



PHYSICS

BOOKS - JBD PUBLICATION

Oscillations and Waves

Exercise

1. 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. 36m

B. 6m

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

D. $\frac{1}{36}m.$

Answer:



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2. The damping force on an oscillating body is proportional to the of the body.

A. displacement

B. velocity

C. acceleration

D. time

Answer:



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3. The distance between two consecutive points in the same phase in wave is called:

A. wavelength

B. resonance length

C. phase length

D. none of these

Answer:



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4. If the amplitude of S.H.M. is doubled ,its time period:

A. become four times

B. is halved

C. is doubled

D. remains the same.

Answer:



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5. The motion of the projection on a diameter of the circle of a point moving with uniform

angular velocity on the circumference of the circle is :

- A. circular motion
- B. linear motion
- C. harmonic motion
- D. simple harmonic motion.

Answer:



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6. A hollow sphere is filled with water through a small hole in it. It is hung by long thread and as water slowly flows out from the hole at the bottom, one finds that the periods of oscillation first increases and then decreases.

Explain. Why.

A. will increase

B. will decrease

C. remains constant

D. first increases, then decreases

Answer:



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7. The SI unit of angular frequency is :

A. herz

B. radian

C. second

D. none of these

Answer:



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8. A simple harmonic motion of amplitude has a time period T . The acceleration of the oscillator when its displacement is half the amplitude is :

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

B. $\frac{-4\pi^2 A}{T^2}$.

C. $\frac{2\pi^2 A}{T^2}$

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

Answer:



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9. A pendulum is clamped on the ceiling of a stationary car and its time period is T . If the car starts to move with some acceleration, then its time period will be :

A. more than T

B. less than T

C. equal to T

D. infinity.

Answer:



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10. When a tuning fork is slightly loaded with wax, the frequency of sound produced by it will:

A. increase

B. decrease

C. remains same

D. may increase or decrease

Answer:



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11. A vehicle with a horn of frequency f is moving with a velocity of 30ms^{-1} in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency

$(f + f_1)$. If the velocity of sound in air is 300 m s^{-1} :

A. $f_1 = 10f$

B. $f_1 = 0$

C. $f_1 = 0.1f$

D. $f_1 = -$

Answer:



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12. Velocity of sound is maximum in:

A. steel

B. vacuum

C. water

D. air

Answer:



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13. A pipe closed at one end and open at the other will give:

- A. all the harmonics
- B. all odd harmonics
- C. all even harmonics
- D. none of the harmonics

Answer:



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14. An observer moves towards a stationary source of sound with a velocity of one-tenth the velocity of sound. The apparent increase in frequency is :

A. zero

B. 0.05

C. 0.1

D. 0.001

Answer:



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15. Transverse waves of the same frequencies are generated in two steel wires A and B .The diameter of A is twice that of B and the tension in A is half that in B.the ratio f the velocities of waves in A and B is:

A. $1:2$

B. $1:\sqrt{2}$

C. $1:2\sqrt{2}$

D. $3:2\sqrt{2}$

Answer:



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16. The distance between two sound successive antinodes in a stationary wave is :

A. λ

B. $\lambda/2$

C. $\lambda/4$

D. 2λ .

Answer:



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17. If the pressure of a gas is increased by a factor 2, then the velocity of sound in it will:

- A. increase by a factor $\sqrt{2}$
- B. be halved
- C. be doubled
- D. remain unchanged

Answer:



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18. When two sound waves of the same frequency and amplitude are in phase by π radian, the result is :

- A. beats
- B. increased
- C. loudness
- D. resonance

Answer: complete silence



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19. Human ear cannot hear those mechanical waves whose frequency lies in the frequency range:

A. 100 m

B. 1m

C. $1 / 10m$

D. 50m

Answer:



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20. Transverse waves are produced in a long string by attaching its free end to a vibrating tuning fork. Figure below shows the shape of a part of the string, which pair of points are in phase?



A. A and D

B. B and E

C. C and F

D. A and G

Answer:



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21. When a wave travels in a medium, the particle displacements are given by :

$y(x, t) = 0.03 \sin \pi(2t - 0.01x)$ where y and

x are in m, metres and t in seconds.the
wavelength of the wave is :

A. 10 m

B. 20 m

C. 100 m

D. 200 m

Answer:



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22. The equation of a simple harmonic wave is given by $y = 3 \frac{\sin \pi}{2} (50t - x)$ where x and y are in metres and t is in seconds. The ratio of maximum particle velocity to the wave velocity is :

A. 2π

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

C. 3π

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

Answer:



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23. A wave is travelling in the +ve x - direction having displacement along y-direction as 1m, wavelength 2π m and frequency of $\frac{1}{\pi}$ Hz is:

A. $y = \sin(10\pi x - 20\pi t)$

B. $y = \sin(2\pi x + 2\pi t)$

C. $y = \sin(x - 2t)$

D. $y = \sin(2\pi x - 2\pi t)$.

Answer:



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24. Out of the followingg functions representing motion of a particle which represent SHM?

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

$$y = \sin^2 \omega t$$

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

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

A. only (a) and (c)

B. only (d) does not represent SHM

C. only(a) and (b)

D. only (a).

Answer:



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25. Two points are located at a distance of 10 m and 15 m from the source of oscillation .theperiod of oscillation is 0.05 sec and the

velocity of the wave is 300ms^{-1} . What is the phase difference between the oscillation of two points?

A. π

B. $\pi / 6$

C. $\pi / 3$

D. $2\pi / 3$

Answer:



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26. A particle is executing a SHM. Its maximum acceleration is α and maximum velocity is β then, its time period of vibration will be:

A. $\frac{\beta^2}{\alpha}$

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

C. $\frac{\beta^2}{\alpha^2}$

D. $\frac{\alpha}{\beta}$.

Answer:



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27. The transverse displacement $y(x,t)$ of a wave on a string is given by

$$y(x, t) = e^{-\left(ax^2 + bt^2 - 2\sqrt{ab}xt\right)}$$

This represents

a :

A. standing wave of frequency \sqrt{b}

B. wave moving in -x direction with speed

$$\sqrt{\frac{b}{a}}$$

C. standing wave of frequency $\frac{1}{\sqrt{b}}$

D. wave moving in + x direction with speed

$$\sqrt{\frac{a}{b}}$$

Answer:



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28. The displacement of a particle in SHM is $x = 10 \sin\left(2t - \frac{\pi}{6}\right)$ meter. When its displacement is 6m, the velocity of the particle ($\in ms^{-1}$) is :

- A. 8
- B. 24
- C. 18

D. 10

Answer:



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29. The pressure variations in the propagation of sound waves are:

A. isobaric

B. isochoric

C. isothermnal

D. adiabatic

Answer:



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30. A resonance pipe is open at both ends and 30 cm of its length is in resonance with an external frequency 1.1 kHz. If the speed of sound is 330ms^{-1} which harmonic is in resonance?

A. Fourth

B. Third

C. Second

D. First.

Answer:



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31. The frequency of the mass when it is displaced slightly is :



$$\text{A. } f = \frac{1}{2\pi} \frac{\sqrt{k_1 k_2}}{(k_1 + k_2)m}$$

$$\text{B. } f = \frac{1}{2\pi} \sqrt{\frac{k_1 + k_2}{m}}$$

$$\text{C. } f = \frac{1}{2\pi} \sqrt{\frac{k_1 k_2}{m}}$$

$$\text{D. } f = \frac{1}{2\pi} \sqrt{\frac{k_1 + k_2}{k_1 k_2 m}}$$

Answer:



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32. In an experiment to determine the speed of sound using a resonance column:

A. prongs of the tuning fork are kept in a vertical plane

B. prongs of the tuning fork are kept in a horizontal plane

C. in one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air

D. in one of the two resonances observed, the length of the resonating

air column is close to half of the wavelength of sound in air.

Answer:



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33. Fill in the Blanks

Rotation of earth around its own axis is

.



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34. Fill in the Blanks

During resonance, the amplitude of the resultant wave becomes



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35. Fill in the Blanks

In a oscillation, the amplitude decreases with time.



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36. Fill in the Blanks

The waves produced by a loaded spring are in nature.



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37. Fill in the Blanks

A loaded spring oscillates



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38. Fill in the Blanks

The distance between two consecutive nodal points is equal to of wavelength.



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Example

1. Is S.H.M. always linear?



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2. Are all periodic motions oscillatory?



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3. At what points is the energy entirely potential and entirely kinetic in S.H.M. ?



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4. If we cut the spring into parts. How does the spring constant of each part change?





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5. Why is there always a time gap between observing flash and hearing a thunder of clouds while both take place simultaneously?



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6. Is energy conserved in interference?



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7. Define longitudinal wave.



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8. A tuning fork has two prongs. Why?



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9. Is there any relation between uniform circular motion and S.H.M?



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10. What is the differential equation of S.H.M.?



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11. Can we ever construct an ideal simple pendulum?



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12. Can a body have zero velocity and still be accelerated?



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13. What is the relation between path difference and phase difference?



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14. What types of waves are possible in solids?



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15. In which medium a wave can propagate?



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16. What is the effect of pressure on the speed of sound?



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17. How can the frequency of a tuning fork be changed?



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18. why a tuning fork should be struck gently with a rubber pad?



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19. Why the strings of different thickness and different materials are used in Sitar (Violin)?



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20. What is the distance between two consecutive antinodes or nodes?



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21. Is it necessary for the production of beats that the amplitudes of the two superposing waves should be the same?



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22. What determines the natural frequency of a body?



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23. Which physical quantity remains conserved in S.H.M.?



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24. The girl sittin on a swing stands up.What will be the effect on the periodic time of the swing?



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25. Why does the body of a bus begins to rattle sometimes when the bus picks up the speed?



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26. Which of the following relationships between the acceleration and the displacement x of a particle involve simple harmonic motion?



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



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28. Which waves do not require medium for propagation?



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29. How does a bee produce buzzing sound?



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



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31. Why stationary wave is so called?



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32. Can transverse waves be produced in air?



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33. What is the intensity of painful sound?



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34. What is an echo?



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35. Why thick and long curtains are preferred in a big hall?



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36. We can recognise a person just by listening to his voice and without seeing him. How?



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37. Are all periodic motions simple harmonic motions?



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38. Is simple harmonic motion always linear?



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



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40. Which of the following relationships between the acceleration and the displacement x of a particle involve simple harmonic motion?





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41. What is the values of oscillation-amplitude and frequency f the particle executing S.H.M. from equation $y=r \sin \omega t$?



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42. What is the dimentional formula of spring constant?



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43. How is the angular frequency related to the frequency?



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44. How is time period affected ,if the amplitude of simple pendulum is increased?



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45. What is the meaning of constant of a spring?



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46. Why is the simple harmonic motion so named?



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47. Does damped simple harmonic motion strictly simple harmonic?



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48. Is the phase of harmonic motion of the particle same as that of the driving force under forced oscillations?



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49. Why does the body of a bus begins to rattle sometimes when the bus picks up the speed?



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50. Can a body have zero velocity and still be accelerated?



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51. Which physical quantity remains conserved in S.H.M.?



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52. What are isochronous vibrations?



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53. A simple pendulum of length l and with a bob of mass m is moving along a circular arc of

angle θ in a vertical plane. A sphere of mass m is placed at the end of the circle. What momentum will be given to the sphere by the moving bob?



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54. Two springs of different lengths but otherwise identical in all respects vibrate vertically with same load. Will their time period be same or different ?



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55. What is the nature of thermal changes in air when sound propagates through air?



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56. By how much the velocity increases for 1°C rise of temperature?



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57. What is the effect of pressure on the speed of sound?



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58. In which gas - H_2 or O_2 will sound travel with greater speed under given conditions of temperature and pressure?



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59. When a stone is thrown on the surface of water, a wave travel out. From where does the energy came?



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60. Can sound waves in air be polarised?



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61. What is polarisation of light? Explain polarisation of light by reflecting with the suitable diagram and hence derive Brewster's Law.



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62. Which type of waves can exist in material media and are governed by Newton's laws?



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63. How will you show by experiment that there is a transfer of energy by the wave?



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64. Which waves do not require medium for propagation?



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65. Which property is common in all type of waves?



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66. A wave transmits energy. Can it transmit momentum?



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67. What is the nature of the sound waves?



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68. In longitudinal wave, what is the distance between a compression and its nearest rarefaction?



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69. What types of waves are possible in solids?



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70. What causes rolling sound of thunder?



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71. When a wave is reflected from a denser medium, the change in phase is:



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72. What changes in phase take place on refraction?





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73. What is dispersin?



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74. Can sound exhibit dispersin? Why?



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75. What points of the stretched string between two fixed points must be plucked and touched to excite its first overtone?



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76. Is it possible to have interference between the waves produced by two violins? Why?



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77. Name the principle in which overlapping waves algebraically add to produce a resultant wave?



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78. Find expression for the various harmonics in a vibration string fixed at the two ends. Hence predict the position of nodes and antinodes.



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79. Does total energy remain conserved in the phenomenon of interference ?



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80. Which harmonics are missing in a closed organ pipe?



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81. Why no beats can be heard if the frequencies of the two interfering waves differ by more than ten?



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82. When two waves of almost equal frequencies n_1 and n_2 reach at a point simultaneously, what is the time interval between successive maxima?



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83. Derive expression for stationary waves formed in an open organ pipe and discuss normal modes of vibration of the pipe.



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84. Write a short note on simple pendulum.



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85. What do you understand by Fourier theorem?



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86. Write short notes on period and frequency.



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87. Define Beats.



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88. Derive expression for stationary waves formed in an open organ pipe and discuss normal modes of vibration of the pipe.



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89. What is Doppler effect? Derive expression for apparent frequency when source is moving towards a stationary listener



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90. What is Doppler effect ? Derive expression for apparent frequency when source is moving towards a stationary listener



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91. What is Doppler's effect? Derive a general expression for the apparent frequency when both source and observer are in relative motion.



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92. Define the following terms:

displacement



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93. Define the following terms:

amplitude



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94. Define the following terms:

time period



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95. Define the following terms:

angular frequency



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96. Explain damped and undamped oscillations.



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97. What do you mean by transverse and longitudinal waves? Give examples.



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