

India's Number 1 Education App

PHYSICS

BOOKS - CBSE COMPLEMENTARY MATERIAL PHYSICS (HINGLISH)

MECHANICAL WAVES

One Mark Questions

1. Time period of simple pendulum increase with





4. How is the frequency of oscillation related with the frequency of change in the K.E. and P.E. of the body in S.H.M ?

View Text Solution

5. The frequency of total energy of a particle in

SHM is

6. How is the length of seconds pendulum related with acceleration due to gravity of any planet?

Watch Video Solution

7. If the bob of a simple pendulum is made to osciliate in some fluid of density greater than the density of air (density of the bob > density of the fluid), then time period of the pendulum increased or decrease.

8. How is the time period of the effected, when

pendulum is taken to hills or in mines ?



9. A transverse wave travels along x-axis . The

particles of medium move



10. Define angular frequency. Give its S.I. unit.



11. Does the direction of acceleration at various points during the oscillation of a simple pendulum remain towards mean positon ?

12. What is the time period for the function $f(t) = \sin \omega t + \cos \omega t$ may represent the simple harmonic motion ?



13. When will the motion of a simple pendulum

be simple harmonic?



14. Can the motion of an artificial satellite around earth be taken as SHM?Watch Video Solution

15. What is the phase relationship between

diplacement, velocity and acceleration in SHM?

16. What forces keep the simple pendulum in

simple harmonic motion?

Watch Video Solution

17. How will the the time period of a simple

pendulum change when its length is doubled ?

Watch Video Solution

18. What is a harmonic wave function ?



19. If the motion of revolving particle is perodic in nature, give the nature of motion or projection of the revolving particle along the diameter.

Watch Video Solution

20. In forcd oscillation 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. What is the relation

between ω_1 and ω_2 ?

Watch Video Solution

21. Which properties of a medium are responsible for propagation of wave through

it ?

22. What is the nature of the thermal change in air, when a sound wave propagates through it ?



23. Why does sound travel faster in iron than

in water or air ?



24. When will the motion of a simple pendulum be simple harmonic?Watch Video Solution

25. A simple harmonic motion of acceleration 'a' and displacement 'x' is represented by $a + 4\pi^2 x = 0$ What is the time period of S.H.M ?





28. What is the condition to be satisfied by a mathematical relation between time and

displacement to describe a periodic motion ?



summer day is higher ?

Watch Video Solution

30. Under what conditions does a sudden phase reversal of waves on reflection takes place ?



31. The speed of sound does not depend upon

its frequency. Give an example in support of this statement.



32. An explosion takes place at the bottom of a

lake. Will the shock waves in the water be

longitudinal or transverse?





33. Which is most fundamental property of a

wave?

Watch Video Solution

34. How does particle velocity differ from wave

velocity?

35. If any liquid of density of water is used in a resonance tube, how will the frequency change ?

Watch Video Solution

36. Under what condition, te Doppler will not be observed, if the source of sound moves towards the listener ?

View Text Solution

37. What physical change occurs when a source of sound moves and listener is at rest?
Watch Video Solution

38. What physical change occurs when source of sound waves is at rest and the listener moves?

39. If two sound waves of frequencies 480 Hz and 536 Hz superpose, will they produce

beats? Would you hear the beats?



40. What is a non dispersive medium?



Two Mark Questions

1. Which of the following conditions is not

sufficient for SHM and why?

(i) acceleration \propto displacement,

(ii) restoring force \propto displacement.

Watch Video Solution

2. The formula for time period T for a loaded spring, $T = 2\pi$.Does the time period depend on lenght of the spring ?

3. Assertion: Water in a U-tube executes SHM, the time period for mercury filled up to the same height in the U-tube be greater then that in case of water. Reason:The amplitude of an oscilliating

pendulum goes on increasing.

Watch Video Solution

4. There are two springs, one delicate and another stiffer one. Which spring will have a

greater frequency of oscillation for a given

load ?



5. Time period of a particle in S.H.M. Depends on the force constant K and mass m of the particle $T = 2\pi\sqrt{m}/k$. A simple pendulum for small angular displacement executes S.H.M. approximately. Why then is the time periodof a pendulum independent of the mass of the pendulum ?



6. Answer the following questions:

(a) The motion of a simple pendulum is approximately simple harmonic for small angle oscillation. For larger angles of oscilliation, a more involved analysis shows that T is greater than $2\pi \sqrt{\frac{t}{g}}$ Think of a qualitative argument

to appreciate this result.

(b) What is the frequency of oscillation of a simple pendulum mounted in a cabin that is freely falling under gravity ?



7. The maximum acceleration of a simple harmonic oscillator is a_0 and maximum velocity is v_0 . What is the displacement amplitude?

Watch Video Solution

8. Velocity of sound in a tube containing air at 27° C and at a pressure of 76 cm of Hg is 300

m/s. What will its velocity be when the pressure is increased to 100 cm of Hg and the temperature is keptconstant ?

Watch Video Solution

9. Even after breakup of one prong of tunning fork it produces a round of same frequency, then what is the use of having a tunning fork with two prongs ?

View Text Solution

10. Why all the stringed instruments are provided with hollow boxes?
Watch Video Solution

11. The displacement of particle in S.H.M. May be given by $y = a \sin(\omega t + \phi)$ show that if the time t is increased by $2\pi/\omega$, the value of y remains the same.



12. The length of simple pendulum executing SHM is increased by 21%. By what % time period of pendulum increase ?

Watch Video Solution

13. Define wave number and angular wave number and give their S.I. Units.

View Text Solution

14. Why does the sound travel faster in humid

air?

View Text Solution

15. Use the formula
$$v=\sqrt{rac{\gamma P}{
ho}}$$
 to explain why

the speed of sound in air

(a) is independent of pressure, (b) increases

with temperature, (c) increases with humidity.



16. Differentiate between closed pipe and open pipe at both ends of same length fro frequency of fundamental note and harmonics.

View Text Solution

17. Bats can ascertain distances, directions, nature and size of the obstacle without any eye, explain how ?



18. In a sound wave , a displacement node is a pressure antinode and vice-versa. Explain, why



?

19. Does the frequency of a vibrating tuning

fork change on increasing the temperature?

20. Why cannot we hear an echo in a small room ?
Watch Video Solution

21. What do you mean by reverberation and reverberation time ? How is reverberation controlled ?

Watch Video Solution

Three Mark Questions

1. Show that for a particle in linear simple harmaonic motion, the acceleration is directly proportional to its displacement of the given instant.

Watch Video Solution

2. Show that for a particle in linear S.H.M., the average kinetic energy over a period of oscillation equals the average potential energy over the same period.



velocity (i) Maximum (ii) minimum ?



4. Draw (a) displacement time graph pf a particular executing SHM with phase angle ϕ

equal to zero (b) velocity time graph and (c)

acceleration time graph of the particle.



5. Show that a linear combination of sine and cosine function like $x(t) = a \sin \omega t + b \cos \omega t$ represents a simple harmonic. Also, determine

its amplitude and phase constant.

6. Show that S.H.M the phase difference between displacement and velocity is $\frac{\pi}{2}$, and between displacement and acceleration is π .

Watch Video Solution

7. Show that for a small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression of its time period.
8. Distinguish clearly with an illustration between free, forced and resonant oscillations.

Watch Video Solution

9. In reference to a wave motion, define the terms (i) amplitude (ii) time period (iii) frequency (iv) angular frequency (v) wave length and wave number.

Watch Video Solution

10. What do you mean by phase of a wave ? discuss the phase change with time and position.



Long Questions

1. If the pitch of the sound of a source appears to drop by 10~% to a moving person, then

determine the velocity of motion of the

person. Velocity of sound = $300ms^{-1}$.

Watch Video Solution



1. A particle is moving with SHM in a straight line. When the distance of the particle from the equilibrium position has values x_1 and x_2 , the corresponding value of velocities are u_1



2. Find the period of vibrating particle (SHM), which has acceleration of $45cms^{-2}$, when displacement from mean position is 5 cm.



3. A 40 gm mass produces on extension of 4 cm in a vertical spring. A mass of 200 gm is suspended at its bottom and left pulling down. Calculate the frequency of its vibration.



4. The acceleration due to gravity on the surface of the moon is $1.7ms^{-2}$. What is the time perioid of a simple pendulum on the surface of the moon, if its time period on the

surface of earth is 3.5s? Take $g=9.8ms^{-2}$

on the surface of the earth.



5. 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?



6. A set of 24 tuning fork is arranged in a series of increasing frequencies. If each fork gives 4 beats per second with the preceding one and the last sounds the ocatve of the first, find the frequencies of the first and the last forks.



7. The vertical motion of a huge piston in a machine is approximately simple harmonic with a frequency of $0.50s^{-1}$. A block of 10 kg is

placed on the pistion. What is the maximum amplitude of the pistion's SHM for the block and the piston to remain together ?

Watch Video Solution

8. At what temperature will the speed of sound be double its value at 273K?

Watch Video Solution

9. A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20 cm. A body suspended from this spring, when displaced and released, oscillates with a period of 0.60 s. What is the weight of the body?

View Text Solution

10. If the pitch of the sound of a source appears to drop by 10~% to a moving person,

then determine the velocity of motion of the

person. Velocity of sound = $330ms^{-1}$.



11. A body of mass m suspended from a spring executes SHM. Calculate ratio of K.E and P.E. Of body when it is at a displacement half of its amplitude from mean position.

Watch Video Solution

12. A string of mass 2.50kg is under a tension os 200N. The length of the stretched string is 20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?



13. Which of the following funchtions of time represent (a) periodic and (b) non-periodic motion? Give the period for each of period

motion. (ω is any positive constant)

```
(i) \sin \omega t + \cos \omega t
```

(ii) $\sin \omega t + \cos 2\omega t + \sin 4\omega t$

(iii) $e^{-\omega t}$ (iv) $\log \omega t$



14. The equation of a plane progressive wave is

give by equation

 $y=10\sin 2\pi(t-0.005x)$

where y and x are in cm and t is in seconds.



wavelength and velocity of the wave.



15. A tuning fork arrangement (pair) produces 4beats / sec with one fork of frequency 288cps. A little wax is placed on the unknown fork and it then produces 2beats / sec. The frequency of the unknown fork is



16. A pipe 20 cm long is closed at one end, which harmonic mode of the pipe is resonantly excited by a 430 Hz source? Will this same source can be in resonance with the pipe, if both ends are open? Speed of sound = $340ms^{-1}$.



17. The length of wire between the two ends of a sonometer is 105 cm. Where should the two

bridges be placed so trhat the fundamental

frequencies of the three segments are in the

ratio of 1:3:15 ?

18. The transverse displacement of a string (clamped at its two ends) is given by $y(x,t)=0.06\sinigg(rac{2\pi}{3}igg)x\cos(120\pi t)$ wherer x ,y are in m and t ini s. The length of the string is 1.5m and its mass is $3 imes 10^{-2}$ kg. Answer the following: (i) Does the function represent a travelling or a stationary wave?

(ii) Interpret the wave as a superimposition of two waves travelling in opposite directions.What are the wavelength, frequency and speed of propagation of each wave ?(iii) Determing the tension in the string.

Watch Video Solution

19. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45Hz. The mass of the wire is 3.5×10^{-2} kg and its linear mass density is

 $4.0 imes 10^{-2} kgm^{-1}$. What is (a) the speed of a

transverse wave on the string , and (b) the

tension in the string?

Watch Video Solution

20. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53k Hz. What is the speed of sound in steel?

21. A progressive wave of frequency 500Hz is travelling with a velocity of 360 m / s. How far

part are two points 60° out of phase ?



22. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency?



Mcq

1. 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

Watch Video Solution



A. 0⁰

 $C. 90^{0}$

D. 180^{0}

Answer: C



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

A. 0.10m/s

 $\mathsf{B.}\,0.15m\,/\,s$

 $\mathsf{C.}\,0.8m\,/\,s$

 $\operatorname{D.} 0.26m/s$

Answer: B

Watch Video Solution

4. The equation of S.H.M. is $y = a \sin(2\pi n t + a)$, then its phase at time t is

A. $2\pi nt$

B. α

 $\mathsf{C.}\,2\pi t+\alpha$

D. $2\pi t$

Answer: C

Watch Video Solution

5. The equation of simple harmonic motion $y = a \sin(2\pi t + lpha)$ then its phase at time t =

Os is

A. $2\pi nt$

B. α

 $\mathsf{C.}\,2\pi t + \alpha$

D. $2\pi t$

Answer: B

O View Text Solution

6. A particle is oscillating according to the equation $X=7\cos 0.5\pi t$, where t is in

second. The point moves from the position of

equilibrium to maximum displacement in time

A. 4s

 $\mathsf{B.}\,2s$

C. 1*s*

D.0.5s

Answer: C



7. The instantaneous displacement of a simple

pendulum oscillator is given by $x = A \cos \left(\omega t + rac{\pi}{4}
ight)$ Its speed will be

maximum at time

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

B. $\frac{\pi}{2\omega}$
C. $\frac{\pi}{\omega}$
D. $\frac{2\pi}{\omega}$

Answer: A





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

is

A.
$$\omega \sqrt{\left(a^2+y^2
ight)}$$

B. $\omega \sqrt{\left(a^2-y^2
ight)}$

C. *wy*

D.
$$\omega^2 \sqrt{\left(a^2+y^2
ight)}$$

Answer: B



9. 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. $\frac{T}{8}$
C. $\frac{T}{4}$
D. $\frac{T}{16}$

Answer: C



10. Displacement between maximum potential energy position energy potential and maximum kinetic energy position for a particle executing *S. H. M* is

A. -a

B.+a

 $\mathsf{C}.\pm a$

 $\mathsf{D.}\pmrac{a}{4}$

Answer: C

Watch Video Solution

11. If tension in the string is increased from 1 KN to 4 KN,other factors remaining unchanged, the frequency of the second harmonic will

A. be halved

B. main changed

C. be doubled

D. becomes four times

Answer: C

View Text Solution

12. An open organ pipe and a closed organ pipe have the frequency of their first overtone identical. What is the ratio of their lengths ?

A. $\frac{1}{2}$ B. $\frac{4}{3}$ C. $\frac{3}{4}$ D. 1

Answer: C



13. The fundamental frequency of a stretched string is V_0 . If the length is reduced by 35~%

and tension increased by $69\,\%$ the

fundamental frequency will be

A. $0.2V_0$

B. $0.5V_0$

 $C. 2.0V_0$

 $\mathsf{D}.\,1.6V_0$

Answer: C



14. Two waves of same frequency traveling in the same medium in opposite direction when super imposed give rise to

A. beats

B. harmonics

C. standing waves

D. resonance

Answer: C

View Text Solution

15. Equation of progressive wav is given by $y = 0.2 \cos \pi \left\{ (0.4t + 0.02x) - \frac{\pi}{6} \right\}$ The distance is expressed in cm and time in second. What will be the minimum distance between two particles having the phase difference of $\frac{\pi}{2}$?

A. 4*cm*

B. 8cm

C. 25cm

D. 12.5*cm*





16. For two systems to be in resonance, which of the following properties should be equal ?

A. Wavelength

B. Frequency

C. Amplitude

D. Wave velocity
Answer: B



17. Fundamental frequency of a sonometer wire is n. If the length, diameter and tensions are doubled, the new fundamental frequency will be

A. n

B.
$$\sqrt{2}n$$

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



Answer: D



18. The frequency of an open organ pipe is V. If half part of organ pipe is dipped in water then its frequency is

A. V

$$\mathsf{B}.\,\frac{V}{2}$$

 $\mathsf{C}.\,\frac{V}{4}$

D. *O*

Answer: A



19. Two tuning forks when sounded together produce one beat per 0.4 s. Then the difference of their frequencies is

$\mathsf{A.}\,0.2$

 $\mathsf{B.}\,2$

C. 5

 $\mathsf{D}.\,10$

Answer: C

Watch Video Solution

20. The angle between wave velocity and particle velocity in a travelling wave be

 $\mathsf{B.}\,60^0$

 $\mathsf{C}.\,\mathbf{0}^0$

D. 120^{0}

Answer: C

Watch Video Solution