○ 3
- ○ 6
- ○ 4
- ○ 5

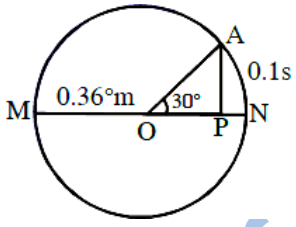
Correct: +4 · Incorrect: -1

3 A particle executes SHM with amplitude 'a' and time period 'T'. The displacement of the particle when its speed is half of maximum speed is $\frac{\sqrt{x}\,a}{2}$. The value of x is ___

- 0.125
- 1.250
- 0.300
- 0.150

Correct: +4 · Incorrect: -1

4 The point A moves with a uniform speed along the circumference of a circle of radius 0.36m and covers 30° in the 0.1s. The perpendicular projection 'P;' from 'A' on the diameter MN represents the simple harmonic motion of 'P'. The restoration force per unit mass when P touches M will be



- 9.87N
- 50N
- 100N
- 0.49N

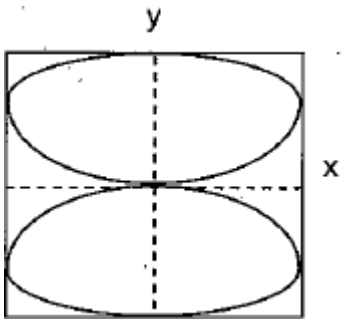
Correct: +4 · Incorrect: -1

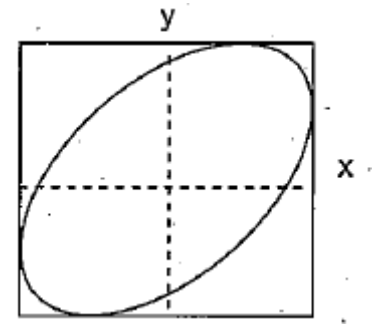
5 The position coordinates of a particle moving n a 3D coordinate system is given by x = a cos ωt, y = a sin ωt and z = aωt. The speed of the particle is

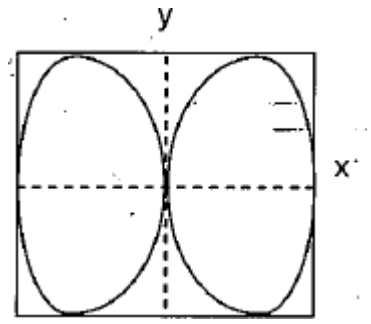
- $\sqrt{2}a\omega$
- $a\omega$
- $\sqrt{3}a\omega$
- $2a\omega$

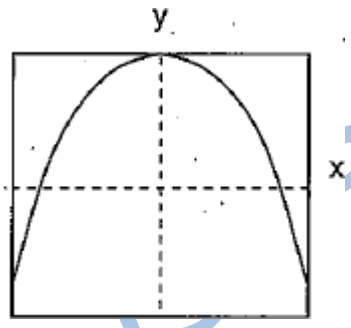
Correct: +4 · Incorrect: -1

6 x and y displacements of a particle are given as x(t) = a sin wt and y(t) = a sin 2wt. The trajectory will look like

○ 

○ 

○ 

○ 

Correct: +4 · Incorrect: -1

7 A particle of mass 1kg is hanging from a spring of force constant $100 Nm^{-1}$. The mass is pulled slightly downward and released so that is executes free simple harmonic motion with time period T. The time when the kinetic energy and potential energy of the system will becomes equal, is

$\frac{T}{x}$.

The value of x is ___

○ 2

- 4
- 6
- 8

Correct: +4 · Incorrect: -1

8 For a body executing SHM:
(A) Potential energy is always equal to KE
(B) Average potential and kinetic energy over any given time interval are always equal.
(C) Sum of the kinetic and potential energy at any point of time is constant
(D) Average KE in one time period is equal to average potential energy in one time period.
Choose the most appropriate option from the options given below:

- (C) and (D)
- only (C)
- (B) and (C)
- only (B)

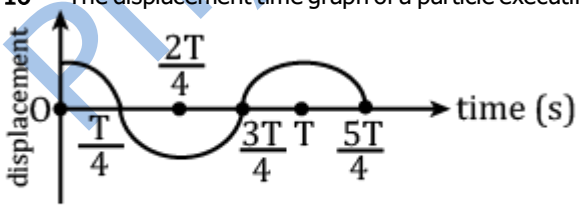
Correct: +4 · Incorrect: -1

9 For what value of displacement the kinetic energy of a simple harmonic oscillation become equal?

- $x=\pm A$
- $x=0$
- $x=\pm\frac{A}{\sqrt{2}}$
- $x=\frac{A}{2}$

Correct: +4 · Incorrect: -1

10 The displacement time graph of a particle executing SHM is given in kgure: (sketch is schematic and not to scale)



Which of the following statements is/are true for this motion?
(1) The force is zero at $t=\frac{3T}{4}$

(2) The acceleration is maximum at t = T

(3) The speed is maximum at $t = \frac{T}{4}$

(4) The PE is equal to KE of the oscillation at $t = \frac{T}{2}$

- (1), (2) and (4)
- (2), (3) an d(4)
- (1), (2) and (3)
- (1) and (4)

Correct: +4 · Incorrect: -1

11 A particle undergoing simple harmonic motion has time dependent displacement given by $x(t) = A\sin\frac{\pi t}{90}$. The ratio of kinetic energy to potential energy of this particle at t = 210s will be

- 1/9
- 1
- 2
- 1/3

Correct: +4 · Incorrect: -1

12 A pendulum is executing simple harmonic motion and its maximum kinetic energy is K_1. If the length of the pendulum is doubled and it performs simple harmonic motion with the same amplitude as in the krst case, its maximum kinetic energy is K_2.

- $K_2 = 2K_1$
- $K_2 = \frac{K_1}{2}$
- $K_2 = \frac{K_1}{4}$
- $K_2 = K_1$

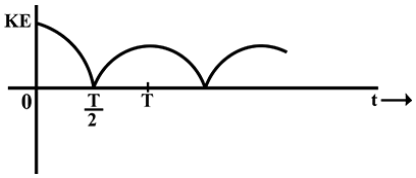
Correct: +4 · Incorrect: -1

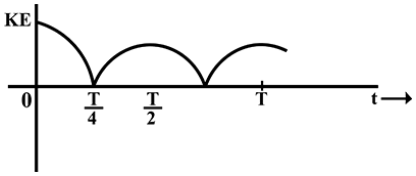
13 A particle is executing simple harmonic motion (SHM) or amplitude A, along the x-axis about x = 0. When its potential energy (PE) equal kinetic energy (KE) the position of the particle will be

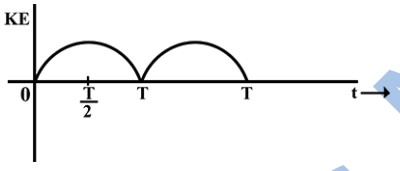
- $\frac{A}{2}$
- $\frac{A}{2\sqrt{2}}$
- $\frac{A}{\sqrt{2}}$
- A

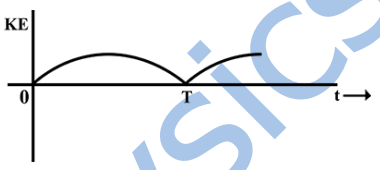
Correct: +4 · Incorrect: -1

14 A particle is executing simple harmonic motion with a time period T. At tiem t = 0 it is at its position of equilibrium. The kinetic energy time graph of the particle will look like

- 

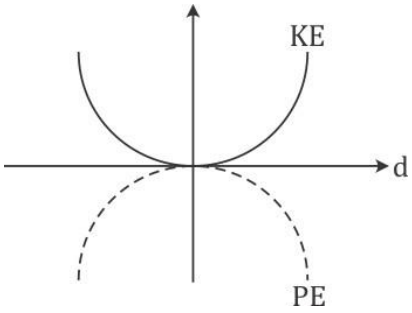
- 

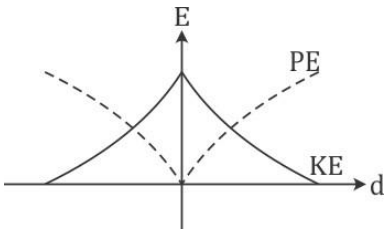
- 

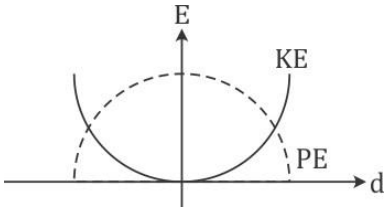
- 

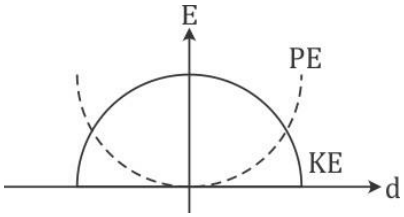
Correct: +4 · Incorrect: -1

15 For a simple pendulum a graph is plotted between its kinetic energy (KE) and potential energy (PE) against its displacement d. Which of the following represents these correctly? (graphs are schematic and not drawn to scale)









Correct: +4 · Incorrect: -1

16 T_0 is the time period of a simple pendulum at a place. If the length of the pendulum is reduced to 1/16 times of its initial value, the modiked time period is

- T_0
- $8\pi\, T_0$
- $4\, T_0$
- $¼\, T_0$

Correct: +4 · Incorrect: -1

17 Consider two identical springs each of spring constants k and negligible mass compared to the mass M as shown in kgure. Fig. 1 shows one of them and Fig. 2 shows their series combination. The ratios of time period of oscillation of two SHM is T_b/T_a = $\sqrt{x}$, where value of x is___(Round off to nearest integer).

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