PHYSICS

BOOKS - SURA PHYSICS (TAMIL ENGLISH)

OSCILLATIONS

Exercise Questions I Multiple Choice Questions

1. In a simple harmonic oscillation, the acceleration against displacement for one

complete oscillation will be

A. an ellipse

B. a circle

C. a parabola

D. a straight line

Answer: D

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2. A particle executing SHM crosses points A and B with the same velocity . Having taken 3 s in passing from A to B , it returns to B after another 3 s . The time period is

A. 15 s

B. 6 s

C. 12 s

D. 9 s

Answer: C

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3. The length of a second's pendulum on the surface of the Earth is 0.9 m. The length of the same pendulum on surface of planet X such that the acceleration of the planet X is n time greater than the Earth is

A. 0.9n

B. $\frac{0.9}{n}m$

C. $0.9n^2m$

D. $\frac{0.9}{n^2}$

Answer: A

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4. A simple pendulum is suspended from the roof of a school bus which moves in a horizontal direction with an acceleration a , then the time

A. $T\alpha\frac{1}{g^2+a^2}$

B. $T\alpha\sqrt{\frac{1}{g^2+a^2}}$

C. $T\alpha\sqrt{g^2+a^2}$

D. $T\alpha\left(g^2+a^2\right)$

Answer: B

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5. Two bodies A and B whose masses are in the ratio 1 : 2 are suspended from two separate massless springs of force constants k_A and k_B respectively . If the two bodies oscillate vertically such that their maximum

velocities are in the ratio 1 :2 , the ratio of the amplitude A to that of B is

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

B. $\sqrt{\frac{k_B}{8k_A}}$

C. $\sqrt{\frac{2k_B}{k_A}}$

D. $\sqrt{\frac{8k_B}{k_A}}$

Answer: B

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6. A spring is connected to a mass m suspended from it and its time 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

A. $T' = \sqrt{2}T$

B. $T' = \frac{T}{\sqrt{2}}$

C. $T' = \sqrt{2T}$

D. $T' = \sqrt{\frac{T}{2}}$

Answer: B

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7. A simple pendulum has a time period T_1. when its point of suspension is moved vertically upwards according as $y = kt^2$ where y is vertical distance covered and $k = 1ms^{-2}$, its time period becomes T_2, Then, $\frac{T_1^2}{T_2^2}$ is $\left(g = 10ms^{-2}\right)$

A. $\frac{5}{6}$

B. $\frac{11}{10}$

C. $\frac{6}{5}$

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

Answer: C

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8. An ideal spring of spring constant k, is suspended from the ceiling of a room and a block of mass M is fastened to its lower end. If the block is released when the spring is un-

stretched , then the maximum extension in the spring is

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

B. $\frac{Mg}{k}$

C. $2\frac{Mg}{k}$

D. $\frac{Mg}{2k}$

Answer: C

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9. A pendulum is hung in a very high building oscillates to and fro motion freely like a simple harmonic oscillator . If the acceleration of the harmonic oscillator. It the acceleration of the bob is $16ms^{-2}$ at distance of 4 from the mean position , the the time period is

A. 2 s

B. 1 s

C. $2\pi s$

D. πs

Answer: D

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10. A hollow sphere is filled with water . It is hung by a long thread . As the water flows out of a hole at the bottom , the period of oscillation will

A. first increase and then decrease

B. first decrease and then increase

C. increase continuously

D. decrease continuously

Answer: A

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11. The damping force on an oscillator is directly proportional to the velocity . The units of the constant of proportionality are

A. $kgms^{-1}$

B. $kgms^{-2}$

C. kgs^{-1}

D. kgs

Answer: C

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

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

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

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

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

Answer: D

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13. Which of the following different equations represents a damped harmonic oscillator ?

A. $\frac{d^2y}{dt^2} + y = 0$

B. $\frac{d^2y}{dt^2} + \gamma\frac{dy}{dt} + y = 0$

C. $\frac{d^2y}{dt^2} + k^2y = 0$

D. $\frac{d^2y}{dt^2} + y = 0$

Answer: B

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14. If the inertial mass and gravitational mass of the simple pendulum of length 1 are not

equal, then the time period of the simple pendulum is

A. $T = 2\pi\sqrt{\frac{m_i l}{m_g g}}$

B. $T = 2\pi\sqrt{\frac{m_g l}{m_i g}}$

C. $T = 2\pi\frac{m_g}{m_i}\sqrt{\frac{l}{g}}$

D. $T = 2\pi\frac{m_i}{m_g}\sqrt{\frac{l}{g}}$

Answer: A

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Exercise Questions Ii Short Answer Questions

1. What is meant by periodic and non-periodic motion ? Give any two examples , for each motion ?

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2. What is meant by mean by force constant of a spring ?

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3. Define time period of simple harmonic motion.

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4. Define frequency of simple harmonic motion.

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5. what is an epoch ?

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6. Write short notes on two springs connected in series.

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7. Write short notes on two springs connected in parallel.

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8. Write down the time period of simple pendulum .

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9. State the laws of simple pendulum.

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10. Write down the equation of time period for linear harmonic oscillator.

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11. What is meant by free oscillation ?

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12. Explain damped oscillation . Give an example.

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13. Define forced oscillation . Give an example.

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14. What is meant by maintained oscillation ?

Given an example.

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15. Explain resonance. Give an example .

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Exercise Questions Iii Long Answer Questions

1. What is meant by simple harmonic oscillation ? Give example

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2. Describe Simple Harmonic Motion as a projection of uniform circular motion.

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3. What is meant by angular harmonic oscillations? Compute the time period of angular harmonic oscillation.

Time period and frequency of angular SHM:

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4. Write down the difference between simple harmonic motion and angular simple harmonic motion.

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5. Discuss the simple pendulum in detail.

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6. Explain the horizontal oscillations of a spring.

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7. Describe the vertical oscillations of a spring.

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8. Write shorts notes on the oscillations of liquid column in U-tube.

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9. Discuss in detail the energy in simple harmonic motion.

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10. Explain in detail the four different types of oscillations.

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Exercise Questions Iv Numerical Problems

1. Consider the Earth as a homogenous sphere of radius R and a straight hole is bored in it through its centre. Show that a particle dropped into the hole will execute a simple

harmonic motion such that its time period is

$$T = 2\pi\sqrt{\frac{R}{g}}$$

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2. Consider a simple pendulum of length l = 0.9 m which is properly placed on a trolley rolling down on a inclined plane which is at $0 = 45^{\circ}$ with the horizontal. Assuming that the inclined plane is frictionless. Assuming that the time period of oscillation of the simple pendulum is T. Find the value of T.

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3. A piece of wood of mass m is floating erect in a liquid whose density is ρ . If it is slightly pressed down and released, then executes simple harmonic motion. Show that its time period of oscillation is $T = 2\pi\sqrt{\frac{m}{A\rho g}}$

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4. Consider two simple harmonic motion along x and y- axis having same frequencies but different amplitudes as $x = A\sin(\omega t + \varphi)$ (along x axis) and $y = B\sin\omega t$(along y axis). then show that $\frac{x^2}{A^2} + \frac{y^2}{B^2} - \frac{2xy}{AB}\cos\varphi = \sin^2\varphi$ and also discuss the special cases when $\varphi = \frac{\pi}{2}$ and $A = B$

Note : when a particle is subjected to two simple harmonic motion at right angle to each other the particle may move along different paths.

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5. Show that for a particle executing simple harmonic motion

a. the average value of kinetic energy is equal to the average value of potential energy.

b. average potential energy = average kinetic energy $= \frac{1}{2}$ (total energy) (Hint : average kinetic energy = < kinetic energy >

$= \frac{1}{T}\int_0^T$ (Kinetic energy) dt and

average Potential energy =

$$= \frac{1}{T}\int_0^T \text{(potential energy) dt}$$

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6. Compute the time period for the following system if the block of mass m is slightly displaced vertically down from its equilibrium position and then released. Assume that the pulley is light and smooth strings and springs are light.

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Additional Questions I Multiple Choice Questions

1. A Particle excites simple harmonic motion between $x = -A \& x = +A$, the time taken for it to go from O to $\frac{A}{2}$ is T_1 & to go from $\frac{A}{2}$ to 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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2. The x - t graph of a particle undergoing simple harmonic motion is shown . The acceleration of the particle at $t = \frac{4}{3}$ is

A. $\frac{\sqrt{3}}{32}\pi cm/s^2$

B. $\frac{-\pi^2}{32}cm/s^2$

C. $\frac{\pi^2}{32} cm / s^2$

D. $\frac{\sqrt{3}}{32} cm / s^2$

Answer: D

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3. The function $x = A \sin^2 \omega t + B \cos^2 \omega t + C \sin \omega t \cos \omega t$ ore presents simple harmonic motion for which of the option ?

A. for all values of A , B & C $(C \neq 0)$

B. $A = B, C = 2B$

C. $CA = -B, C = 2B$

D. all of the above

Answer: D

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4. The displacement of an object attached to a spring & executing SAM is given by $x = 2 \times 10^{-2}$

A. 0.55μ

B. $0.75s$

C. $0.125s$

D. $0.25s$

Answer: A

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5. The maximum velocity of a particle , executing simple harmonic motion with an

amplitude $7mm$ is $4.4ms^{-1}$. The period of oscillation is

A. $0.01s$

B. $0.1s$

C. 10s

D. 100s

Answer: A

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6. If x, v & a denote the displacement , the velocity & 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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7. A particle executing simple harmonic motion along - y - axis has its motion described by the equation $y = A\sin(\omega t) + B$, the amplitude of the example harmonic motion is

A. A

B. B

C. $A + B$

D. $\sqrt{A + B}$

Answer: A

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8. when the maximum k.E of a simple pendulum is k, then what is its displacement in terms of amplitude a when its K.E. is $k/2$

A. $a/\sqrt{2}$

B. $a/2$

C. $a/\sqrt{3}$

D. $a/3$

Answer: A

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9. A particle is executing SHM at mid point of mean position & extremity . What is the potential energy in terms of total energy (E)

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

B. $\frac{E}{16}$

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

D. $\frac{E}{8}$

Answer: A

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10. A spring is cut into 4 equal parts & 2 parts are connected in parallel. What is the effective in parallel. What is the effective spring constant.

A. 4 K

B. 16k

C. 8k

D. 6k

Answer: C

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11. If the length of simple pendulum is tripled, what will its new time period is terms of original period T ?

A. 0.7 T

B. 1.73 T

C. $T/2$

D. T

Answer: B

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12. The ratio of frequences of 2 pendulums are $2:3$, then their lengths are in ratio,

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

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

C. $\frac{4}{9}$

D. $\frac{9}{4}$

Answer: D

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13. What is time period of a pendulum hanged in a satellite ? (T is time period on earth)

A. zero

B. T

C. infinite

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

Answer: C

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14. If a simple pendulum of length 'L' has maximum angular displacement alpha'. Then the maximum kinetic energy of bob mass m is

A. $\frac{1}{2}\frac{ML}{9}$

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

C. $\mathrm{mgL}(1-\cos\alpha)$

D. $\mathrm{MgL}\sin\alpha/2$

Answer: C

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15. Which of the following equations represents a simple harmonic wave ?

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

B. $\sin \square t + \sin 2 \square t$

C. $\sin \square t - \sin 2 \square t$

D. $\sin^2 \square t$

Answer: A

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16. The phase difference between the instantaneous velocity & acceleration of a particle executing simple harmonic motion is

A. 0.5π

B. π

C. 0.707π

D. 0.61π

Answer: A

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17. Which one of the following represents simple harmonic motion ?

A. acceleration = kx

B. acceleration $= k_0 x + k_1 x^2$

C. acceleration $= -k(x + a)$

D. acceleration $= k(x + a)$

Answer: C

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18. Two simple pendulums of time periods 2.0s & 2.1s are made to vibrate simultaneously.

They are in phase initially , after how may vibrations are there in the same phase ?

A. 21

B. 25

C. 30

D. 35

Answer: A

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19. The magnitude of acceleration of particle executing SHM at the position of maximum displacement is

A. zero

B. minimum

C. maxmium

D. none of these

Answer: C

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20. The SHMs are represent by the equation $y_1 = 0.1 \sin\left(100\pi t + \frac{\pi}{3}\right) \& y_2 = 0.1 \cos \pi t.$

The phase difference of the velocity of particle is

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

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

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

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

Answer: A

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Additional Questions Iii Fill In The Blanks

1. The time period for U - tube Oscillation is ..... .

A. $T = \sqrt{\frac{l}{2g}}$

B. $T = 2\pi\sqrt{\frac{2g}{l}}$

C. $T = 2\pi\sqrt{\frac{l}{g}}$

D. $T = 2\pi\sqrt{\frac{l}{2g}}$

Answer: D

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2. In SHM , kinetic energy is ..... .

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

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

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

D. $\frac{1}{2}m\square^2 \left(x^2A^2\right)$

Answer: C

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3. .....is a special case of forced oscillations.

A. Resonance

B. SHM

C. Angular harmonic motion

D. Torsional motion

Answer: A

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4. Force per unit length is called ..... .

A. Torsional constant

B. acceleration

C. force constant

D. Surface tension

Answer: D

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5. The motion which has single frequency and constant amplitude is called ..... .

A. SHM

B. resonance

C. frequency

D. damaping

Answer: D

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6. The maximum displacementof the particle is called ..... .

A. SHM

B. resonance

C. Amplitude

D. Altitude

Answer: C

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7. ..... of oscillation is large for resonance.

A. Frequency

B. Time period

C. Amplitude

D. Phase

Answer: C

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8. Electromagnetic oscillations in a tank circuit is an example for .....

A. free oscillations

B. damped oscillations

C. maintained oscillations

D. forced oscillations

Answer: B

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9. For a conservative system in one dimension , the force field can be derived fork is determined with a sonometer using ..... .

A. potential energy

B. total energy

C. kinetic energy

D. surface energy

Answer: A

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10. Frequency of a given turning fork is determined with a sonometer using ..... .

A. maintained oscillation

B. resonance

C. forced oscillation

D. damped oscillation

Answer: B

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Additional Questions Iv Choose The Odd One Out

1. CHOOSE THE ODD ONE OUT

A. $-\square^2 r$

B. ma

C. $-kr$

D. $\sqrt{\frac{K}{I}}$

Answer: D

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2. CHOOSE THE ODD ONE OUT

A. Oscillation

B. Vibration

C. Rotation

D. SHM

Answer: D

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3. CHOOSE THE ODD ONE OUT

A. Driver

B. Driven

C. Resonance

D. Force constant

Answer: D

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Additional Questions V Choose The Correct Pair

1. CHOOSE THE CORRECT PAIR :

A. Scalar potential energy - $\left(-\frac{dU}{dx}\right)$

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

C. Kinetic energy - $\frac{1}{2}m\omega^2x^2$

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

Answer: A

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2. CHOOSE THE CORRECT PAIR :

A. Angular SHM $\sqrt{\frac{K}{I}}$

B. Linear SHM - $\sqrt{\frac{2k}{m}}$

C. U - tude - $2\pi\sqrt{\frac{2l}{2g}}$

D. Simple pendulum - $2\pi\sqrt{\frac{l}{2g}}$

Answer: A

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Additional Questions Vi Choose The Incorrect Pair

1. CHOOSE THE INCORRECT PAIR:

A. Amplitude - Displacement

B. resonance - forced oscillation

C. Free- oscillation -tuning fork vibration

D. Maintained oscillation- swing movement

Answer: A

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2. CHOOSE THE INCORRECT PAIR:

A. K.E. - $\frac{3}{4}$ T.E.

B. P.E- $\frac{1}{4}$ T.E

C. T.E. - (K.E.+P.E.)

D. T.E - $\frac{1}{2}m\square^2\ x^2$

Answer: D

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Additional Questions Vii Assertion Reason

1. Assertion : The projection of uniform circular motion on a diameter is SHM.

Reason : A motion which has single frequency and constant amplitude is called SHM.

A. Assertion and Reason are correct and Reason is correct explanation of Assertion

B. Assertion and Reason are true but Reason is the false explanation of the

Assertion

C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: A

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2. if moon move in an elliptical orbit around the earth. The mass of the moon is very small compared to the mass of the earth because

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Additional Questions Viii Choose The Correct Or Incorrect Statements

1. (I) If the frequency of driver (external periodic force) is equal to the frequency of driven (natural frequency) then resonance occurs.

(II) A singer maintaining a note at a frequency of a glass and cause it ti shatter pieces is an example of resonance.

Which one is correct statement ?

A. I only

B. II only

C. Both are correct

D. None

Answer: C

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2. (I) Air blown gently across the mouth of a bottle is an example for forced vibrations.

(II) Oscillations of a coil in a galvanometer is

an example for free oscillation of a coil in a galvanometer is an example for free oscillation.

which one is correct statement ?

A. I only

B. II only

C. Both are correct

D. None

Answer: D

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3. (I) S.I. unit of frequency is hertz (Hz).

(II) S.I. unit of force constant isNm.

which one is correct statement ?

A. I only

B. II only

C. Both are correct

D. None

Answer:

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4. (I) Combination of springs connected in series $K_s = K_1 + K_2$

(II) Frequency of oscillation in a u - tude is n $n = \frac{1}{2\pi}\sqrt{\frac{2g}{l}}$

Which one is incorrect statement ?

A. I only

B. II only

C. Both are correct

D. None

Answer:

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Very Short Answer Questions

1. What is Oscillatory motion?

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2. What is phase of SHM?

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3. What is Oscillatory motion?

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4. What are periodic motion? Give any two examples.

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5. Define simple harmonic motion (S.H.M)

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6. Why the amplitude of the vibranting pendulum should be small?

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7. when a pendulum clock gains time , what adjustments should be made ?

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8. The displacement of harmonic oscillator is given by $x = \alpha \sin wt + \beta \cos wt$. What is the amplitude of the oscillation.

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Short Answer Questions

1. State five characteristics of SHM.

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2. Tabulate , the displacement , velocity and acceleration is SHM.

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3. Who among the following first gave the experimental velocity of G?

A. Cavendish

B. Copernicus

C. Brook Taylor

D. NONE of these

Answer: a

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4. The bob of vibrating simple pendulum is made of ice. How will the period of swing will change when the ice starts melting ?

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5. Discuss strings stretched between fixed points.

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6. At what displacement , (i) the P.E of a simple harmonic oscillator is maximum , (ii) the k. e is maximum ?

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Long Answer Questions

1. Write a short note on simple Harmonic motion.

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2. Show that the projection of uniform circular motion on a diameter is SHM.

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3. what would be the duration of the year if the distance between the earth and the sun gets doubled?

A. 1032

B. 625

C. 365

D. 129

Answer: a

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4. If a body of mass m is taken out from a point below the surface of earth equal to half the radius of earth, R, to a height R above the earths surface, then work done on it will be____mgr

A. 5/6

B. 6/7

C. 7/8

D. 8/9

Answer: c

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5. What would be the duration of the year if the A artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy E0. Its potential energy is

A. 2E0

B. E0

C. 1.5E0

D. -E0

Answer: A

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6. A body is projected vertically from the surface of the earth of radius R with velocity equal to half of the escape velocity. The maximum height reached by the body is

A. R

B. R/2

C. R/3

D. R/4

Answer: C

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7. One end of a U-tube containing mercury is connected to a suction pump and the other end to atmosphere. A small pressure difference is maintained between the two columns. Show that, when the suction pump is

removed, the column of mercury in the U-tube executes simple harmonic motion.

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8. Consider a simple pendulum, having a bob attached to a string , that oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple. Pendulum depends on its length (l) , mass of the bob (m) , and acceleration due to gravity (g) . Derive

the expression for is time period using method of dimension .

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Numerical Problems 1 Mark

1. Find the period of a simple pendulum 1.20m long.

A. 1.4 s

B. 3.2 s

C. 4.1 s

D. 2.2 s

Answer: D

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2. Find the length of a simple pendulum whose period is 2.00 s.

A. 2m

B. 0.4m

C. 1m

D. 3m

Answer: C

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3. A pendulum is 1.20m long is observer to have 1m Long is observed to have a period of 2.00s at certain location then the acceleration due to gravity is ,

A. $9.71 m / s^2$

B. $9.85 m / s^2$

C. $9.79 m / s^2$

D. $10.1 m / s^2$

Answer: B

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4. The three springs with force constant $k_1 = 7.5 \frac{N}{m}, k_2 = 10.0 \frac{N}{m}, k_3 = 12.5 \frac{N}{m}$ are connected in parallel to a mass of $0.500 kg$.

The mass is then pulled to the right and released . Then the period of the motion is.

A. 0.6 s

B. 0.8 s

C. 0.5 s

D. 0.4 s

Answer: B

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5. The three springs with force constant $k_1 = 8\frac{N}{m}, k_2 = 10\frac{N}{m}, k_3 = 12\frac{N}{m}$ are connected in series to a mass of 0.5kg . The mass is then pulled to the right and released . Then the period of the motion is.

A. 2 s

B. $2.2s$

C. $2.5s$

D. $3.1s$

Answer: C

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6. A particle executing a SHM has maximum acceleration at a distance of 0.5 cm from its mean position is $2cm/s^2$. What will be its velocity when it is at a distance of 1 cm from its mean position.

A. $4cm/s$

B. $2\sqrt{3}cm/s$

C. $11.2cm/s$

D. $4\sqrt{7}cm/s$

Answer: B

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7. A body of mass 1kg is executing SHM given by $x = 4\cos\left(100t + \frac{\pi}{2}\right)$ cm what is the velocity ?

A. $200\sin\left(100t + \frac{\pi}{2}\right)$

B. $-200\sin\left(100t + \frac{\pi}{2}\right)$

C. $400 \sin\left(100t + \frac{\pi}{2}\right)$

D. $-400 \sin\left(100t + \frac{\pi}{2}\right)$

Answer: D

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8. The piston in the cylinder head of a locomotive has a stroke (twice the amplitude) of 1.0 m if the piston moves with S. H. M with an angular frequency of 200rad min^{-1}. Then the maximum speed will be,

A. $50m / \min$

B. $100m / \min$

C. $150m / \min$

D. $200m / \min$

Answer: B

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9. A spring balance has a scale that reads from 0 to 50kg the length of the scale is 20 cm . A body suspended from this balance, when

displaced and released, oscillates with a period of 0.6s. Then the weight of the body will be

A. 200 N

B. 208 N

C. $219.3N$

D. $272.1N$

Answer: C

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10. A small body of mass 100 g is undergoing SHM of amplitude 100 cm and period 0.2 s. What is the maximum value of the force acting on the body ?

A. 86.4 N

B. 102.1 N

C. 98.5 N

D. 71.2 N

Answer: B

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Numerical Problems 2 Marks

1. A mass M attached to a spring oscillates with a period of 2 sec . If the mass is increased by 2 kg , the period increase by the second. Find the initial mass m assuming that Hook's law is obeyed.

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2. A spring stretches by $0.020m$ when a 1.5 kg object is suspended from its end . How much mass should be attached to the spring so that its frequency of vibration is $f = 3.1Hz$?

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3. An oscillating block- spring system has a mechanical energy of 1.00 J , an amplitude of 10.0 cm and a maximum speeding of $1.20m/s$

. Find the spring constant, the mass of the block, and the frequency of oscillation

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4. The acceleration dula to gravity on the surface of moon is $1.7ms^{-2}$. What is the time period of a simple pendulum on the surface of moon if its time period on the surface of earth is 3.5s ?

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5. A 0.950 kg mass hangs vertically from a spring that he a spring constant of 8.50 N /m . The mass is set into vertical oscillations and after 600 s , you find tht the amplitude of the oscillation is $\frac{1}{10}$ That of initial amplitude. What is the damping constant associated with this motion?

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Numerical Problems 3 Marks

1. A uniform disk of radius r= 0.6 m and mass M = 2.5 kg is freely suspended from a horizontal pivot located a radial distance d = 0.30 m from its centre . Find the angular frequency of small amplitude oscillations of the disk .

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2. A body oscillates with SHM along with x - axis.

Its displacement varies with time according to

the equation $x = (4.00m)\cos\left(\pi_t{}^{+}\frac{\pi}{4}\right)$ calculate at t = 1.00s : (a) displacement (b) velocity (c) acceleration (d) Also calculate the maximum speed and maximum acceleration and (e) phase at t = 2.00s.

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3. A particular executes SHM with a time period of 16s. At time $t = 2s$, the particle crosses the mean position while at t= 4 , its

velocity is $4ms^{-1}$ Find its a amplitude of motion.

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4. A particular moving in a straight line has velocity v give by $v^2 = \alpha - \beta y^2$ where α and β are constant and y is its distance from a fixed point in the line . Show that the motion of the particle is SHM . Find its time period and amplitude.

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5. A spring compressed by 10 cm develops a restoring force of 10 N.A body of mass 9 kg is placed on it . What is the force constant of the spring ? What is the depression in the spring under the weight of the body? What is the period of oscillation if the body is disturbed from its equilibrium position?

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Creative Questions Hots

1. Can a motion be oscillatory , but not simple harmonic. If your answer is yes , give an explanation and if not explain why ?

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2. Every simple harmonic motion is periodic motion but me every periodic motion need not be simple harmonic motion. Do you agree? Give example.

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3. What is the basic condition for the motion of a particle to be S.H.M ?

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4. The maximum acceleration of a simple harmonic oscillator is a_0 and the maximum velocity is V_0 . What is the displacement amplitude ?

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5. A girl is swinging on a swing in the sitting position. How will the period of swing be affected if she stands up?

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6. Will a pendulum clock lose or gain time when taken to the top of a mountain ?

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7. How would the time period of a spring mass system change, when it is made to oscillate horizontally and then vertically?

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8. Alcohol in a U tube executes S.H.M. of time period T. Now, alcohol is replaced by water upto the same height in the U-tube What will be the effect on the time period?

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9. Whet is the ratio between the potential energy the total energy of a particle executing S.H.M, when it's displacement is half of its amplitude?

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10. Why are army troops not allowed to march in steps while crossing the bridge?

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11. How can earthquakes cause disaster sometimes?

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12. Sometimes a wire glass is broken by the powerful voice of a celebrated singer why?

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13. Glass window may be broken by a far away explosion. Explain why?

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14. The body of a bus begins to rattle something, when the bus picks up a certain speed, why?

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15. What will be the change in time period of a loaded spring . When to moon ?

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16. In forced oscillations of a particle, the amplitude is maximum for a frequency ω_1 of the force, while the energy is maximum for a frequency ω_2 of the force. Then.....

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17. The maximum velocity of a particle , executing simple harmonic motion with an amplitude $7mm$ is $4.4ms^{-1}$. The period of oscillation is

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18. A hollow sphere is filled with water . It is hung by a long thread . As the water flows out of a hole at the bottom , the period of oscillation will

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19. Two simple harmonic are represented by the equation $y_1 = 0.1 \sin\left(100\pi + \frac{\pi}{3}\right)$ 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.

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20. A simple pendulum has time period (T_1). The point of suspension is now moved upward according to the relation $y = Kt^2, \left(K = 1m/s^2\right)$ where (y) is the vertical displacement. The time period now becomes (T_2). The ratio of $\frac{T_1^2}{T_2^2}$ is $\left(g = 10m/s^2\right)$.

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21. The bob of simple pendulum executes S.H.M in water with the a period t, while the period of oscillation of the bob is t_0 in the air , neglecting frictional force of water and given that the density of the bob is $\frac{4000}{3} kgm^{-3}$, Find the relationship between t and t_0 ?

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Value Based Questions

1. Student in a class were asked by their science teacher about different types of motion , with Examples. But few students were confused with explanation ,for example . Periodic motion. SHM , Oscillatory motion , Rotational motion. SHM , Oscillatory motion . Periodic motion, etc. How would have the teacher explained , so the students understood easily ?

(i) What are path difference & phase difference ?

(ii) For the waves , given below find out the

phase & path differences.

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2. There is no atmosphere on the moon because

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