PHYSICS

BOOKS - TARGET PHYSICS (HINGLISH)

OSCILLATIONS

Classical Thinking

1. If the motion of an object repeats itself at regular intervals of time , it is called ______ motion
.

A. non oscillatory motion.

B. non periodic motion

C. periodic motion

D. rectilinear motion

Answer: C

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2. Which of the following is not a simple harmonic motion?

A. Motion of needle of sewing machine

B. Vibrations of atoms in molecules

C. Motion of tip of hands of a clock

D. Motion of pendulum clock

Answer: C

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3. Select the correct statements.

(i) A simple harmonic motion is necessarily periodic

(ii) A simple harmonic motion is necessarily oscillatory

(iii) An oscillatory motion is necessarily periodic

(iv) A periodic motion is necessarily oscillatory

A. all periodic motions aie not oscillatory.

B. all periodic motions are oscillatory.

C. all periodic motions are not periodic motions.

D. all periodic motions are non hahnonic.

Answer: A

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4. Select the WRONG statement. A body is said to be in S.H.M, if

A. the motion is periodic

B. its acceleration is directed towards a fixed point in its path

C. the magnitude of acceleration is directly proportional to displacement

D. the acceleration is directed in the direction of displacement

Answer: D

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5. When a particle undergoes S.H.M., there is always a constant ratio between its displacement and

A. period

B. acceleration

C. mass

D. velocity

Answer: C

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6. The dimensions of k in equation F = kx are

A. $\left[M^{1}L^{1}T^{-2}\right]$

B. $\left[M^{0}L^{2}T^{-1}\right]$

C. $\left[M^{1}L^{0}T^{-2}\right]$

D. $\left[M^{1}L^{0}T^{-1}\right]$

Answer: c

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7. A particle moving along the X-axis executes simple harmonic motion, then the force acting on it is given by

where, A and K are positive constants.

A. -A kx

B. A cos (kx)

C. A^{-kx}

D. A kx

Answer: C

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8. The restoring force and P .E. of a particle executing S,H.M are F and V when its displacement is· x. The relation between F, V and xis

A. $\frac{V}{F}+x=0$

B. $\frac{F}{V}+x=0$

C. $2\frac{V}{F}+x=0$

D. $\frac{F}{2}V+x=0$

Answer: A

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9. Which of the following functionss represents a simple harmonic oscillation ?

A. $\sin \omega t - \cos \omega t$

B. $\sin^2 \omega t$

C. $\sin \omega t + \sin 2\omega t$

D. $\sin \omega t - \sin 2\omega t$

Answer: A

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10. Which of the following graphs correctly shows variation between the restoring force I F I and distance from the mean position (x) of a particle performing linear S.H.M.?

A.

B.

C.

D.

Answer: D

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11. A paricle of mass $200g$ executes a simple harmonic motion. The restorting force is provided by a spring of spring constant $80N/m$. Find the time period.

A. 0.31s

B. 0.15s

C. 0.05s

D. 0.02s

Answer: D

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12. If the period of oscillation of mass m suspended from a spring is 2 s, then the period of mass 4 m will be

A. 1s

B. 2s

C. 3s

D. 4s

Answer: D

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13. Acceleration of a particle, executing SHM, at it's mean position is

A. is infinity

B. varies

C. is maximum

D. is zero

Answer: C

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14. The acceleration of a particle in S.H.M. is

A. always zero

B. always constant

C. maximum at the extreme position

D. maximum at the equilibrium position

Answer: C

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15. The correct differential equation of linear S.H.M. is

A. $\frac{d^2x}{dt^2} - \frac{k}{m}x = 0$

B. $\frac{dx}{dt} - \frac{k}{m}x = 0$

C. $\left(\frac{dx}{dt}\right)^2 - \frac{k}{m}x = 0$

D. $\frac{d^2x}{dt^2} + \frac{k}{m}x = 0$

Answer: D

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16. In simple harmonic motion, the ratio of acceleration of the particle to its displacement at any time is a measure of

A. spring constant

B. angular frequency

C. $(\text{angular frequency})^2$

D. restoring force

Answer: C

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17. The displacement of a particle moving in S.H.M. at any instant is given by $y = a\sin\omega t$. The accelreation after time $t = \frac{T}{4}$ os

A. $A\omega$

B. $-A\omega$

C. $A\omega^2$

D. $-A\omega^2$

Answer: D

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18. A particle executing sim ple harn1oni c motion has amplitude of I metre and time period 4 second. At t = 0. x = 5 going towards positive x direction. Then the equation for tl1e displacement x at rime t

A. $x=10\sin\left(\frac{\pi t}{2}+\frac{\pi}{6}\right)cm$

B. $x=15\sin\left(\frac{\pi t}{6}+\frac{\pi}{3}\right)cm$

C. $x=10\cos\left(\frac{\pi t}{3}+\frac{\pi}{6}\right)cm$

D. $x=15\cos\left(\frac{\pi t}{6}+\frac{\pi}{3}\right)cm$

Answer: A

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19. The angular velocities of three bodies in SHM are $\omega_1, \omega_2, \omega_3$ with their respective amplitudes as

A_1, A_2, A_3. If all three bodies have same mass and maximum velocity then

A. $A_1\omega_1 = A_2\omega_2 = A_3\omega_3$

B. $A_1\omega_1^2 = A_2\omega_2^2 = A_3\omega_3^2$

C. $A_1^2\omega_1 = A_2^2\omega_2 = A_3^2\omega_3$

D. $A_1^2\omega_1^2 = A_2^2\omega_2^2 = A_3^2\omega_3^2$

Answer: A

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20. The velocity of a particle in simple harmonic motion at displacement y from mean position is

A. $\omega\sqrt{A^2+y^2}$

B. $\omega\sqrt{A^2-y^2}$

C. ωy

D. $\omega^2\sqrt{A^2-y^2}$

Answer: B

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21. The differnetial equation of S.H.M is given by $\frac{d^2x}{dt^2} + \propto x = 0$. The frequency of motion is

A. $\frac{\sqrt{\propto}}{2\pi}$

B. $\frac{\pi}{\sqrt{\propto}}$

C. $\frac{2\pi}{\sqrt{\propto}}$

D. $\frac{\propto}{2\pi}$

Answer: A

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22. The maximum acceleration of a body moving is SHM is a_0 and maximum velocity is v_0. The amplitude is given by

A. $\propto^2 / \beta$

B. $\beta^2 / \propto$

C. $\propto / \beta$

D. $\beta / \propto$

Answer: B

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23. A small body of mass 0.10 kg is executing S.H.M. of amplitude 1.0 m and period 0.20 sec . The maximum force acting on it i

A. 98.596 N

B. 985.96 N

C. 100.2 N

D. 76.23 N

Answer: A

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24. If a body of mass 0.98 kg is made to oscillate on a spring of force constant 4.84 N/m the angular frequency of the body is

A. 1.22 rad/s

B. 2.22 rad/s

C. 3.22 rad/s

D. 4.22 rad/s

Answer: B

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25. To make the frequency double of an oscillator, we have to

A. double the mass

B. half the mass

C. quadruple the mass

D. reduce the mass to one-fourth

Answer: D

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26. The equation of SHM of a particle is $\frac{d^2y}{dt^2} + ky = 0$, where k is a positive constant. The time period of motion is

A. $\frac{2\pi}{k}$

B. $2\pi k$

C. $\frac{2\pi}{\sqrt{k}}$

D. $2\pi\sqrt{k}$

Answer: C

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27. Assertion: In S.H.M., the velocity and displacement of the particle are in the same phase.

Reason: Velocity is the ratio of displacement to the time taken.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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28. Two particles P and Q start from origin and execute simple harmonic motion along X-axis with same amplitude but with periods $3s$ and $6s$ respectively. The ratio of the velocities of P and Q when they meet is

A. $1:2$

B. $2:1$

C. $2:3$

D. $3:2$

Answer: B

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29. The displacement of a particle executing S.H.M. is given by, y = 0.20 sin (100 t) cm. The maximum speed of the particle is

A. 200 cm/s

B. 100 cm/s

C. 20 cm/s

D. 50 cm/s

Answer: C

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30. A particle executes S.H.M. with an amplitude 0.5 m and frequency 100 Hz. The maximum speed of the particle will be

A. $\pi m / s$

B. 0.5 m/s

C. $5\pi \times 10^{-5} m / s$

D. $100\pi \quad m/s$

Answer: D

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31. A particle is executing a linear S.H.M. Its velocity at a distance x from the mean position is given by $v^2 = 144 - 9x^2$. The maximum velocity of the particle is

A. 12 unit

B. 18 unit

C. 24 unit

D. 36 unit

Answer: A

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32. A particle performing a U.C.M. has a

A. S.H.M

B. U.C.M

C. non-harmonic motion

D. periodic oscillation

Answer: A

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33. When a particle in U.C.M. performs complete circle on a reference circle, its projection

A. performs one to fro motion on horizontal diameter.

B. two back and forth motion on diameter.

C. follows the same motion on circumference of the circle.

D. remains stationary at any time

Answer: A

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34. The phase angle is

A. one dimensional quantity

B. two dimensional quantity

C. three dimensional quantity

D. dimensional quantity

Answer: D

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35. The term phase in S.H.M

A. is the angle measured in degree only.

B. specifies the position of the particle only

C. specifies the direction of motion only

D. specifies both the position and direction of motion.

Answer: D

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36. The phase change from right to left extreme position is

A. π

B. $\pi / 2$

C. 2π

D. $3\pi / 2$

Answer: A

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37. The phase difference between the displacement and acceleration of a particle execuliting simple harmonic motion is

A. 0

B. 360°

C. 180°

D. 90°

Answer: C

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38. The displacement of a particle performing S.H.M is $x = A \quad \sin(\omega t + \propto)$. The quantity $\propto$ is called

A. phase constant

B. epoch

C. initial phase

D. all of these

Answer: D

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39. The phase of a particle executing simple harmonic motion is $\frac{\pi}{2}$ when it has

A. maximum velocity

B. maximum acceleration

C. maximum displacement

D. both (b) and (c)

Answer: D

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40. Graph between velocity and displacement of a particle, executing S.H.M. is

A. a straight line

B. a parabola

C. a hyperbola

D. an ellipse

Answer: D

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41. A particle executing S.H.M. starts from the mean position. Its phase, when it reaches the extreme position, is

A. $\frac{\pi}{2}$

B. π

C. $\frac{3\pi}{2}$

D. 2π

Answer: A

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42. The average acceleration of a particle performing SHM over one complete oscillation is

A. zero

B. $\frac{A\omega^2}{2}$

C. $\frac{A\omega^2}{\sqrt{2}}$

D. $A\omega^2$

Answer: A

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43. When a particle in linear S.H.M. completes two oscillations, its phase increases by

A. 2π radian

B. 3π radian

C. 4π radian

D. π radian

Answer: C

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44. The equation of SHM of a particle is $\frac{d^2y}{dt^2} + ky = 0$, where k is a positive constant. The time period of motion is

A. $2\pi nt$

B. $\propto$

C. $2\pi nt + \propto$

D. $2\pi t$

Answer: C

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45. The phase of a particle performing S.H.M. increases by $\pi / 2$ after every 4 seconds. Its time period of oscillation is

A. 8s

B. 4s

C. 2s

D. 16s

Answer: D

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46. The equation of a simple harmonic motion is given by , $x = 8\sin(8\pi t) + 6\cos(8\pi t)$. The initial phase angle is

A. $\tan^{-1}(4/3)$

B. $\tan^{-1}(3/4)$

C. $\tan^{-1}(2/3)$

D. $\tan^{-1}(5/8)$

Answer: B

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47. If the particle in linear S.H.M. starts from the extreme left position, then its equation of motion is given by

A.

B.

C.

D.

Answer: D

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48. The potential energy of a particle perfonning S.H.M. is

A. maximum at the centre of path

B. minimum at the extreme position

C. proportional to the displacement from the centre

D. proportional to the square of the diplacement from the centre.

Answer: D

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49. At the mean position, the potential energy of a particle performing S.H.M. is

A. minimum

B. in between minimum and maximum

C. maximum

D. half of maximum value

Answer: A

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50. During SHM, a paricle has displacement x form mean position. If accreleration. Kinetic energy and potential energy are represented by a K and U respectively, the choose the appropriate graph

A.

B.

C.

D.

Answer: C

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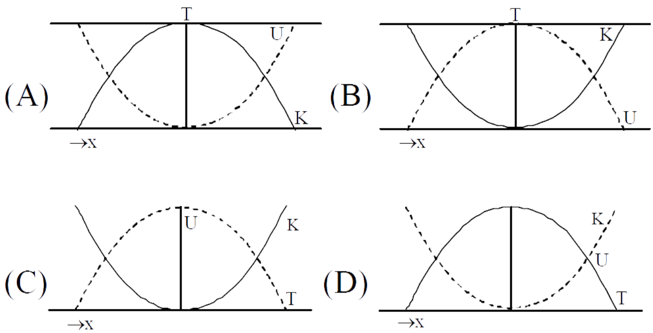
51. A particle is executing S.H.M. along a straight line. The graph showing the variation of kinetic, potential and total energy K, U and T respectively with displacement is -



A.

B.

C.

D.

Answer: A

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52. The potential energy of a particle with displacement X is $U(X)$. The motion is simple harmonic, when (K is a positive constant)

A. $U = -\frac{kx^2}{2}$

B. $U = kx^2$

C. U=K

D. U=kx

Answer: A

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53. A body of mass 1 is executing simple harmonic motion. Its displacement y(cm) at t seconds is given by $y = 6\sin(100t + \pi/4)$. Its maximum kinetic energy is

A. 6 J

B. 18 J

C. 24 J

D. 36 J

Answer: B

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54. The distance of the body from mean position, where the kinetic energy of a particle perfonning S.H.M. of amplitude 8 mm, is three times its potential energy is

A. 4 cm

B. 4 mm

C. 6 mm

D. 6 cm

Answer: B

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55. The kinetic energy of a particle executing S.H.M. is 16 J when it is at its mean position. If the mass of the particle is 0.32 kg , then what is the maximum velocity of the particle

A. 5 m/s

B. 15 m/s

C. 10 m/s

D. 20 m/s

Answer: C

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56. The total energy of a particle executing S.H.M. is 80 J . What is the potential energy when the particle is at a distance of 3/4 of amplitude from the mean position

A. 60 J

B. 10 J

C. 40 J

D. 45 J

Answer: D

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57. Maximum kinetic energy of a particle suspended from a spring in oscillating state is 5 joule and amplitude is 10 cm. The force constant of the spring will be

A. 100 N/m

B. 10 N/m

C. 1000 N/m

D. 500 N/m

Answer: C

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58. Two particle are executing SHMs .The equations of their motions are

$$y_1 = 10\sin\left(\omega t + \frac{\pi}{4}\right) \text{ and } y_2 = 5\sin\left(\omega t + \frac{\sqrt{3}\pi}{4}\right)$$

What is the ratio of their amplitudes.

A. $1:1$

B. $1:2$

C. $2:5$

D. $5:2$

Answer: C

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59. Two simple harmonic motions are given by $y_1 = a\sin\left[\left(\frac{\pi}{2}\right)t + \phi\right]$ and $y_2 = b\sin\left[\left(\frac{2\pi}{3}\right)t + \phi\right]$. The phase difference between these after $1s$ is

A. π

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{6}$

Answer: D

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60. Two parallel S.H.M.s have equations $y_1 = A_1 \sin(\omega t + 2\pi)$ and $y_2 = A_2 \sin\left(\frac{\omega}{t} + 4\pi\right)$. The amplitude of the resultant motion is

A. $+ = (A_1 + A_2)$

B. $+ = (A_1 - A_2)$

C. $\sqrt{A_1^2 + A_2^2 + A_1 A_2}$

D. $\sqrt{A_1^2 + A_2^2}$

Answer: A

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61. In a simple pendulum the period of oscillation (T) is related to the length of the pendulum (L) as

A. $\frac{l}{T}$=constant

B. $\frac{l^2}{T}$=constant

C. $\frac{l}{T^3}$=constant

D. $\frac{l^2}{T^3}$=constant

Answer: C

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62. If the lift moves up and comes down with uniform speed, then the time period of pendulum in the lift

A. increases and decreases respectively.

B. remains same

C. decrease and increase respectively

D. becomes zero

Answer: B

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63. A second's pendulum is placed in a space laboratory orbiting around the earth at a height $3R$, where R is the radius of the earth. The time period of the pendulum is

A. zero

B. $2\sqrt{3}$

C. 4 s

D. infinite

Answer: D

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64. A simple pendulum has a time period T. If the support and the pendulum fall freely, the time period will be

A. infinity

B. greater than T

C. less than T

D. zero

Answer: A

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65. If the length of a pendulum is made 9 times and mass of the bob is made 4 times then the value of time period becomes

A. 3T

B. 3/2T

C. 4T

D. 2T

Answer: A

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66. The length of seconds pendulum at a place wl}ere g = 4.9 m/s^2 is

A. 99.54 cm

B. 60 cm

C. 50 cm

D. 101 cm

Answer: C

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67. If at any time, the displacement of a simple pendulum be 0.02 m, then its acceleration is 2 m/ s^2. What is the angular speed of the pendulum at that instant?

A. 100 rad/s

B. 10 rad/s

C. 1 rad/s

D. 0.1 rad/s

Answer: B

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68. The equation

$$\frac{d^2y}{dt^2} + b\frac{dy}{dt} + \omega^2 y = 0$$

represents the equation of motion for a

A. free vibrator

B. damped harmonic oscillator

C. forced oscillator

D. resonant oscillator

Answer: B

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69. The S.I. unit of damping constant is

A. kg s

B. $kg^2 s$

C. kgm/s

D. kg/s

Answer: D

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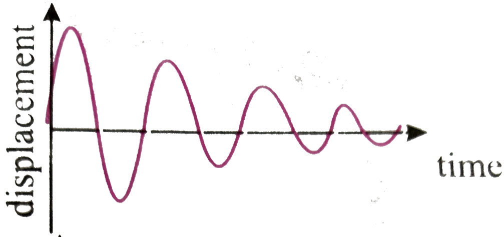
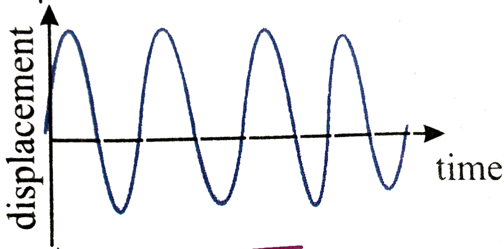
70. Which of the following figure represents damped harmonic motion i)

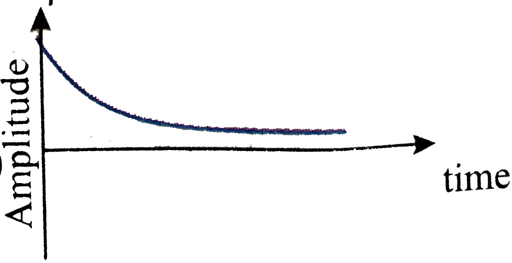


ii)



iii)

iv)



A.

B.

C.

D.

Answer: C

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71. A mass M is suspended from a massless spring. An additional mass m stretches the spring further by a distance x. The combined mass will oscillate with a period

A. $T = 2\pi\sqrt{\dfrac{mg}{x(M+m)}}$

B. $T = 2\pi\sqrt{\dfrac{(M+m)x}{mg}}$

C. $T=\frac{\pi}{2}\sqrt{\frac{mg}{x(M+m)}}$

D. $T=2\pi\sqrt{\frac{M+m}{mgx}}$

Answer: B

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72. Two strings A and B have force constants k_1 and k_2 respectively. The ratio of the work done on A to that done on B when they are stretched by the same force is

A. k_1 / k_2

B. $\sqrt{k_1 / k_2}$

C. k_2 / k_1

D. $\sqrt{k_2 / k_1}$

Answer: C

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73. A block rests on a horizontal table which is executing SHM in the horizontal plane with an amplitude A. What will be the frequency of oscillation, the block will just start to slip? Coefficient of friction $= \mu$.

A. $\frac{1}{2\pi}\sqrt{\frac{\mu g}{A}}$

B. $\frac{1}{4\pi}\sqrt{\frac{\mu g}{A}}$

C. $2\pi\sqrt{\frac{A}{\mu g}}$

D. $4\pi\sqrt{\frac{A}{\mu g}}$

Answer: A

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74. The oscillation of a body on a smooth horizontal surface is represented by the equation,

$X = A\cos(\omega t)$

where, X = displacement at time t

$\omega =$ frequency of oscillation

Which one of the following graphs shows correctly the variation a with t?

Here, a = acceleration at time t

T = time period

A.

B.

C.

D.

Answer: C

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75. The equation of a damped simple harmonic motion is $m\frac{d^2x}{dt^2}+b\frac{dx}{dt}+kx=0$. Then the angular frequency of oscillation is

A. $\omega=\left(\frac{k}{m}=\frac{p^2}{4m^2}\right)^{1/2}$

B. $\omega=\left(\frac{k}{m}-\frac{p}{4m}\right)^{1/2}$

C. $\omega=\left(\frac{k}{m}-\frac{p^2}{4m}\right)^{1/2}$

D. $\omega=\left(\frac{k}{m}-\frac{p^2}{4m^2}\right)$

Answer: A

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Critical Thinking

1. A particle doing simple harmonic motion amplitude $= 4cm$ time period $= 12 \sec$ The ratio between time taken by it in going from its mean position to $2cm$ and from $2cm$ to extreme position is

A. 1

B. $1/3$

C. $1/4$

D. $1/2$

Answer: D

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2. A particle executes simple harmonic motion between $x = -A$ and $x = +A$. The time taken for it to go from $0 \rightarrow A/2 is T_1$ and $\rightarrow goo m A/2 \rightarrow (A) is (T_2)$. Then.

A. $T_1 < T_2$

B. $T_1 > T_2$

C. $T_1 = T_2$

D. $T_1 = 2T_2$

Answer: A

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3. One-forth length of a spring of force constant K is cut away. The force constant of the remaining spring will be

A. $\frac{3}{4}$K

B. $\frac{4}{3}$K

C. K

D. 4k

Answer: B

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4. What is the maximum acceleration of the particle doing the SHM $\gamma = 2\sin\left[\frac{\pi t}{2}\phi\right]$ where gamma is in cm?

A. $\frac{\pi}{2}cm/s^2$

B. $\frac{\pi^2}{2} cm / s^2$

C. $\frac{\pi}{4} cm / s^2$

D. $\frac{\pi^2}{4} cm / s^2$

Answer: B

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5. A simple harmonic wave having an amplitude a and time period T is represented by the equation y = $5\sin\pi(t+4)m$. Then the value of amplitude (a) in (m) and time period (T) in second are

A. A=10, T=2

B. A=5, T=1

C. A=10, T=1

D. A=5, T=2

Answer: D

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6. A body of mass 5 gm is executing S.H.M. about a point with amplitude 10 cm . Its maximum velocity is 100 cm / sec . Its velocity will be 50 cm / sec at a distance

A. 5 cm

B. $5\sqrt{2}$ cm

C. $5\sqrt{3}$ cm

D. $10\sqrt{2}$ cm

Answer: C

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7. A particle starting at the end of its swing performs S.H.M. of amplitude 0.1 m and frequency 60 vibrations per minute. The displacement of the particle at the end of 2 s is

A. 0.2m

B. 0.1m

C. 0.15m

D. 0.02m

Answer: B

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8. A particle is executing simple harmonic motion with a period of T seconds and amplitude a metre . The shortest time it takes to reach a point $\frac{a}{\sqrt{2}}$ from its mean position in seconds is

A. T

B. T/4

C. T/8

D. T/16

Answer: C

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9. The equation of motion of a body is S.H.M. IS X=4 $\sin\left(\pi t+\frac{\pi}{3}\right)$. The frequency, per minute, of the motion is

A. 20

B. 15

C. 10

D. 30

Answer: D

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10. The equation of motion of a body is S.H.M. is x=4 $\sin\left(\pi t+\frac{\pi}{3}\right)$. The velocity at the end of 4 seconds will be

A. π cm/s

B. $\frac{\pi}{2}$ cm/s

C. $\frac{3}{2}$ cm/s

D. 2π cm/s

Answer: D

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11. The equation of motion of a body in S.H.M. is x=4 $\sin\left(\pi t+\frac{\pi}{3}\right)$. The acceleration, in $cm/S62$, at the end of 4 s will be

A. $\frac{3}{2}\pi^2$

B. $\frac{2}{3}\pi^2$

C. $-\frac{\sqrt{2}}{3}\pi^2$

D. $-2\sqrt{3}\pi^2$

Answer: D

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12. A particle is moving in a straight line with S.H.M. of amplitude r. At a distance s from the mean position of motion, the particle receives a blow in the direction of motion which instantaneously doubles the velocity . Find the new amplitude.

A. $\sqrt{4a^2 - 3s^2}$

B. $\dfrac{\sqrt{a^2 + 3s^2}}{2}$

C. $\dfrac{a^2 + 3s^2}{4}$

D. $\dfrac{4a^2 - 3s^2}{2}$

Answer: B

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13. A particle is performing linear S.H.M. If the acceleration and corresponding velocity of the particle are $\propto$ and v respectively and if we plot v^2 on Y axis and $\propto^2$ on X axis, then the graph will be

A. a parabola

B. a straight line

C. an ellipse

D. a hyperbola

Answer: B

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14. A body of mass 36 g moves with S.H.M. of amplitude A = 13 cm and time period T = 12 s. At time t = 0, the displacement x is + 13 cm. The shortest time of passage from x = + 6.5 cm to x = - 6.5 cm is

A. 4s

B. 2s

C. 6s

D. 3s

Answer: B

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15. The displacement of a particle executing S.H.M. is x = 5 sin $(20\pi t)$. Then its frequency will be

A. 20π Hz

B. 20 Hz

C. 10 Hz

D. 10π Hz

Answer: C

Watch Video Solution

16. A body oscillates with simple harmonic motion according to the equation, $x = 6 \quad \cos \quad 3\left(\pi t + \frac{\pi}{9}\right)$. The differential equation represented by the equation is

A. $\frac{d^2x}{dt^2} = 3x$

B. $\frac{d^2x}{dt^2} = -2\pi x$

C. $\frac{d^2x}{dt^2} = -9\pi^2 x$

D. $\frac{d^2x}{dt^2} = -9\pi x$

Answer: C

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17. A particle performs S.H.M. with amplitude 5 m, period 0.02 . s and x = 2.5 m at t = 0. Which is the correct equation?

A. $x = 5 \quad \sin\left(100\pi t + \frac{\pi}{3}\right)$

B. $x = 5 \quad \sin\left(50\pi t + \frac{\pi}{6}\right)$

C. $x = 5 \quad \sin\left(50\pi t + \frac{\pi}{3}\right)$

D. $x = 5 \quad \sin\left(100\pi t + \frac{\pi}{6}\right)$

Answer: D

Watch Video Solution

18. A particle moves with simple harmonic motion in a straight line. In first τs, after starting form rest it travels a destance a, and in next τs it travels 2a, in same direction, then:

A. amplitude of motion is 3a

B. time period of oscillations is 8τ.

C. amplitude of motion is 4a

D. time period of oscillations is 6τ.

Answer: D

Watch Video Solution

19. A simple harmonic motion is given by the equation x=10cos $10\pi t$. The phase of S.H.M. after time 2 s is

A. 20π

B. 10.5π

C. 20.5π

D. 10π

Answer: C

Watch Video Solution

20. The equation of linear simple harmonic motion is x = 8 cos$(12\pi t)$ where x is in cm and t is in second. The initial phase angle is

A. 0

B. $\frac{\pi}{4}$ rad

C. $\frac{\pi}{2}$ rad

D. $\frac{3\pi}{4}$ rad

Answer: C

Watch Video Solution

21. A particle is performing linear S.H.M. with frequency 1 Hz and amplitude 10 cm. Initially, the particle is at a distance +5 cm. Its epoch is

A. π

B. $\frac{\pi}{2}$

C. 0

D. $\frac{\pi}{6}$

Answer: D

Watch Video Solution

22. Given equation of S.H.M. is y = 10 sin(20t+0.5). The initial phase is

A. 0.5 radian

B. 20 radian

C. 10 radian

D. 25 radian

Answer: A

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23. A simple harmonic motion is represented by the equation, y = 5 sin $\pi(t+4)$. Then the values of amplitude A and initial phase $\propto$ are respectively.

A. $A=5, \propto =4\pi$

B. $A=10, \propto =0$

C. $A = 5, \propto = 0$

D. $A = 10, \propto = 4\pi$

Answer: A

Watch Video Solution

24. The amplitude and the periodic time of a S.H.M. are 5 cm and 6 sec respectively. At a distance of 2.5 cm away from the mean position, the phase will be

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{5\pi}{12}$

D. $\frac{\pi}{3}$

Answer: A

Watch Video Solution

25. The velocity and acceleration of a particle performing S.H.M. have a steady phase relationship. The acceleration shows a phase lead of

A. $\frac{\pi}{2}$

B. π

C. $\frac{\pi}{4}$

D. 2π

Answer: A

Watch Video Solution

26. A particle in S.H.M. has velocity of 6.28 emfs, two seconds after passing the equilibrium position. The period of motion is 12 s and amplitude 24 cm. The epoch (initial phase) is

A. 0

B. $\frac{\pi}{12}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{4}$

Answer: A

Watch Video Solution

27. A particle is in S.H.M. along a straight line 0.2 m long with a period of 6 s. Its displacement after $\frac{1}{2}$ second, if its epoch is $\left(\frac{\pi}{6}\right)^c$, will be

A. 5cm

B. $3\sqrt{5}$ cm

C. $5\sqrt{3}$ cm

D. $\sqrt{15}$ cm

Answer: C

Watch Video Solution

28. The amplitude and the time period in a S.H.M. is 0.5 cm and 0.4 sec respectively. If the initial phase is $\pi/2$ radian, then the equation of S.H.M. will be

A. $y = 0.5 \quad \sin \quad 5\pi t$

B. $y = 5 \quad \sin \quad 5\pi t$

C. $y = 0.5 \quad \sin \quad 2.5\pi t$

D. $y = 0.5 \quad \cos \quad 5\pi t$

Answer: D

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29. If x, v, a, K.E. and P.E. represent displacement, velocity, acceleration, kinetic energy and potential energy at any instant respectively for a particle executing S.H.M., then which of the following statements is INCORRECT?

A. v and x may have same direction

B. v and a may have same direction

C. a and x may have same direction

D. K.E and P.E may have same value.

Answer: C

View Text Solution

View Text Solution

30. The potential energy of a particle executing S.H.M. is 2.5 J, when its displacement is half of amplitude. The total energy of the particle will be

A. 2.5 J

B. 10 J

C. 12 J

D. 20 J

Answer: B

Watch Video Solution

31. A particle starts simple harmonic motion from the mean position. Its amplitude is a and total energy E . At one instant its kinetic energy is 3E/4 . Its displacement at that instant is

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

B. $\frac{A}{3}$

C. $\frac{A}{\sqrt{3/2}}$

D. $\frac{A}{\sqrt{3}}$

Answer: B

Watch Video Solution

32. A body is executing simple harmonic motion. At a displacement x, its potential energy is E_1 and a displacement y, its potential energy is E_2. The potential energy E at a displacement (x+y) is

A. $\sqrt{P.E. = \sqrt{P.E._1} - \sqrt{P.E._2}}$

B. $\sqrt{P.E. = \sqrt{P.E._1} + \sqrt{P.E._2}}$

C. $P.E. = P.E._1 + P.E._2$

D. $P.E. = P.E._1 - P.E._2$

Answer: B

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33. The kinetic energy and the potential energy of a particle executing SHM are equal The ratio of its displacement and amplitude will be

A. $\frac{1}{\sqrt{2}}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{2}$

D. $\sqrt{2}$

Answer: A

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34. The displacement of a particle of mass 0.1 kg from . its mean position is given by, y = 0.05 sin $4\pi(5t + 0.4)$ (where all the quantities are in S.I. unit). Period of motion is 0.1 s. The total energy of the particle is

A. $0.05\pi^2$ J

B. 0.05 J

C. $5\pi^2$ J

D. 5 J

Answer: A

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35. The displacement of two identical particles executing SHM are represented by equations $x_1 = 4\sin\left(10t + \frac{\pi}{6}\right) \& x_2 = 5\cos(\omega t)$ For what value of •, energy of both the particles is same.

A. 16 unit

B. 6 unit

C. 4 unit

D. 8 unit

Answer: D

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36. The total energy of a simple harmonic oscillator is 3×10^{-5} J and maximum force acting on the body is 1.5×10^{-3} N. If the period of the motion is 2s and initial phase is 30°, then the equation of motion will be

A. $x = 0.4 \quad \sin\left(\pi t + \frac{\pi}{6}\right)$

B. $x = 0.4 \quad \sin\left(2\pi t + \frac{\pi}{6}\right)$

C. $x = 0.4 \quad \sin\left(\pi t + \frac{\pi}{6}\right)$

D. $x = 0.4 \quad \sin\left(2\pi t + \frac{\pi}{6}\right)$

Answer: C

Watch Video Solution

37. The ratio of the K.E. and P.E. possessed by a body executing S.H.M. when it is at a distance of $\frac{1}{n}$ of its amplitude from the mean position, is

A. n^2

B. $\frac{1}{2}n^2$

C. $n^2 + 1$

D. $n^2 - 1$

Answer: D

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38. A simple harmonic oscillator has amplitude 'A'. If the kinetic energy of oscillator is one-fourth of the total energy, then the displacement is

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

B. $\frac{\sqrt{3}A}{2}$

C. $\frac{A}{4}$

D. $\frac{A}{2}$

Answer: B

Watch Video Solution

39. A loaded vertical spring executes simple harmonic oscillations with period of 4 s. The difference between the kinetic energy and potential energy of this system oscillates with a period of

A. 8s

B. 1s

C. 2s

D. 4s

Answer: C

Watch Video Solution

40. A particle is executing SHM with amplitude A. At displacement $x = \left(-\frac{A}{4}\right)$, force acting on the particle is F, potential energy of the particle is

U, velocity of particle is v and kinetic energy is K. Assuming potential energyh to be zero at mean position. At displacement x=A/2

A. force acting on the particle will be 4F.

B. potential energy of particle will be 2 P.E.

C. velocity of particle will be $\sqrt{\frac{2}{5}}$v.

D. kinetic energy of particle will be 0.8 K.E.

Answer: D

Watch Video Solution

41. Assertion: Total energy of a particle executing S.H.M. · is maximum at mean position .

Reason: The velocity of the particle executing S.H.M. is maximum at mean position.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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42. The equation of simple harmonic motion of two particle is $x_1 = A_1 \sin \omega t$ and $x_2 = A_2 \sin(\omega t + \propto)$. If they superimpose, then the amplitude of the resultant S.H.M. will be

A. $\sqrt{A_1^2 + A_2^2 - 2A_1A_2 \cos \propto}$

B. $\sqrt{A_1^2 - A_2^2 - 2A_1A_2 \cos \propto}$

C. $\sqrt{A_1^2 + A_2^2 - 2A_1A_2 \sin \propto}$

D. $\sqrt{A_1^2 + A_2^2 + 2A_1A_2 \sin \propto}$

Answer: B

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43. The resultant of two S.H.M. having the same period T but different amplitudes and phases, along the same line is S.H.M

A. having a period 2T

B. having a period T

C. having a period T/2

D. having a period $\frac{T}{4}$

Answer: B

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44. Two S.H.M.s along the same straight line in the same direction and of the same period are given by the equations, $x_1 = 3 \quad \sin\left(4\pi t + \frac{\pi}{6}\right)$ and $x_2 = 4 \quad \sin\left(4\pi t + \frac{\pi}{3}\right)$. The initial phase of the resultant motion is

A. $\sqrt{18 + 12\sqrt{2}}$

B. $\sqrt{25+12\sqrt{3}}$

C. $\sqrt{24+18\sqrt{3}}$

D. $\sqrt{25+12\sqrt{2}}$

Answer: B

Watch Video Solution

45. Two S.H.M.s along the same straight line in the same direction and of the same period are given by the equations, $x_1 = 3 \quad \sin\left(4\pi t + \frac{\pi}{6}\right)$ and $x_2 = 4 \quad \sin\left(4\pi t + \frac{\pi}{3}\right)$. The initial phase of the resultant motion is

A. $\tan^{-1}\left(\frac{6+4\sqrt{3}}{\sqrt{3}}\right)$

B. $\tan^{-1}\left(\frac{2\sqrt{3}+3}{2+2\sqrt{3}}\right)$

C. $\tan^{-1}\left(\frac{3+4\sqrt{3}}{4+3\sqrt{3}}\right)$

D. $\tan^{-1}\left(\frac{4+6\sqrt{3}}{\sqrt{6}}\right)$

Answer: C

Watch Video Solution

46. A simple pendulum is vibrating in an evacuated chamber, it will oscillate with

A. increasing amplitude

B. constant amplitude

C. decreasing amplitude

D. decreasing period

Answer: B

Watch Video Solution

47. If a hole is bored along the diameter of the earth and a stone is dropped into hole

A. the stone reaches the centre of the earth and stops there

B. the stone reaches the other side of the earth and stops there.

C. the stone executes simple harmonic motion about the centre of the earth

D. the stone reaches the other side of the earth and escapes into space.

Answer: C

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48. Assertion: The rotation of earth about its axis is a simple harmonic motion.

Reason: The earth completes each rotation about its axis in 24 hours while orbiting around sun.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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49. A simple pendulum of length 1 m the bob performs circular motion in horizontal plane if its string making an angle 60° with the verticle , then the period of rotation of the bob will be $(g = 10m/s^2$

A. 1 N

B. 0.29 N

C. 0.5 N

D. 2 N

Answer: A

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50. Restoring force acting on a pendulum, when it is deflected through an angle 30° is (mass of the bob = 200 g, g = 10 m $/ s^2$)

A. 1 N

B. 0.1 N

C. 10 N

D. 0.01 N

Answer: A

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51. The period of a simple pendulum is doubled, when

A. its length is doubled

B. its length is halved

C. its length is made four times

D. the mass of the bob is doubled

Answer: C

Watch Video Solution

52. A pendulum clock thast keeps correct time on the earth is taken to the moon. It will run

A. at correct rate

B. 6 times faster

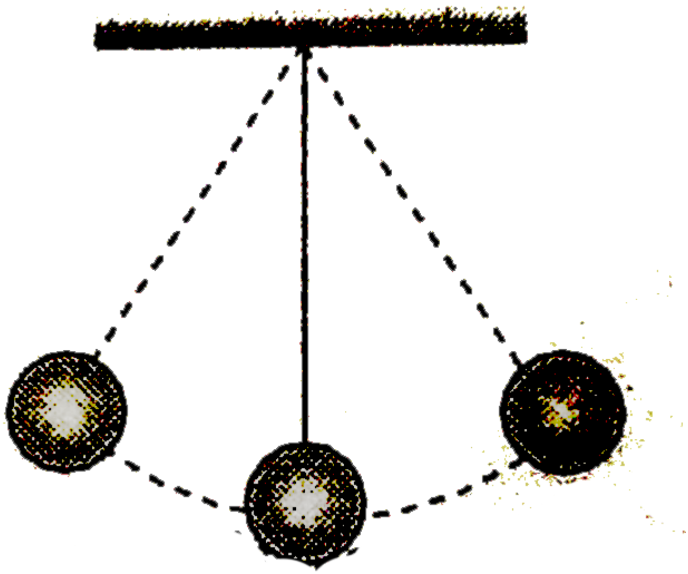
C. $\sqrt{6}$ times faster

D. $\sqrt{6}$ times slower

Answer: D

Watch Video Solution

53. What is the velocity of the bob of a simple pendulum at its mean position, if it is able to rise to vertical height of 10 cm (take $g = 9.8 m/s^2$)



A. 2.2 m/s

B. 1.8 m/s

C. 1.4 m/s

D. 0.6 m/s

Answer: C

Watch Video Solution

54. A simple pendulum of length 98cm has amplitude of $2\sqrt{10}$ cm. Taking $g = 9.8m/s^2$, its maximum velocity will be

A. 2 cm/s

B. 0.2 cm/s

C. 10 cm/s

D. 20 cm/s

Answer: D

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55. The bob of a simple pendulum of mass m and total energy E will have maximum linear momentum equal to

A. $\sqrt{2m / E}$

B. $\sqrt{2mE}$

C. 2 m E

D. $m \quad E^2$

Answer: B

Watch Video Solution

56. A carriage is sliding down an inclined plane at an angle of 60° with a simple pendulum of length 1 m, its period of oscillation will be

A. 2s

B. 1s

C. 0.5s

D. 0.45s

Answer: D

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57. A second's pendulum performs 100 oscillations in

A. 200 second

B. 100 second

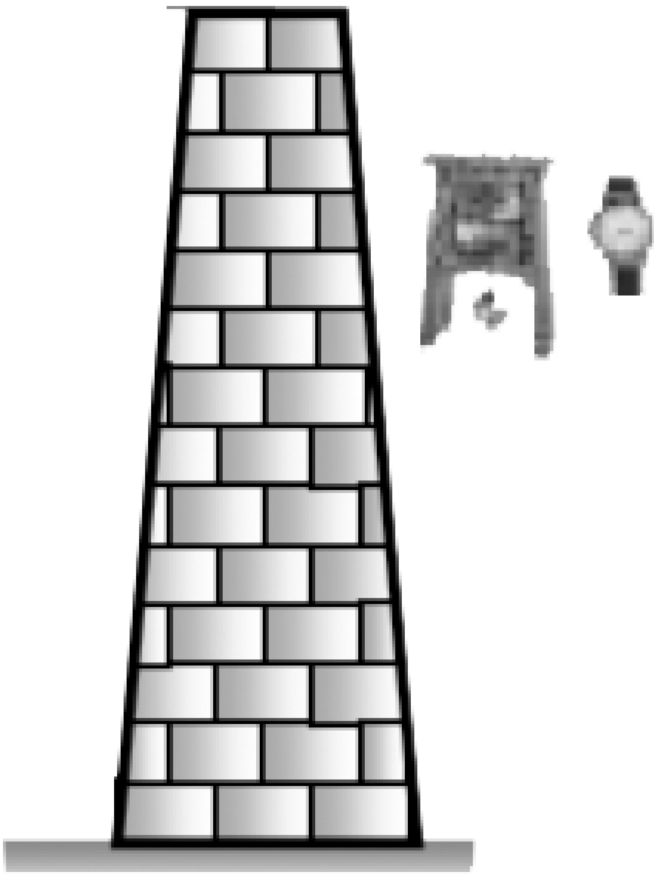
C. 50 second

D. 25 second

Answer: A

Watch Video Solution

58. A man having a wrist watch and a pendulum clock rises on a TV tower. The wrist watch and pendulum clock by chance fall from the top of the tower. Then



A. both will keep correct time during the fall.

B. both will keep correct time during the fall.

C. wrist watch will keep correct time and clock will become fast.

D. clock will stop but wrist watch will function normally.

Answer: D

Watch Video Solution

59. Two simple pendulum A and B of lengths $1.69m$ and $1.44m$ start swinging at the time from a location where acceleration due to gravity is

$10ms^{-1}$. Answer the following question.

After how much time, the two pendulums will be in phase again ?

A. 4

B. 5

C. 6.5

D. 8.5

Answer: C

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60. Two pendulum of lengths $1m$ and $16m$ are in phase at the mean position at a certain instant of time. If T is the time period of the shorter pendulum, then the minimum time after which they will again be in phase is

A. T/4

B. T/3

C. 4T/3

D. 4T

Answer: C

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61. The time period of a simple pendulum inside a stationary lift is T. If it starts descending with acceleration g/5. the new period of the simple pendulum will be

A. 2T

B. $\frac{\sqrt{5}}{2}T$

C. $\sqrt{\frac{5}{3}}T$

D. $\frac{2}{\sqrt{5}}T$

Answer: B

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62. A simple pendulum of length l has a brass bob attached at its lower end. Its period is T . If a steel bob of same size, having density x times that of brass, replaces the brass bob and its length is changed so that period becomes 2 T, then new length is

A. 2l

B. 4l

C. 4l x

D. $\frac{4l}{x}$

Answer: B

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63. Two pendulums begin to swing simultaneously. If the ratio of the frequency of oscillations of the two is 7 : 8, then the ratio of lengths of the two pendulums will be

A. $7:8$

B. $8:7$

C. $49 : 64$

D. $64 : 49$

Answer: D

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64. The length of a second's pendulum on the surface of earth is 1 m. What will be the length of a second's pendulum on the moon?

A. (1/6)m

B. 6m

C. (1/36)m

D. 36m

Answer: A

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65. If the length of second's pendulum is decreased by 2%, how many seconds it will lose per day

A. 3927s

B. 3727s

C. 3427s

D. 864s

Answer: D

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66. A clock which keeps correct time at $20^\circ C$ is subjected to $40^\circ C$. If coefficient of linear expansion of the pendulum is $12 \times 10^{-6} / ^\circ C$. How much will it gain or loss in time ?

A. 10.4 seconds

B. 20.6 seconds

C. 5.6 seconds

D. 15.4 seconds

Answer: A

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67. The length of simple pendulum executing SHM is increased by 69%. The percentage increase in the time period of the pendulum is

A. 0.1

B. 0.2

C. 0.3

D. 0.44

Answer: C

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68. Pendulum A and B having periodic times 4 s and 4.2 s, are made to oscillate simultaneously. At time t = 0, they are in the same phase. After how many complete oscillations of A, they will be again in the same phase?

A. 7s

B. 14s

C. 28s

D. 68s

Answer: D

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69. If a simple pendulum is taken to place where g decreases by 2%, then the time period

A. decrease by 2%

B. increase by 1%

C. decrease by 1%

D. increase by 2%

Answer: B

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70. If the length of simple pendulum is increased by 300%, then the time period will be increased by

A. 1

B. 2

C. 3

D. 4

Answer: A

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71. The amplitude of damped oscillator becomes half in one minute. The amplitude after 3 minutes will be $1/x$ times the original, where x is

A. 2×3

B. 2^3

C. 3^2

D. 3×2^2

Answer: B

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72. When a dampled harmonic oscillator completes 100 oscillations, its amplitude is reduced to $\frac{1}{3}$ of its initial value. When will be its amplitude when it completes 200 oscillations?

A. $\frac{1}{5}$

B. $\frac{1}{6}$

C. $\frac{1}{9}$

D. $\frac{1}{100}$

Answer: C

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73. A body of mass 0.25 kg is attached to a vertical spring. The spring is executing damped simple harmonic spring will drop to half its initial value ?

[The damping constant b = 0.05 kg/s]

A. $4 \quad \log_{10} 2$

B. $4 \quad \log_e 2$

C. $5 \quad \log_e 2$

D. $5 \quad \log_{10} 2$

Answer: C

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74. The amplitude of a damped oscillator becomes $\frac{1}{(27)^{th}}$ of its initial value after 6 minutes. Its amplitude after 2 minutes is

A. $\frac{A_0}{6}$

B. $\frac{A_0}{9}$

C. $\frac{A_0}{4}$

D. $\frac{A_0}{3}$

Answer: D

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75. A particle of mass (m) is executing oscillations about the origin on the (x) axis. Its potential energy is $V(x) = k|x|^3$ where (k) is a positive constant. If the amplitude of oscillation is a, then its time period (T) is.

A. proportional to $\frac{1}{\sqrt{A}}$

B. independent of A.

C. proportional to $\sqrt{A}$

D. proportional to $A^{3/2}$

Answer: A

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76. A pendulum has time period T in air when it is made to oscillate in water it acquired a time period $T = \sqrt{2}T$ The density of the pendulum bob is equal to (density) of water $= 1)$

A. $\sqrt{2}$

B. 2

C. $2\sqrt{2}$

D. $2 / \sqrt{2}$

Answer: B

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77. This question has statement 1 and statement 2 . Of the four choice given after the Statement , choose the one that best describe the two Statement .

If the spring $S_1$and S_2 of force constant k_1 and k_2 respectively , are streached by the same force , it is found that more work is done on spring S_1 then on spring S_2

Statement -1: If statement by the same answer work done on S_1 work on S_1 is more then S_2

Statement - 2 : $k_1 < k_2$

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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78. Assertion: In S.H.M., the velocity and displacement of the particle are in the same phase.

Reason: Velocity is the ratio of displacement to the time taken.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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79. If the amplitude of the pendulum increases, then time period________.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but, Reason is True.

Answer: D

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80. When a particle performs S.H.M., its kinetic energy varies periodically. If the frequency of the particle is 10, then the kinetic energy of the particle will vary with frequency equal to

A. 10

B. 20

C. 5

D. 30

Answer: B

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81. A simple · pendulum of length L is hanging from a rigid support on the ceiling of a stationary train. If the train moves forward with an acceleration a, then the time period of the pendulwn will be

A. $2\pi\sqrt{\frac{L}{(g^2+a^2)^{1/2}}}$

B. $2\pi\sqrt{\frac{L}{(g^2-a^2)^{1/2}}}$

C. $2\pi\sqrt{\frac{L}{(g+a)}}$

D. $2\pi\sqrt{\frac{L}{(g-a)}}$

Answer: A

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Competitive Thinking

1. Which of the following is a necessary and sufficient condition for S.H.M.

A. Constant period

B. Constant acceleration

C. Proportionality between acceleration and displacement from equilibrium position

D. Proportionality between restoring force and displacement from equilibrium position.

Answer: D

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2. Which of the fo llowing statements is wrong for a S.H.M.?

A. veocity is maximum at mean position

B. K.E. of the body is less at extreme position

C. Acceleration is more at extreme position and direction is away from mean position

D. Acceleration is less at mean position

Answer: C

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3. For a particle executing simple harmonic motion, which of the following statements is not correct

A. The total energy of the particle always remains the same

B. The restoring force is always directed towards a fixed point.

C. The restoring force is maximum at the extreme positions

D. The acceleration of the particle is maximum at the equilibrium position.

Answer: D

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4. Two springs of constants k_1 and k_2 have equal maximum velocities, when executing simple harmonic motion. The ratio of their amplitudes (masses are equal) will be

A. $\frac{k_1}{k_2}$

B. $\frac{k_2}{k_1}$

C. $\left(\frac{k_1}{k_2}\right)^{1/2}$

D. $\left(\frac{k_2}{k_1}\right)^{1/2}$

Answer: D

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5. The force constant of a wire is k and that of another wire is . 2k When both the wires are stretched through same distance, then the work done

A. $W_2 = 0.5 \quad W_1$

B. $W_2 = W_1$

C. $W_2 = 2W_1$

D. $W_2 = 2W_1^2$

Answer: C

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6. A mass is suspended from a spring having spring constant k is displaced veritcally and relased. It oscillates with period T the weight of the mass suspended is (g= gravitatioanal acceleration)

A. $\frac{KTg}{4\pi^2}$

B. $\frac{KT^2g}{4\pi^2}$

C. $\frac{KTg}{2\pi^2}$

D. $\frac{KT^2g}{2\pi^2}$

Answer: B

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7. The period of oscillation of a mass M, hanging from a spring of force constant k is T. When additional mass m is attached to the spring, the period of oscillation becomes 5T/4. m/M =

A. $9:16$

B. $25:16$

C. $25:9$

D. $16:9$

Answer: A

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8. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3s. When the mass m is increased by $1kg$, the time period of oscillations becomes 5s. The value of m in kg is

A. $\frac{9}{16}$

B. $\frac{3}{4}$

C. $\frac{4}{3}$

D. $\frac{16}{9}$

Answer: A

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9. Spring is pulled down by 2 cm. What is amplitude of its motion?

A. 0 cm

B. 6 cm

C. 2 cm

D. 4 cm

Answer: C

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10. A load of mass 100 gm increases the length of wire by 10 cm. If the system is kept in oscillation, its time period is $(g = 10m / s^2)$

A. 0.314 s

B. 3.14 s

C. 0.628 s

D. 6.28 s

Answer: C

11. when two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed the motion is

A. Not a simple harmonic

B. Simple harmonic with amplitude $\frac{a}{b}$

C. Simple harmonic with amplitude $\sqrt{a^2 + b^2}$

D. Simple harmonic with amplitude $\frac{(a+b)}{2}$

Answer: C

12. Which of the following equation does not represent a simple harmonic motion

A. $y = \sin \quad \mathrm{a} \quad \sin \omega t$

B. $y = \quad \mathrm{a} \quad \cos \omega t$

C. $y = a \sin \omega t + b \cos \omega t$

D. $y = a \quad \tan \quad \omega t$

Answer: D

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13. The displacement of a particle along the x-axis is given by $x = a\sin^2\omega t$. The motion of the particle corresponds to

A. simple harmonic motion of frequency $\omega / 2\pi$

B. simple harmonic motion of frequency ω / π

C. simple harmonic motion of frequency $3\omega / 2\pi$

D. non simple harmonic motion

Answer: D

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14. A particle is executing SHM of periodic time T the time taken by a particle in moving from mean position to half the maximum displacement is $(\sin 30^\circ = 0.5)$

A. $\frac{T}{2}$

B. $\frac{T}{4}$

C. $\frac{T}{8}$

D. $\frac{T}{12}$

Answer: D

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15. A particle is moving in a circle with uniform speed its motion is

A. periodic and simple harmonic

B. periodic but not simple harmonic

C. non-periodic

D. non of the above

Answer: B

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16. The periodic time of a body executing simple harmonic motion is 3 sec. After how much time from time $t = 0$, its displacement will be half of its amplitude

A. $\frac{1}{8}$s

B. $\frac{1}{6}$s

C. $\frac{1}{4}$s

D. $\frac{1}{3}$s

Answer: C

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17. A particle moves in x-y plane according to ru le

x $= a \sin \omega t$ and y=$a \cos \omega t$. The particles follows:

A. an elliptical path

B. a circular path

C. a parabolic path

D. a straight line path inclined equally to x and y-axis.

Answer: B

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18. The equation of SHM of a particle is $\frac{d^2y}{dt^2} + ky = 0$, where k is a positive constant. The time period of motion is

A. $\frac{2\pi}{k}$

B. $2\pi k$

C. $\frac{2\pi}{\sqrt{k}}$

D. $2\sqrt{\frac{\pi}{b}}$

Answer: C

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19. If the period of oscillation of mass M suspended from a spring is one second, then the period of 4M will be

A. 1 s

B. 2 s

C. 3s

D. 4 s

Answer: D

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20. The velocity of a particle performing simple harmonic motion, when it passes through its mean position i

A. infinity

B. zero

C. minimum

D. maximum

Answer: D

Watch Video Solution

21. In S.H.M. maximum acceleration is a

A. amplitude

B. equilibrium

C. acceleration is constant

D. none of these

Answer: A

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22. Which one of the following equations of motion represents simple harmonic motion ?

A. Acceleration=-$k_0 x + k_1 x_2$

B. Acceleration $= \; - k(x + a)$

C. Acceleration=k(x+a)

D. Acceleration=kx

Answer: B

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23. A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from the mean position are v_1 and v_2, respectively. Its time period is

A. $2\pi\sqrt{\frac{x_1^2+x_2^2}{v_1^2}+v_2^2}\Bigg)$

B. $2\pi\sqrt{\frac{x_2^2+x_1^2}{v_1^2}+v_2^2}\Bigg)$

C. $2\pi\sqrt{\frac{x_2^1+x_2^2}{v_2^1}+v_2^2}\Bigg)$

D. $2\pi\sqrt{\frac{x_2^1-x_2^2}{v_2^1}-v_2^2}\Bigg)$

Answer: B

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24. If the displacement (x) and velocity (v) of a particle executing simple harmonic motion are related through the expression $4v^2 = 25 - x^2$, then its time period is given by

A. π

B. 2π

C. 4π

D. 6π

Answer: C

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25. The velocity of a particle performing linear S.H.M. at mean position is v0. What will be its velocity at the mean position when its amplitude is doubled and time period reduced to l /3 ?

A. v_0

B. $2v_0$

C. $4v_0$

D. $6v_0$

Answer: D

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26. A particle starts performing simple harmonic motion. Its amplitude is A. At one time its speed is half that of the maximum speed. At this moment the displacement is

A. $\frac{\sqrt{3}}{2}a$

B. $\frac{\sqrt{2}}{3}a$

C. $\frac{2}{3}a$

D. $\frac{3}{2}a$

Answer: A

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27. A particle performs linear S.H.M. At a particular instant, velocity of the particle is 'u' and acceleration is ' $\propto$ ' while at another instant, velocity is 'v' and acceleration 'β' (0ltpropltbeta)`. The distance between the two position is

A. $\dfrac{u^2 - v^2}{\propto + \beta}$

B. $\dfrac{u^2 + v^2}{\propto + \beta}$

C. $\dfrac{u^2 - v^2}{\propto - \beta}$

D. $\dfrac{u^2 + v^2}{\propto - \beta}$

Answer: A

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28. A mass M attached to a horizontal spring executes SHM with an amplitude A_1. When mass M passes through its mean position a smaller mass m is placed over it and both of them move togther with amplitude A_2. Ratio of $\left(\frac{A_1}{A_2}\right)$ is:

A. $\left[\frac{m_1}{m_1+m_2}\right]^{\frac{1}{2}}$

B. $\left[\frac{m_1+m_2}{m_1}\right]^{\frac{1}{2}}$

C. $\left[\frac{m_2}{m_1+m_2}\right]^{\frac{1}{2}}$

D. $\left[\frac{m_1+m_2}{m_2}\right]^{\frac{1}{2}}$

Answer: A

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29. The displacement of a particle performing simple harmonic motion is given by, $x = 8 \quad \sin \quad \omega t + 6 \cos \quad \omega t$, where distance is in cm and time is in second. What is the amplitude of motion?

A. 10 cm

B. 14 cm

C. 8 cm

D. 6 cm

Answer: A

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30. If a simple pendulum oscillates with an amplitude of 50 mm and time period of 2 sec, then its maximum velocity is

A. 0.10 m/s

B. 0.16 m/s

C. 0.8 m/s

D. 0.26 m/s

Answer: B

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31. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be

A. $\dfrac{2\pi\beta}{\propto}$

B. $\dfrac{\beta^2}{\propto^2}$

C. `prop/beta

D. $\frac{\beta^2}{\propto}$

Answer: A

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32. A particle is executing sin1ple harmonic motion with an amplitude of 2 m. The difference in the magnitude of its maximum acceleration and maximum velocity is 4. The time period of its oscillation and its velocity when it is l m away from the mean position are respectively

A. $2s, 2\sqrt{3}ms^{-1}$

B. $\frac{7}{22}s, 4\sqrt{3} \quad ms^{-1}$

C. $\frac{22}{7}s, 2\sqrt{3}ms^{-1}$

D. $\frac{44}{7}s, 4\sqrt{3}ms^{-1}$

Answer: C

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33. The velocity of a particle executing a simple hannonic motion is 13ms^{-1}. when its distance from the equi librium positfon (Q) is 3 m and its velociry is $12 ms^{-1}$. when it is 5 m away from Q.

The frequency of the simple hannonic motion is

A. $\frac{5\pi}{8}$

B. $\frac{5}{8\pi}$

C. $\frac{8\pi}{5}$

D. $\frac{8}{5\pi}$

Answer: B

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34. A particle executes simple harmonic motion of amplitude A. (i) At what distance from the mean positio is its kinetic energy equal to its potential energy? (ii) At what points is its speed half the maximum speed?

A. 0.51 A

B. 0.61 A

C. 0.71 A

D. 0.81 A

Answer: C

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35. A partilce is executive simple harmonic motion given by

$$x = 5\sin\left(4t - \frac{\pi}{6}\right)$$

The velocity of the particle when its displacement is 3 units is

A. $\dfrac{2\pi}{3}$

B. $\dfrac{5\pi\square}{6}$

C. 20

D. 16

Answer: D

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36. The equation of displacement of particle performing S.H.M. is x = 0.25 sin (200 t). The maximum velocity is

A. 100 m/s

B. 200 m/s

C. 50 m/s

D. 150 m/s

Answer: C

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37. The acceleration of a particle performing a linear S.H.M. is $16cm/s^2$, when it is at a dis"tan"ce of 4 cm from the mean position. The period of S.H.M. is

A. 1 s

B. 2.572 s

C. 3.142 s

D. 6.028 s

Answer: C

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38. A pendulum is hung the roof of a sufficiently high huilding and is moving freely to and fro like a simple harmonic oscillator .The acceleration of the bob of the pendulum is $20m / s^2$ at a distance of $5m$ from the meanposition .The time period of oscillation is

A. 2π s

B. π s

C. 2 s

D. 1 s

Answer: B

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39. A particle executing simple harmonic motion has an amplitude of 6 cm . Its acceleration at a distance of 2 cm from the mean position is $8c\frac{m}{s^2}$ The maximum speed of the particle is

A. 8 cm/s

B. 12 cm/s

C. 16 cm/s

D. 24 cm/s

Answer: B

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40. The maximum velocity and the maximum acceleration of a body moving in a simple harmonic oscillator are 2 m/s and$4m/s^2$. Then angular velocity will be

A. 3 rad/s

B. 0.5 rad/s

C. 1 rad/s

D. 2 rad/s

Answer: D

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41. A particle executing SHM has a maximum speed of $0.5ms^{-1}$ and maximum acceleration of $1.0ms^{-2}$. The angular frequency of oscillation is

A. $2 \quad rad \quad s^{-1}$

B. $0.5 \ \text{rad} \ s^{-1}$

C. $2\pi \quad rad \quad s^{-1}$

D. $0.5\pi \quad rad \quad s^{-1}$

Answer: A

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42. The maximum velocity of a particle in S.H.M. is 0.16 mis and maximum acceleration is 0.64 m/s^2. The amplitude is

A. 4×10^{-2} m

B. 4×10^{-1} m

C. 4×10 m

D. 4×10^{0} m

Answer: A

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43. A particle executes simple harmonic motion with an angular velocity and maximum acceleration of $3.5 rad / \sec$ and $7.5 m / s^2$ respectively. The amplitude of oscillation

A. 0.28m

B. 0.36m

C. 0.53m

D. 0.61m

Answer: D

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44. A particle executes simple harmonic motion with an amplitude of 4 cm . At the mean position the velocity of the particle is 10 cm/ s . The distance of the particle from the mean position when its speed becomes 5 cm/s is

A. $\sqrt{3}$ cm

B. $\sqrt{5}$ cm

C. $2(\sqrt{3})$ cm

D. $2(\sqrt{5})$ cm

Answer: C

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45. A particle performing SHM starts equilibrium position and its time period is 16 seconds. After 2 seconds its velocity is $\pi m/s$. Amplitude of oscillation is

$$\left(\cos 45^\circ = \frac{1}{\sqrt{2}}\right)$$

A. $2\sqrt{2}$m

B. $4\sqrt{2}$m

C. $6\sqrt{2}$m

D. $8\sqrt{2}$m

Answer: D

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46. A particle executes linear simple harmonic motion with an amplitude of 2 cm . When the particle is at 1 cm from the mean position the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is

A. $\dfrac{1}{2\pi\sqrt{3}}$

B. $2\pi\sqrt{3}$

C. $\dfrac{2\pi}{\sqrt{3}}$

D. $\frac{\sqrt{3}}{2\pi}$

Answer: C

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47. A particle executes linear simple harmonic motion with an amplitude of $3cm$. When the particle is at $2cm$ from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then, its time period in seconds is

A. $\frac{\sqrt{5}}{\pi}$

B. $\frac{\sqrt{5}}{2\pi}$

C. $\frac{4\pi}{\sqrt{5}}$

D. $\frac{2\pi}{\sqrt{3}}$

Answer: C

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48. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time :

A. for an amplitude of g / ω^2

B. for an amplitude of g^2 / ω^2

C. at the highest position of the problem

D. at the mean position of the platform

Answer: A

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49. Out of the following functions representing motion of a particle which represents SHM

I. $y = \sin \omega t - \cos \omega t$

II. $y = \sin^3 \omega t$

III. $y = 5\cos\left(\frac{3\pi}{4} - 3\omega t\right)$

IV. $y = 1 + \omega t + \omega^2 t^2$

A. only (1) and (2)

B. only (1)

C. only (4) does not represent S.H.M

D. only (1) and (3)

Answer: D

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50. A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude a ans time period T. The speed of the pendulum at $x = \frac{a}{2}$ will be

A. $\frac{\pi A\sqrt{3}}{T}$

B. $\frac{\pi A}{T}$

C. $\frac{\pi A\sqrt{3}}{2T}$

D. $\frac{3\pi^2 A}{T}$

Answer: A

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51. A particle performs simple harmonic mition with amplitude A. Its speed is trebled at the instant that it is at a destance $\frac{2A}{3}$ from equilibrium position. The new amplitude of the motion is:

A. 3A

B. $A\sqrt{3}$

C. $\frac{7A}{3}$

D. $\frac{A}{3}\sqrt{41}$

Answer: C

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52. A body is executing simple harmonic motion with an angular frequency s rad/2 . The velocity of the body at 20 mm displacement, when the amplitude of motion is 60 mm , is

A. 40 mm/s

B. 60 mm/s

C. 113 mm/s

D. 120 mm/s

Answer: C

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53. If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T, then, which of the following does not change with time?

A. $a^2T^2 + 4\pi^2v^2$

B. aT / x

C. $aT + 2\pi v$

D. aT / v

Answer: B

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54. The amplitude of a particle executing S.H.M. with frequency of 60 Hz is 0.01 m. The maximum value of the acceleration of the particle is

A. $144\pi^2 m/s^2$

B. $144 m/s^2$

C. $\frac{144}{\pi^2} m/s^2$

D. $288\pi^2 m/s^2$

Answer: A

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55. Two simple harmonic motion of angular frequency 100 and $1000 rads^{-1}$ have the same displacement amplitude The ratio of their maximum acceleration is

A. $1:10^3$

B. $1:10^4$

C. $1:10$

D. $1:10^2$

Answer: D

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56. In a S.H.M., the path length is 4 cm and the maximum acceleration is $2\pi^2 cm / s^2$. The periodic time of S.H.M. is

A. 2s

B. $\sqrt{2}s$

C. 4s

D. 1/2s

Answer: A

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57. A particle performing SHM has time period $\frac{2\pi}{\sqrt{3}}$ and path lenght 4 cm. The displacement from mean position at which acceleration is equal to velocity is

A. 0.5 cm

B. 1 cm

C. 1.5 cm

D. 2 cm

Answer: B

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58. When a particle performing uniform circular motion of radius 10 cm undergoes the SHM, what will be its amplitude?

A. 10 cm

B. 5 cm

C. 2.5 cm

D. 20 cm

Answer: A

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59. Time period of pendulum is 6.28 s and amplitude of oscillation is 3 cm. Maximum acceleration of pendulum is

A. $8cm/s^2$

B. $0.3cm/s^2$

C. $3cm / s^2$

D. $58.2cm / s^2$

Answer: C

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60. A body starting from mean position is executing simple harmonic motion. Its time . period is 24 s. After 4 s, its velocity is $\pi \quad m / s$ then its path length is

A. 24 m

B. 48 m

C. 52 m

D. 12 m

Answer: B

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61. A particle performing SHM starting extreme position. Graphical repersentation shows that, between displacement and acceleration , there is a phase difference of

A. 0 rad

B. $\frac{\pi}{4}$ rad

C. $\frac{\pi}{2}$ rad

D. π rad

Answer: D

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62. Two points are located at a distance of $10m$ and $15m$ from the source of oscillation. The period of oscillation is 0.05s and the velocity of the wave is $300m / s$. What is the phase difference between the oscillation of two points?

A. π

B. $\frac{\pi}{6}$

C. $\frac{\pi}{3}$

D. $\frac{2\pi}{3}$

Answer: D

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63. The vanat10n of acceleration (a) and displacement (x) of the particle executing S.H.M. is indicated by which of the following curves?

A.

B.

C.

D.

Answer: A

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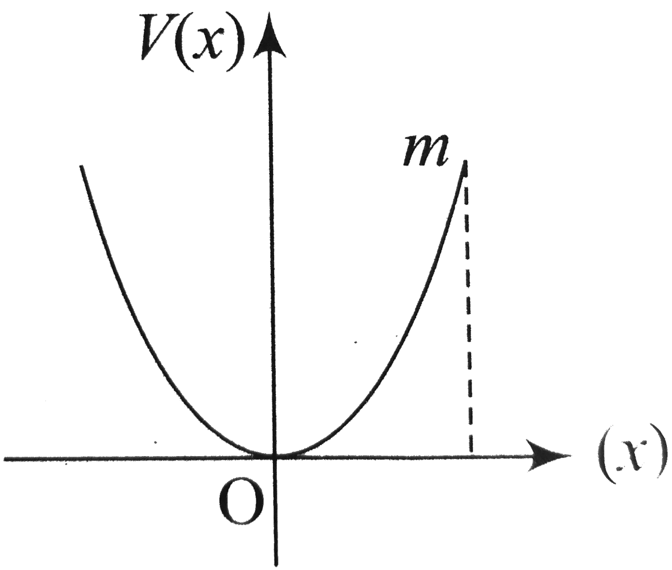
64. A particle of mass m is released from rest and follow a particle part as shown Assuming that the displacement of the mass from the origin is small which graph correctly depicts the position of the particle as a function of time?



A.

B.

C.

D.

Answer: B

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65. The total energy of a particle executing S.H.M. is proportional to

A. displacement from equilibrium position

B. frequency of oscillation

C. velocity in equilibrium position

D. square of amplitude of motion

Answer: D

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66. The total energy of a particle executing simple harmonic motion is $(x - \text{displacement})$

A. $\propto x$

B. $\propto x^2$

C. independent of x

D. $\propto x^{1/2}$

Answer: C

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67. In S.H.M. which one of the following graphs is a straight line ?

A. T.E. against displacement

B. P.E against displacement

C. Acceleration against time

D. Velocity against displacement

Answer: A

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68. The P.E. of a particle executing SHM at a distance x from its equilibrium position is

A. $\frac{1}{2}m\omega^2x^2$

B. $\frac{1}{2}m\omega^2A^2$

C. $\frac{1}{2}m\omega^2(A^2 - x^2)$

D. zero

Answer: A

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69. In a simple harmonic oscillator, at the mean position

A. kinetic energy is minimum, potential energy is maximum

B. both kinetic and potential energies are maximum

C. kinetic energy is maximum, potential energy is minimum.

D. both kinetic and potential energies are minimum

Answer: C

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70. When a particle executing a linear S.H.M. moves from its extreme position to the mean position, its

A. kinetic energy increases, potential energy decreases.

B. kinetic energy decreases, potential energy increases

C. both kinetic and potential energy remain constant

D. potential energy becomes zero and kinetic energy remains constant

Answer: A

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71. A particle is executing simple harmonic motion with a time period T. At time $t = 0,$ it is at its position of equilibium. The kinetice energy -time graph of the particle will look like

A.

B.

C.

D.

Answer: B

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72. A particle of mass m executing S.H.M. about its mean position. The total energy of the particle at given instant is

A. $\dfrac{\pi^2 mA^2}{T^2}$

B. $\dfrac{2\pi^2 mA^2}{T^2}$

C. $\dfrac{4\pi^2 mA^2}{T^2}$

D. $\dfrac{8\pi mA^2}{T^2}$

Answer: B

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73. W denotes to the total energy of a particle in linear S.H.M. At a point, equidistant from the mean position and extremity of the path of the particle

A. K.E. of the particle will be $\frac{W}{2}$ and P.E will also be $\frac{W}{2}$.

B. K.E. of the particle will be $\frac{W}{4}$ and P.E will also be $\frac{3W}{4}$.

C. K.E. of the particle will be $\frac{3W}{4}$ and P.E will also be $\frac{W}{4}$.

D. K.E. of the particle will be $\frac{W}{8}$ and P.E will also be $\frac{7W}{8}$.

Answer: C

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74. A simple pendulum is oscillating with amplitude 'A' and angular frequency 'ω' . At displacement 'x' from mean position, the ratio of kinetic energy to potential energy is

A. $\frac{x^2}{A^2 - x^2}$

B. $\frac{x^2 - A^2}{x^2}$

C. $\frac{A2 - x^2}{x^2}$

D. $\frac{A - x}{x}$

Answer: C

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75. The ration of kinetic energy to the potential energy of a particle executing SHM at a distance equal to half its amplitude , the distance being measured from its equilibrium position is

A. $2:1$

B. $3:1$

C. $8:1$

D. $4:1$

Answer: B

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76. If a spring extends by x on loading, then then energy stored by the spring is (if T is tension in the spring and k is spring constant)

A. $\frac{T^2}{2x}$

B. $\frac{T^2}{2k}$

C. $\frac{2k}{T^3}$

D. $\frac{2T^2}{k}$

Answer: B

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77. A particle executes simple harmonic motion with a frequency v. The frequency with which the kinetic energy oscillates is

A. f/2

B. f

C. 2f

D. 4f

Answer: C

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78. The total energy of the body excuting $S.H.M.$ is E. Then the kinetic energy when the displacement is half of the amplitude, is

A. $\frac{T.E}{2}$

B. $\frac{T.E}{4}$

C. $\frac{3T.E}{4}$

D. $\frac{\sqrt{3}}{4}T.E$

Answer: C

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79. Ratio of kinetic energy at mean position to potential energy at A/2 of a particle performing SHM

A. $1:4$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: D

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80. A linear harmonic oscillator of force constant $2 \times 10^6 N/m$ and amplitude 0.01 m has a total mechanical energy of 160 Joules. Its

A. maximum potential energy is 100 J

B. maximum K.E is 100 J

C. maximum P.E is 160 J

D. both B and C

Answer: D

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81. When the potential energy of a particle executing simple harmonic motion is one-fourth of its maximum value during the oscillation, the displacement of the particle from the equilibrium position in terms of its amplitude a is

A. $\frac{A}{4}$

B. $\frac{A}{3}$

C. $\frac{A}{2}$

D. $\frac{2A}{3}$

Answer: C

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82. Total energy of a particle performing S H M is 25 J. when particle is passing through the mean position, its velocity is (Given mass of the particle is 0.5 kg)

A. 5 m/s

B. 20 m/s

C. 10 m/s

D. 25 m/s

Answer: C

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83. If the KE of a particle performing a SHM of amplitude A is $\frac{3}{4}$ of its total energy, then the value of its displacement is

A. $x = + = \frac{a}{2}$

B. $x = + = \frac{a}{4}$

C. $x = + = \frac{\sqrt{3}a}{2}$

D. $x = + = \frac{a}{\sqrt{2}}$

Answer: A

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84. A particle of mass 4 kg is executing S.H.M. Its displacement is given by the equation Y=8 $\cos[100t + \pi / 4]$ cm. Its maximum kinetic energy is

A. 128 J

B. 64 J

C. 16 J

D. 32 J

Answer: A

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85. An elastic spring of unstretched length L and spring constant K is stretched by a small length x. It is further stretched by another small length y. the work done in second stretcing is

A. $\frac{ky}{2}(x+2y)$

B. $\frac{k}{2}(2x+y)$

C. $ky(x+2y)$

D. $\frac{ky}{2}(2x+y)$

Answer: D

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86. Work done for a certain spring when stretched through 1 mm is 10 joule. The amount of work that must be done on the spring to stretch it further by 1 mm is

A. 30 J

B. 40 J

C. 10 J

D. 20 J

Answer: A

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87. Two simple harmonic are represented by the equation

$$y_1 = 0.1 \sin\left(100\pi + \frac{\pi}{3}\right) \text{ and } y_2 = 0.1 \cos \pi t.$$

The phase difference of the velocity of particle 1 with respect to the velocity of particle 2 is.

A. $\frac{-\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{-\pi}{6}$

D. $\frac{\pi}{3}$

Answer: C

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88. The S.H.M. of a particle is given by the equation $y = 3\sin\omega t + 4\cos\omega t$. The amplitude is

A. 7

B. 1

C. 5

D. 12

Answer: C

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89. The resultant of two rectangular simple harmonic motion of the same frequency and unequal amplitude but differing in phase by $\pi/2$ is

A. simple harmonic motion of frequency $\omega/2\pi$

B. circular

C. elliptical

D. parabolic

Answer: C

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90. Two mutually perpendicular simple harmonic vibrations have same amplitude, frequency and phase. When they superimpose, the resultant form of vibration will be

A. a circle

B. an ellipse

C. a straight line

D. a parabola

Answer: C

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91. The length of a pendulum is halved. Its energy will be

A. decrease to half

B. increased to 2 times

C. decreased to one fourth

D. increased to 4 times

Answer: B

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92. The period of oscillation of a simple pendulum of constant length at earth surface is T. Its period inside a mine is C

A. greater then T.

B. less than T.

C. equal to T.

D. cannot be compared

Answer: A

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93. A simple pendulum of length I and mass (bob) m is suspended vertically. The string makes an angle θ with the vertical. The restoring force acting on the pendulum is

A. $mg \quad \sin\theta$

B. $mg \quad \cos\theta$

C. $-mg \quad \sin\theta$

D. $-mg \quad \cos\theta$

Answer: C

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94. A simple pendulum of length l has a maximum angular displacement θ. The maximum kinetic energy of the bob of mass m will be

A. $mgl(1+\cos\theta)$

B. $mgl(1+\cos^2\theta)$

C. $mgl(1-\cos\theta)$

D. $mgl(\cos\theta-1)$

Answer: C

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95. A simple pendulum of length 'L' has mass 'M' and it oscillates freely with amplitude energy is (g = acceleration due to gravity)

A. `(MgA^2)/(2L)

B. $\frac{MgA}{2L}$

C. $\frac{MgA^2}{L}$

D. $\frac{2MgA^2}{L}$

Answer: A

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96. Starting from the extreme position, the time taken by an ideal simple pendulum to travel a distance of half the amplitude is

A. T/6

B. T/12

C. T/3

D. T/4

Answer: A

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97. A man measures time period of a pendulum (T) in stationary lift. If the lift moves upward with acceleration $\frac{g}{4}$, then new time period will be

A. $\frac{2T}{\sqrt{5}}$

B. $\frac{\sqrt{5}T}{2}$

C. $\frac{\sqrt{5}}{2T}$

D. $\frac{2}{\sqrt{5}T}$

Answer: A

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98. A simple pendulum is suspended from the ceilling of a left. When the lift is at rest, its time period is T. With what accleration should lift be acclerated upwards in order to reduce its time period to $\frac{T}{2}$.

A. 4g

B. g

C. 2g

D. 3g

Answer: D

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99. A pendulum has time period T . If it is taken on to another planet having acceleration due to gravity half and mass 9 times that of the earth then its time period on the other planet will be

A. $\sqrt{T}$

B. T

C. $T^{1/3}$

D. $\sqrt{2}T$

Answer: D

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100. Time period of a pendulum on earth surface is T_1. It is arranged on earth surface at a height R and thus its time period is T_2. What is the ratio of T_1 and T_2?

A. 0.8

B. 0.5

C. 1

D. 0.2

Answer: B

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101. If length of a simple pendulum is increased by 44%, then what is the gain in the time period of pendulum?

A. 0.4

B. 0.2

C. 0.1

D. 0.21

Answer: B

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102. In a seconds pendulum, mass of bob is 30 gm . If it is replaced by 90 gm mass. Then its time period will

A. 1s

B. 2s

C. 4s

D. 3s

Answer: B

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103. A heavy brass sphere is hung froma weightless inelastic string and used as a simple pendulum. Its time period of osciallation is T. When the shere is immersed in a non-viscous liquid of density $\frac{1}{10}$ that of brass. If acts as a simple perpendicular of period.

A. $\sqrt{\frac{10}{9}}\mathrm{T}$

B. $\frac{10}{9}\mathrm{T}$

C. T

D. $\left(\frac{9}{10}\right)^{2}T$

Answer: A

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104. The bob of a simple pendulum performs SHM with period T in air and with period T_1 in water. Relation between T and T_1 is (neglect friction due to water, density of the material of the bob is = $\frac{9}{8}\times 10^3\frac{kg}{m^3}$, density of water = $10^3\frac{kg}{m^3}$)

A. $T_1 = 3T$

B. $T_1 = 2T$

C. $T_1 = T$

D. $T_1 = \frac{T}{2}$

Answer: A

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105. Two simple pendulums of length 0.5 m and 20 m, respectively are given small linear displacement in one direction at the same time. They will again be in the phase when the pendulum of shorter length has completed oscillations.

A. 5

B. 1

C. 2

D. 3

Answer: C

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106. The acceleration due to gravity at a place is $\pi^2 m / s^2$. Then, the time period of a simple pendulum of length 1 m is

A. $2 / \pi$ s

B. 2π s

C. 2s

D. π s

Answer: C

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107. A simple pendulum of length 1 m is freely suspended from the ceiling of an elevator. The time period of small oscillations as the elevator moves up with an acceleration of $2m/s^2$ is (use g=10m/s^2)

A. $\dfrac{\pi}{\sqrt{5}}$ s

B. $\sqrt{\dfrac{2}{5}}\pi s$

C. $\dfrac{\pi}{\sqrt{2}}$ s

D. $\dfrac{\pi}{\sqrt{3}}$ s

Answer: D

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108. Two simple pendulums A and B are made to oscillate simultaneously and it is found that A completes 10 oscillations in 20 sec and B completes 8 oscillations in 10 sec. The ratio of the lengths of A and B is

A. $\frac{25}{64}$

B. $\frac{64}{25}$

C. $\frac{8}{5}$

D. $\frac{5}{4}$

Answer: B

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109. When the length of a simple pendulum is decreased by 600 mm, the period of oscillation is halved. The original length of the pendulum was

A. 800 mm

B. 1000 mm

C. 1200 mm

D. 240 mm

Answer: A

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110. When the length of a simple pendulum is increased by 36 cm, its time period of oscillation is found to increase by 25 %. The initial length of the simple pendulum 1s (Acceleration due to gravity= $9.8ms^{-2}$)

A. 36 cm

B. 25 cm

C. 64 cm

D. 46 cm

Answer: C

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111. Which of the following quantity does not change due to damping of oscillations?

A. Angular frequency

B. Time period

C. initial phase

D. Amplitude

Answer: C

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112. A particle oscillating under a force $\vec{F} = -k\vec{x} - b\vec{v}$ is a (k and b are constants)

A. simple harmonic oscillator

B. non linear oscillator

C. damped oscillator

D. forced oscillator

Answer: C

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113. The disperod of a particle varies according to the relation $x = 4(\cos \pi t + \sin \pi t)$. The amplitude of the particle is.

A. 8

B. -4

C. 4

D. $4\sqrt{2}$

Answer: D

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114. For a particle performing linear SHM, its average speed over one oscillation is (where, a= amplitude of SHM, n=frequency of oscillation)

A. 2 an

B. 4 an

C. 6 an

D. 8 an

Answer: B

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115. A large horizontal surface moves up and down in SHM with an amplitude of 1 cm . If a mass of 10 kg (which is placed on the surface) is to remain continually in contact with it, the maximum frequency of S.H.M. will be

A. 0.5 Hz

B. 1.5 Hz

C. 5 Hz

D. 10 Hz

Answer: C

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116. The vertical extension in a light spring by a weight of 1 kg suspended from the wire is 9.8 cm . The period of oscillation

A. $20\pi s$

B. $2\pi s$

C. $2\pi / 10s$

D. $200\pi s$

Answer: C

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117. A weightless spring of length 60 cm and force constant 200 N/m is kept straight and unstretched on a smooth horizontal table and its ends are rigidly fixed. A mass of 0.25 kg is attached at the middle of the spring and is slightly displaced along the length. The time period of the oscillation of the mass is

A. $\frac{\pi}{20}$ s

B. $\frac{\pi}{10}$ s

C. $\frac{\pi}{5}$ s

D. $\dfrac{\pi}{\sqrt{200}}$ s

Answer: A

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118. Two particles are executing simple harmonic of the same amplitude (A) and frequency ω along the x-axis . Their mean position is separated by distance `X_(0)(X_(0)gtA). If the maximum separation between them is (X_(0)+A), the phase difference between their motion is:

A. $\dfrac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{6}$

Answer: B

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119. A particle executes SHM with amplitude of 20 cm and time period of 12 s. What is the minimum time required for it to move between two points 10 cm on either side of the mean position?

A. 0.6s

B. 0.5s

C. 0.4s

D. 0.2s

Answer: B

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120. The path length of oscillation of simple pendulum of length 1 m is 16 cm. Its maximum velocity is (take, $g = \pi^2 m / s^2$)

A. $2\pi cm / s$

B. $4\pi cm / s$

C. $8\pi cm / s$

D. $16\pi cm / s$

Answer: C

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121. A mass is suspended from a vertica spring which is executing SHM of frequency 5 Hz.

The spring is unstretched at the highest point of oscillation. Maximum speed of the mass is (take, acceleration due to gravity, $g = 10m/s^2$)

A. $2\pi m/s$

B. $\pi m/s$

C. $\frac{1}{2\pi}m/s$

D. $\frac{1}{\pi}m/s$

Answer: D

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122. A simple pendulum attached to the ceiling of a stationary lift has a time period T. The distance y covered by the lift moving upwards varies with time t as $y = t^2$ where y is in metres and t in seconds. If $g = 10 m/s^2$, the time period of pendulum will be

A. $\sqrt{\frac{4}{5}} T$

B. $\sqrt{\frac{5}{6}} T$

C. $\sqrt{\frac{5}{4}} T$

D. $\sqrt{\frac{6}{5}} T$

Answer: B

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123. When the kinetic energy of a body executing S.H.M. is 1/3 of the potential energy, the displacement of the body is x percent of the amplitude, where x is

A. 33

B. 87

C. 67

D. 50

Answer: B

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124. Starting from the origin a body osillates simple harmonicall with a period of 2 s. A fter what time will its kinetic energy be 75% of the total energy?

A. $\frac{1}{4}$ s

B. $\frac{1}{3}$ s

C. $\frac{1}{12}$ s

D. $\frac{1}{6}$ s

Answer: D

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125. A particle of mass 0.2 kg moves with simple harmonic motion of amplitude 2 cm. If th~ total energy of the particle is 4×10^{-5} J, then the time period of the motion is

A. 2π seconds

B. $\frac{3\pi}{2}$ seconds

C. π seconds

D. $\frac{\pi}{2}$ seconds

Answer: A

Watch Video Solution

126. A point performs simple harmonic oscillation of period T and the equation of motion is given by $x = a\sin\left(\omega t + \frac{\pi}{6}\right)$. After the elapse of what fraction of the time period, the velocity of the point will be equal to half of its maximum velocity ?

A. $\frac{T}{3}$

B. $\frac{T}{12}$

C. $\frac{T}{8}$

D. $\frac{T}{6}$

Answer: B

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127. In case of a simple harmonic motion, if the velocity is plotted along the X-axis and the displacement (from the equilibrium position) is plotted along the Y-axis, the resultant curve happens to be an ellipse with ratio:

$$\frac{\text{major axis(along X)}}{\text{major axis (along Y)}} = 20\pi$$

What is the frequency of the simple harmonic motion ?

A. 100 Hz

B. 20 Hz

C. 10 Hz

D. $\frac{1}{10}$ Hz

Answer: C

View Text Solution

128. A spring has a certain mass suspended from it and its period for vertical oscillation is T. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is now

A. $\frac{T}{2}$

B. $\frac{T}{\sqrt{2}}$

C. $\sqrt{2}T$

D. 2T

Answer: B

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129. A spring of force constant k is cut into lengths of ratio $1:2:3$. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k'. Then k' : k" is :

A. $1:16$

B. $1:9$

C. $1:11$

D. $1:14$

Answer: C

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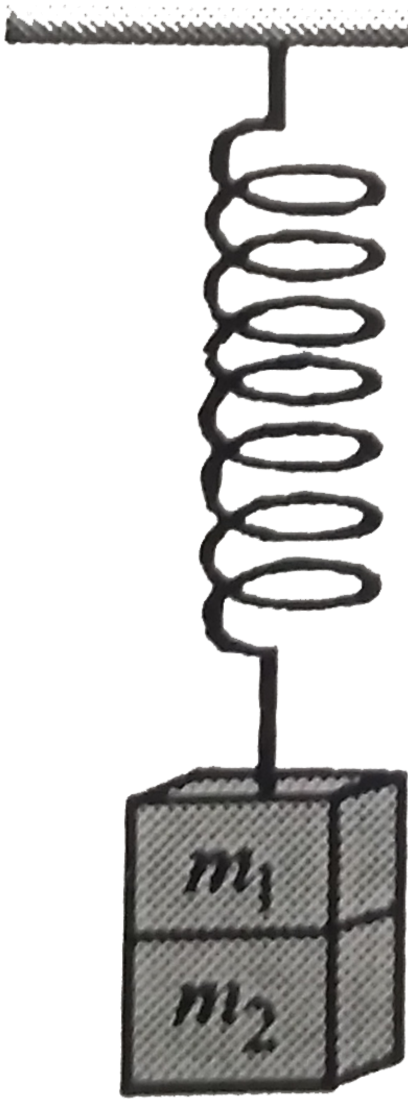
130. Two masses m1 and m2 are suspended together by a massless spring of constant k. When the masses are in equilibrium, m1 is removed without disturbing the system. The amplitude of oscillations is



A. $\frac{m_1 g}{k}$

B. $\frac{m_2 g}{k}$

C. $\frac{(m_1 + m_2)g}{k}$

D. $\frac{(m_1 - m_2)g}{k}$

Answer: A

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131. A point mass is subjected to two simultaneous sinusoidal displacement in $x-$ direction, $x_1(t) = A \sin \omega t$ and

$x_2(t) = A\sin\left(\omega + \frac{2\pi}{3}\right)$. Adding a third sinusoidal displacement $x_3(t) = B\sin(\omega t + \phi)$ brings the mass to complete rest. The value of B and ϕ are

A. $\sqrt{2}A, \frac{3\pi}{4}$

B. $A, \frac{4\pi}{3}$

C. $\sqrt{3}A, \frac{5\pi}{6}$

D. $A, \frac{\pi}{3}$

Answer: B

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132. A silver atom in a solid oscillates in simple harmonic motion in some direction with a frequency of $10^{12}\,/\mathrm{sec}$. What is the force constant of the bonds connecting one atom with the other? (Mole wt. of silver = 108 and Avagadro number `=6.02xx10^(23)" gm "mole^(-1))

A. 2.2 N/m

B. 5.5 N/m

C. 6.4 N/m

D. 7.1 N/m

Answer: D

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133. A solid cylinder of mass $3kg$ is rolling on a horizontal surface with velocity $4ms^{-1}$. It collides with a horizontal spring of force constant $200Nm^{-1}$. The maximum compression produced in the spring will be :

A. 0.5 m

B. 0.6 m

C. 0.7 m

D. 0.2 m

Answer: B

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134. A solid sphere of mass 2 kg is rolling on a frictionless horizontal surface with velocity $6m/s$. It collides on the free and of an ideal spring whose other end is fixed. The maximum compression produced in the spring will be

(Force constant of the spring = 36 N/m)

A. $\sqrt{14}$ m

B. $\sqrt{2.8}$ m

C. $\sqrt{1.4}$ m

D. $\sqrt{0.7}$ m

Answer: B

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

A.

B.

C.

D.

Answer: B

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Evaluation Test

1. A cylinder of mass M, radius R is kept on a rough horizontal plane at one extreme end of the platfonn at t = 0. Axis of the cylinder is parallel to z-axis. The platform is oscillating in the xy-plane and its displacement from origin is represented by x = 4 $\cos(2\pi t)$ metres. There is no slipping between the cylinder and the platfonn. Find the acceleration of the centre of mass of cylinder at t $=\frac{1}{6}$s

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A. $\frac{-5}{3}\pi^2$

B. $\frac{-2}{3}\pi^2$

C. $\frac{-8}{3}\pi^2$

D. $\frac{-4}{3}\pi^2$

Answer: C

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2. A particle is executing SHM in both x and y directions whose equations are as follows:

$x = \cos(\pi t)$ and $y = \cos\left(\frac{\pi t}{2}\right)$

What will be the net trajectory of the particle on the x-y plane?

A. circle

B. ellipse

C. parabola

D. hyperbola

Answer: C

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3. Two pendulum of time periods 3 s and 7 s respectively start oscillating simultaneously from two opposite extreme positions. After how much time they will be in same phase?

A. $\frac{12}{5}$ s

B. $\frac{21}{8}$ s

C. $\frac{5}{2}$ s

D. $\frac{27}{10}$ s

Answer: B

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4. A stone is swinging in a horizontal circle 1 m in diameter at 60 rev/min. A distant light causes a shadow of the stone to be formed on a nearly vertical wall. The amplitude and period of motion for the shadow of the stone are,

A. 0.5 m, 1s

B. 1m, 2s

C. 1m, 1s

D. 0.5m, 2s

Answer: A

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5. What will be the momentum v/s position plot of a spring mass oscillator kept on a rough horizontal surface? What should be the plot for one cycle?

A.

B.

C.

D.

Answer: B

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6. A pendulum suspended from the roof of a railway carriage travelling at a speed v mis round a curve of radius 'a' metres makes n oscillations per second. If the same pendulum makes n_1 oscillations per second when the carriage is stationary, what is the value of v_2?

A. $ag\sqrt{\frac{n^4}{n_1^4}-1}$

B. $ag\sqrt{n^4-n_1^4}$

C. $\frac{a}{g}\sqrt{1-\frac{n^4}{n_1^4}}$

D. $as\left(1-\frac{n^4}{n_1^4}\right)^2$

Answer: A

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7. A circle disc has a tiny hole in it, at a distance z from its center. Its mass is M and radius $E(R > z)$. A horizontal shaft is passed through the hole and held fixed so that the disc can freely swing in the vertical plane. For small distrubance, the disc performs SHM whose time period is minimum for $z =$

A. $\frac{R}{2}$

B. $\frac{R}{3}$

C. $\frac{R}{\sqrt{2}}$

D. $\frac{R}{\sqrt{3}}$

Answer: C

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8. If the length of a simple pendulum is equal to the radius of the earth, its time period will be

A. $2\pi\sqrt{\frac{L}{g}}$

B. $2\pi\sqrt{\dfrac{1}{g\left(\frac{1}{L}+\frac{1}{R}\right)}}$

C. $2\pi\sqrt{\dfrac{R}{g}}$

D. $2\pi\sqrt{\dfrac{L+R}{g}}$

Answer: B

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9. The potential energt of a particle of mass 0.1 kg, moving along the x-axis, is given by $U = 5x(x-4)J$, where x is in meter. It can be concluded that

A. the particle is acted upon by a constant force

B. the speed of the particle is maximum at x=2 m

C. the particle executes SHM

D. the period of oscillation of particle is $\frac{\pi}{5}$s

Answer: A

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10. If the superpositions of two SHM is given by $x_1 = A_1 \cos(\omega_1 t)$ and $x_2 = A_2 \cos(\omega_2 t + \delta_2)$ along X-axis, identify the wrong option

A. If $A_1 = A_2$ and $\delta_2 = \pi$, the particle is always at rest.

B. If $\delta_2 = 0$, $A_1 = A_2$ and $\omega_1 \neq \omega_2$, then the resultant motion is harmonic with frequency $\omega = \dfrac{\omega_1 + \omega_2}{2}$

C. If

$A_1 = A_2, \omega_1 \neq \omega_2, \delta_2 = 0$ and $A_1 = A_2,$

then the particle is at origin at time 't'

$$= \frac{3\pi}{\omega_1 + \omega_2}$$

D. If $A_1 = A_2, \omega_1 = \omega_2$ and $\delta_2 = 0$, then the amplitude of resultant S.H.M. is $2A_1$.

Answer: A

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11. A plank with a small block on top of it is under going vertical SHM. Its period is $2\,\text{sec.}$ The minium amplitude at which the block will separate from plank is :

A. $\frac{10}{\pi^2}$

B. $\frac{\pi^2}{10}$

C. $\frac{20}{\pi^2}$

D. $\frac{\pi}{10}$

Answer: A

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12. A ideal gas is kept in a cylinder of cross sectional area A and volume v_0. The mass of the gas enclosed is M and bulk modulus B. If the piston of the cylinder is pressed by small x, then find the time period of small oscillations,

A. $2\pi\sqrt{\dfrac{BA^2}{MV_0}}$

B. $2\pi\sqrt{\dfrac{BA}{MV_0^2}}$

C. $2\pi\sqrt{\dfrac{BA}{MV_0}}$

D. $2\pi\sqrt{\dfrac{B^2A}{MV_0}}$

Answer: A

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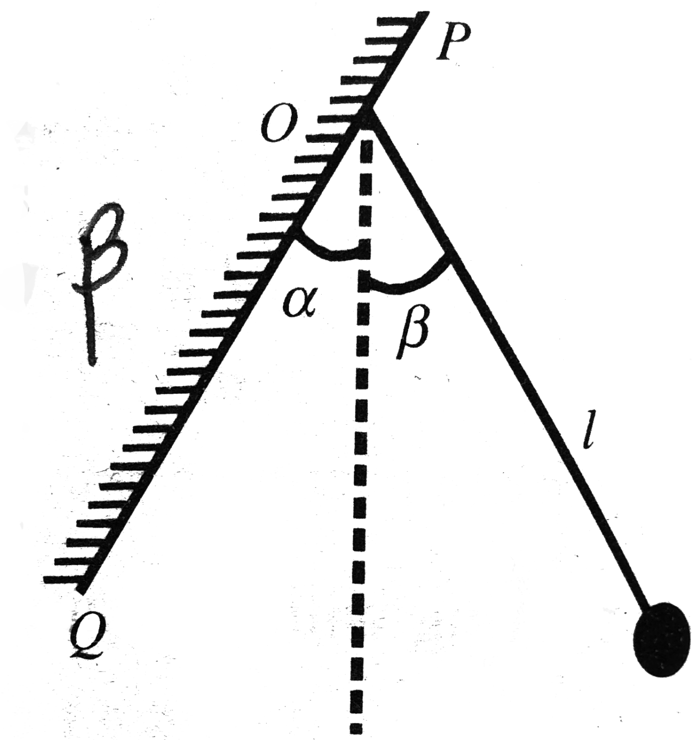
13. A ball is suspended by a thread of length l at the point O on an incline wall as shown. The inclination of the wall with the vertical is α.The thread is displaced through a small angle β away from the vertical and the ball is released. Find the period of oscillation of pendulum.



Consider both cases

a. $\alpha > \beta$

b. $\alpha < \beta$

Assuming that any impact between the wall and the ball is elastic.

A. $2\sqrt{\frac{g}{l}}\cos^{-1}\left(\frac{\propto}{\beta}\right)$

B. $\sqrt{\frac{g}{l}}\cos^{-1}\left(p \text{ or } \frac{p}{\beta}\right)$

C. $2\sqrt{\frac{g}{l}}\cos^{-1}\left(\frac{\beta}{\propto}\right)$

D. $\sqrt{\frac{g}{l}}\cos^{-1}\left(\frac{\beta}{\propto}\right)$

Answer: A

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14. In case of mechanical wave, a particle oscillates and during oscillation its kinetic and potential energy changes. So, when particle is passing through mean position,

A. kinetic energy is maximum

B. potential energy is minimum

C. both (A) and (B)

D. none of these

Answer: C

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