PHYSICS

BOOKS - BINA LIBRARY PHYSICS (ASSAMESE ENGLISH)

OSCILLATIONS

Exercise

1. Define a simple harmonic motion.

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2. Define time period of oscillation.

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3. What is an amplitude ?

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4. What is the phase difference-between velocity and displacement ?

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5. What is the phase difference between acceleration and displacement ?

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6. At which point of motion the acceleration of a body executing SHM is zero ?

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7. What is the basic difference between a uniform circular motion and a SHM ?

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8. What is the time period of a simple pendulum in a freely falling lift'?

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9. Are all periodic motions oscillatory?

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10. How is phase angle related to angular frequency?

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11. When the motion of a simple pendulum will be simple harmonic?

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12. What does the negative sign in F = — kx signify?

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13. What are the characteristics of a simple harmonic motion?

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14. Find an expression for the time period of a loaded spring in simple harmonic motion.

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

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16. Distinguish with illustrations between free and forced oscillations. What is a resonance?

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17. At what position, velocity of a particle in SHM is maximum?

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18. What is the product of time period and frequency of vibration of a body in SHM?

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19. Show that motion of a simple pendulum is simple harmonic.

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20. State how acceleration is related to displacement in simple harmonic motion and mention the characteristics of this type of motion.

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

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22. Show that the motion of a simple pendulum is simple harmonic for small amplitudes of oscillation.

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23. Draw and discuss the displacement energy graph for a SHM

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24. Prove that the sum of potential and kinetic energies of a body in SHM is constant

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25. State the laws of a simple pendulum.

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26. Show that the motion of a loaded spring is simple harmonic. Find an expression for its time period.

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27. Find the total energy of a particle in SHM at any instant

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28. Find an expression for the time period of oscillation of liquid kept in a vertical U-tube.

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29. Give an example of an oscillatory motion which is not simple harmonic.

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30. A ball of radius r is made to oscillate in a bowl of radius R. Find the time period of oscillation.

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31. How is the period of a pendulum affected when its point of suspension is moved horizontally with acceleration a.

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32. How is the period of a pendulum affected when its point of suspension is moved vertically downward with a acceleration $a < g$.

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33. How is the period of a pendulum affected when its point of suspension is

(a) moved vertically upwards with acceleration a.

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34. A hollow sphere filled with water is hung by a thread. If it has a small hole at the bottom through which water slowly goes out, how does the time period change ?

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35. A spring has a mass m suspended from it. If the spring is cut in half and same mass is suspended, from one of the halves, will the frequency of vibration is changed ?

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36. A simple pendulum of length I and mass m is suspended in a car that is travelling with a constant speed v around a circle of radius R. If the pendulum undergoes small oscillations about its equilibrium position, what will be its frequency•of oscillation ?

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37. What is the frequency of oscillation of a simple pendulum mounted in a cabin that is freely falling under gravity?

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38. A man with a wrist watch in his hand falls from the top of a tower. Does the watch indicate correct time during the fall?

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39. A seconds pendulum is suspended from the roof of a lift. If the lift is moving up with an acceleration 9.8 m/s2 its time period is

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40. A simple pendulum is suspended from the roof of a lift. What will be its time period when the lift moves downwards with an acceleration a

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41. What is the time period of a simple pendulum in a freely falling lift'?

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42. A simple pendulum with a negatively charged bob is made to oscillate just above a positively charged plate. What happens to its time period?

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43. If a tunnel is dug through the earth from one side to the other along a diameter and a body is dropped in it, what will be the nature of its motion ?

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44. Show with example how an accelerating body can have zero velocity.

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45. A spring balance is graduated from O to 16 kg. When is reads 16 kg the spring is stretched by 10 cm. A body suspended from the spring is found to oscillate vertically with a frequency 2 oscillations per second. What the weight of the body ?

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46. The time period of a simple pendulum is 4.25. When its length is decreased by 1m its

period is 3.75. Find the original length of the pendulum.

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47. A body of mass 1 kg is made to oscillate in turns on springs of force constant 16 N/kg. Deduce the angular frequency.

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48. A pendulum clock shows accurate time. If its length is increased by 0.4%, calculate the•error in time per day.

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49. A harmonic oscillator is represented by x = 0.34 cos (3000 t + 0.74) mm. Find its amplitude, frequency, period and epoch.

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50. A SHM is represented by y = 10 sin $\left(10t - \frac{\pi}{6}\right)$ metres. Calculate its frequency, time period, maximum velocity and maximum acceleration.

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51. A body executing SHM with amplitude of 2 cm makes $\left(\frac{30}{\pi}\right)$ vibrations in 1 min. What is the maximum velocity of the body during the motion?

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52. A particle starts oscillating simple harmonically from its equilibrium portion. What is the ratio of KE and PE. of the particle at time T/12 second ?

(T is the time period of oscillation)

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53. The length of a simple pendulumis increased by 1%. Its time period will

A. increase by 2%

B. decrease by 0.5 %

C. increase by 0.5%

D. decrease by 1%

Answer:

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54. A particle executes SHM with frequency n.

The frequency with which KE oscillates is

A. n

B. 2n

C. 4n

D. n/2

Answer:

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55. A particle moves such that its acceleration a is given by a = - bx, where x is displacement

from equilibrium position and b is a constant.

The period of oscillation is

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

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

C. $2\pi\sqrt{b}$

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

Answer:

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56. A body is executing SHM. When its displacement from the mean position is 4 cm and 5 cm, the corresponding velocities of the particle are 10cm/s and 8 cm/s. The time period is

A. π sec

B. $\left(\frac{\pi}{2}\right)$ sec

C. 2π sec

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

Answer:

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57. To make frequency double of an oscillator we have to

A. double mass

B. half the mass

C. quadruple the mass

D. reduce the mass to one-fourth

Answer:

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58. If a spring extends by x and on loading, energy stored by the spring is

A. $T^2/2x$

B. $T^2/2K$

C. $2k/T^2$

D. $2T^2/K$

Answer:

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59. Two springs of spring constants 1500 N/m and 3000 N/m respectively are stretched with the same force. They will have P.E. in the ratio

A. 4 : 1

B. 1 : 4

C. 2 : 1

D. 1 : 2

Answer:

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60. A linear oscillator of force constant 2×10^6 N/m and amplitude 0.01 m has a total mechanical energy of 160 J. Its

A. minimum PE is xero

B. maximum PE is 100J

C. maximum KE is 100J

D. minimum KE is 100J

Answer:

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61. When a force of 0.1 N is applied a spring is stretched by 1.5 cm. The spring is cut into three parts and one part is stretched by 3 cm. The force required for this is

A. 0.2 N

B. 0.3 N

C. 0.4 N

D. 0.6N

Answer:

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62. A particle is SHM repeats its motion after every

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

B. $\frac{\pi}{\omega}$ sec

C. $2\frac{\pi}{\omega}$ sec

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

Answer:

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63. The phase difference between the displacement and velocity of a particle in SHM is

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

B. 0

C. π

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

Answer:

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64. In a SHM

A. PE is conserved

B. KE is conserved

C. total energy is conserved

D. none of these

Answer:

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65. In a SHM the KE of a body is maximum at

A. the extreme position

B. the equilibrium position

C. in between the two

D. none of the these

Answer:

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66. The mass and diameter of a planet are twice those of earth. The period of oscillation of a second pendulum on the planet is

A. $1/\sqrt{2}$ sec

B. $2\sqrt{2}$ sec

C. 2 sec

D. 1/2 sec

Answer:

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67. For a simple pendulum, the graph between L and T is

A. hyperbola

B. a curved one

C. a parabola

D. a straight line

Answer:

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68. A particle is subjected to two mutually perpendicular SHM stich that x = $2\sin\omega t$ and y = $2\sin\left(\omega t + \left(\frac{\pi}{4}\right)\right)$

The path of the panicle will be

A. an ellipse

B. a straight line

C. a parabola

D. a circle

Answer:

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69. The time period of a simple pendulum inside a stationary lift is T. If the lift starts. moving upwards with an acceleration of g/3 what will be its time period ?

A. T/3

B. 3T

C. sqrt 3 (T/2)

D. sqrt (3/2) T

Answer:

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70. A second's pendulum is mounted in a rocket. Its period of oscillation decreases, when the rocket

A. moves round the earth in geostationary orbit

B. moves up with uniform velocity

C. moves up with uniform acceleration

D. moves down with uniform acceleration

Answer:

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71. Which one of the following is a SHM ?

A. ball bouncing between two rigid vertical walls

B. particle moving in a circle with uniform speed

C. earth spinning about its own axis

D. wave moving through a string fixed at ends

Answer:

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72. A particle performing SHM passing through mean position has

A. maximum potential energy

B. maximum kinetic energy

C. maximum acceleration

D. minimum kinetic energy

Answer:

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73. A spring having a spring constant K is loaded with mass m. The spring is in two equal parts and one of them is loaded with the same mass. The new spring constant is

A. K/2

B. K

C. 2K

D. K^2

Answer:

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74. For a particle executing SHM along x-axis, the force is given by

A. - Akx

B. Akx

C. AcosKx

D. A exp (-Kx)

Answer:

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75. A simple pendulum consists of a hollow sphere containing mercury. It is suspended by

means of a wire. If a little mercury is drained off, its period

A. remains unchanged

B. decreases

C. increases

D. becomes erratic

Answer:

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