PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

SOUND

Exercise

1. What is most essential for propagation of mechanical wave?

2. How are electromagnetic waves generated?

3. What do you mean by electromagnetic waves?

4. What do you mean by matter waves?

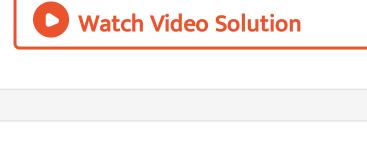▶ **Watch Video Solution**

5. What are mechanical waves. State its examples.

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6. What are travelling or progressive wave? Name the types of progressive wave?

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7. Define amplitude?

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8. Define period of a wave?

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9. Explain what is meant by phase of a wave.

10. Wave motion is doubly periodic. Explain.

11. State properties of medium for propagation of mechanical waves.

12. What do we need to know to describe phase at a place?

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13. State characteristics of progressive wave?

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14. Using axis of displacement and distance, sketch two waves A and B Such that A has

twice the wavelength and half the amplitude of B.

15. Derive the relation between speed, frequency and wavelength of wave.

16. Explain phase difference with proper diagram.

17. Draw a wave and indicate points which are

(1) in phase (2) out of phase and (3) have a

phase difference of $\dfrac{\pi}{2}$

18. The speed of sound in air is $330m/s$. and

that in glass is $4500m/s$. What is the ratio of

the wavelength of sound of given frequency in the two media?

19. A certain sound wave in air has a speed $340m/s$ and wavelength 1.7m, For this wave, calculate (i) the frequency (ii) time period.

20. A tuning fork of frequency 170 Hz produces sound wave of wavelength 2m. Calculate speed of sound.

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21. Sound wave A has period 0.015 s, sound wave B has period 0.025 s. Which sound has greater frequency?

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22. Name the types of progressive wave.

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23. In transverse wave, what are the region of positive and negative displacements called?

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24. Define transverse wave.

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25. Define longitudinal wave.

26. State the characteristics of transverse wave.

27. State the characteristics of longitudinal waves.

28. Distinguish between a longitudinal waves and transverse waves.

29. Write the expression for displacement for a sinusoidal wave travelling in positive x-direction.

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30. Write the expression for displacement for a sinusoidal wave travelling in negative x - direction.

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31. Why is a progressive wave described mathematically?

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32. On what does the speed of mechanical waves depend?

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33. What is isothermal process?

34. What is adiabatic process?

35. What isthe effect of humidity of air on velocity of sound?

36. Explains Newton's formula for velocity of sound. What is it's limitation?

OR

Why Newton's formula for velocity of sound was inadequate?

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37. Explain Newton's formula for (a) velocity of sound in air and (b) state its assumptions.

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38. Explain Laplace's correction to the Newton's formula for velocity of sound in air.

39. Explain the effect of change in temperature on speed of sound in air.

OR

Show that velocity of sound (v) varies with the square root of absolute temperature of the medium.

40. Show that for $1°C$ rise intemperature the velocity of sound in air increases by approximately 0.61 m/s

41. Explain the effect of change in pressure on speed of sound in air at constant temperature.

42. Suppose you are listening to an out-door live concert sitting at a distance of 150m from the speakers. Your friend is listening to the live broadcast of the concert in another country and the radio signal has to travel 3000 km. to reach him. Who will hear the music first and what will be the time difference between the two? Velocity of light = $3 \times 10^8 m/s$ and that of sound is $330m/s$.

43. Consider a closed box of rigid walls so that the density of the air inside it is constant. On heating, the pressure of this enclosed air is increased from P_0 to P. It is now observed that sound travels 1.5 times faster than at pressure P_0. Calculate P/P_0

44. At what temperature will the speed of sound in air be 1.75 times its speed at NTP?

45. If the velocity of sound in air at a given place on two different days of a given week are in the ratio $1 : 1.1$. Assuming the temperatures on the two days to be the same what quantitative conclusion can you draw about the conditions on the two days?

46. Explain principle of superposition of waves.

47. What is the reverberation?

48. What is acoustics of sound?

49. What is Echelon effect?

50. What do you mean by an echo? How does it occur?

51. Why can an echo not be heard at every place?

52. What causes reverberation?

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53. How can reverberation be reduced?

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54. How is principle of acoustic used by animals?

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55. What is a full from of SONAR? Explain how it works?

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56. What conditions must be satisfied for proper acoustics in an auditorium?

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57. State medical applications of acoustics?

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58. State applications of acoustics?

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59. A man shouts loudly close to a high wall. He hears an echo. If the man is at 40 m from the wall, how long after the shout will the

echo be heard? (speed of sound in air = 330 m/s)

60. An echo sounder in a fishing boat receives an echo from a shoal of fish 0.45 secs after it was sent. If the speed of sound in water is 1500m/s, how deep is a shoal?

61. A girl stands 170 m away from a high wall and claps her hands at a steady rate so each clap coincides with echo of the one before.

(I) If she claps 60 claps in 1 min what value should be the speed of sound in air ?

62. A girl stands 171 m away from a high wall and claps her hands at a steady rate so each clap coincides with echo of the one before.

(I) If she claps 60 claps in 1 min what value should be the speed of sound in air ?

(II) Now, she moves to another location and finds that she should now make 40 claps in 1min. to coincides with successive echoes. Calculate the distance for the new position from the wall.

63. A man standing between 2 parallel cliffsfires a gun. He hears 2 echoes one after 3

sec and other after 5 sec. The separation between the two cliffs is 1360m, what is the speed of sound?

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64. Which are the major qualities of sound?

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65. Explain the terms Pitch and Timbre.

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66. Explain the term loudness. Give its unit and formula in decibel.

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67. When heard independently, two sound waves produce sensation of 60 db and 55 db respectively. How much will the sensation be if those are sounded together, perfectly in phase?

68. Define Doppler effect for sound waves?

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69. What is essential for obtaining Doppler effect for sound waves?

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70. What is the major difference between Doppler effect of sound and light?

71. What is the effect of wind on Doppler shift of sound waves? Does velocity of sound remain same in presence of wind?

72. Under which three conditions the changes in frequency can be studied under Doppler effect?

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73. State common properties between Doppler effect of sound and light.

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74. Under which conditions of motion between source and observer, Doppler effect is not observed?

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75. Derive an expression for apparent frequency when source is moving and listener is stationary.

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76. Derive an expression for apparent frequency when listener approaches a stationary source with velocity v_2?

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77. Write an expression for apparent frequency when both source and listener are moving and explain it.

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78. State the expression for apparent frequency :

i. when source of sound and listener are moving towards each other.

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79. State the expression for apparent frequency :

i. when source of sound and listener are moving away from each other.

▶ Watch Video Solution

80. State the expression for apparent frequency :

i. when source is stationary and listener is moving towards the stationary source

81. State the expression for apparent frequency :

i. when source is stationary and listener is moving away from stationary source.

82. A rocket is moving at a speed of $220 m/s$ towards a stationary target. It emits a wave of frequency 1200 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. Calculate (1) The frequency of sound detected by the target and (2) The frequency of echo detected by rocket (velocity of sound = 330 m/s.)

83. A bat,flying at velocity $V_B = 12.5m/s$,isfollowed by a car running at velocity $V_C = 50m/s$. Actual directions of the velocities of the car and the bat are as shown in the figure below, both being in the same horizontal plane (the plane of the figure). To detect the car, the bat radiates ultrasonic waves of frequency 36 kHz. Speed of sound at surrounding temperature is $350m/s$. There is an ultrasonic frequency detector fitted in the car. Calculate the frequency recorded by this detector. The ultrasonic waves radiated by the

bat are reflected by the car. The bat detects these waves and from the detected frequency, it knows about the speed of the car. Calculate the frequency of the reflected waves as detected by the bat. ($\sin 37° = \cos 53° \approx 0.6$, $\sin 53° = \cos 37° \approx 0.8$)

84. A police car travels towards a stationary observer at a speed of 15 m/s. The siren on the car emits a sound of frequency 250 Hz.

Calculate the recorded frequency. The speed of sound is 340 m/s.

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85. The sound emitted from the siren of an ambulance has frequency of 1500 Hz. The speed of sound is 340m/s. Calculate the difference in frequencies heard by a stationary observer in the ambulance initially, travels towards and then away from the observer at a speed of 30m/s.

86. A vibrating tuning fork emits waves of wave length 1.33 m in air and 4.938 m in hydrogen. Find the speed of sound in hydrogen. Speed of sound in air is $340m/s$,

87. A wave disturbance in a medium has a wavelength of 0.002 m. Find the number of waves in one meters.

88. A timing fork of frequency 340 Hz completes 100 vibrations, in air. What isthe distance covered by the sound wave, [v = 332 m/s]

89. When a tuning fork of frequency 400 Hz completes 20 vibrations the distance covered

by sound is 17.2 m. find the wavelength and velocity of sound waves.

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90. A man standing between two parallel cliffsfires a gun and hearstwo echoes of the report, one after 1 s and the other after 4 s. What is the distance between the cliffs if the velocity of sound is 340 m/s.

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91. Find the temperature at which the velocity of sound in air will be double its velocity at $0°C$

92. A sounding source has a frequency of 256 Hz. If the temperature of air be $27°C$, what is the wavelength of wavessent by the source? Velocity of sound in air at $0°C$, $= 331m/s$.

93. The wavelength of a note is 3 m in air when the temperature is $17° C$. Find the wavelength of the same note in air $37° C$.

94. The velocities of sound are measured in hydrogen and oxygen gases at a given temperature. If $\dfrac{M_0}{M_H} = \dfrac{32}{2} = \dfrac{16}{1}$ Find the ratios of the velocities in oxygen and hydrogen.

95. The speed limit for the vehicle on a road is $108 \ km/hr$. A policeman detects a drop of 25% in the pitch of the horn of a car as it passes him. Is the policeman justified in punishing the car driver for crossing the speed limit? (Velocity of sound = $350 m/s$.)

96. Choose the correct option?

A sound carried by air from a sitar to a listener

is a wave of following type.

A. Longitudinal stationary

B. Transverse progressive

C. Transverse stationary

D. Longitudinal progressive

    A. Longitudinal stationary

    B. Transverse progressive

    C. Transverse stationary

D. Longitudinal progressive

Answer:

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97. Choose the correct option?

When sound waves travel from air to water, which of these remains constant?

A. Velocity

B. Frequency

C. Wavelength

D. All of the above

A. Velocity

B. Frequency

C. Wavelength

D. All of the above

Answer:

98. Choose the correct option?

The Laplace's correction in the expression for velocity of sound given by Newton is needed because sound waves

    A. are longitudinal

    B. propagate isothermally

    C. propagate adiabatically

    D. are of long wavelength

Answer:

99. Choose the correct option?

Speed of sound is maximum in

A. air

B. water

C. vacuum

D. solid

Answer:

100. Choose the correct option?

The walls of the hall built for music concerns should

A. amplify sound

B. reflect sound

C. transmit sound

D. absorb sound

A. amplify sound

B. reflect sound

C. transmit sound

D. absorb sound

Answer:

101. Choose the correct option?

The speed of sound in a perfectly rigid rod is

A. zero

B. infinite

C. 332 m / s

D. 6664 m / s

A. zero

B. infinite

C. 332 m/s

D. 6664 m/s

Answer:

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102. Choose the correct option?

The increase in the speed of sound, on increasing the temperature of the medium by

$10^\circ C$, will be

A. 0.61 m / s

B. 60 m / s

C. 6 m / s

D. 600 m / s

A. 0.61 m/s

B. 60m/s

C. 6 m/s

D. 600 m/s

Answer:

103. Choose the correct option?

If the air pressure is doubled at constant temperature, then the speed of sound will be become

A. double

B. three times

C. four times

D. same

A. double

B. three times

C. four times

D. same

Answer:

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104. Choose the correct option?

The speed of a supersonic wave as compared

to that of sound is

A. less

B. more

C. equal

D. one tenth

A. less

B. more

C. equal

D. one tenth

Answer:

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105. Choose the correct option?

The pitch of voice of a child is

A. higher

B. lower

C. depends upon velocity of sound

D. none of above

   A. higher

   B. lower

   C. depends upon velocity of sound

   D. none of above

Answer:

106. Choose the correct option?

Decibel is unit of

    A. loudness of sound

    B. wavelength

    C. wave velocity

    D. none of these

Answer:

107. Choose the correct option?

During longitudinal wave motion the quantities transmitted in direction of propagation are

A. energy and mass

B. energy only

C. energy and momentum

D. energy, mass and momentum

A. energy and mass

B. energy only

C. energy and momentum

D. energy, mass and momentum

Answer:

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108. Choose the correct option?

The product of periodic time and frequency of

vibration is

A. wave velocity

B. wave number

C. wavelength

D. unity

A. wave velocity

B. wave number

C. wavelength

D. unity

Answer:

109. Choose the correct option?

If pressure of air gets doubled, then velocity of

sound in air

A. gets doubled

B. becomes four times

C. remains unchanged

D. becomes half

    A. gets doubled

    B. becomes four times

    C. remains unchanged

D. becomes half

Answer:

110. Choose the correct option?

The velocity of sound is largest in

A. Vacuum

B. water

C. Iron

D. Air

A. Vacuum

B. water

C. Iron

D. Air

Answer:

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111. Choose the correct option?

For the propagation of wave through a medium the medium should be elastic,so that

A. it can transfer energy

B. it can restore energy

C. it can regain its original shape

D. None of the above

Answer:

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112. Choose the correct option?

The speed of sound waves having a frequency of 256 Hz compared with a speed of sound

waves having a frequency of 512 Hz is

A. Same

B. Twice as greater

C. Half of greater

D. Four times as greater

A. Same

B. Twice as greater

C. Half of greater

D. Four times as greater

Answer:

113. Choose the correct option?

The distance between the centres of compression and adjacent rarefaction is equal to:

A. Half the wavelength

B. The wavelength

C. One fourth of the wavelength

D. Double the wavelength

A. Half the wavelength

B. The wavelength

C. One fourth of the wavelength

D. Double the wavelength

Answer:

114. Choose the correct option?

Each particle of the medium vibrates with……..

amplitude

A. same

B. decreasing

C. increasing

D. unequal

A. same

B. decreasing

C. increasing

D. unequal

Answer:

▶ **Watch Video Solution**

115. Choose the correct option?

The......is developed during compression according to Laplace's formula for speed of sound.

    A. sound

    B. light

    C. heat

    D. cooling

Answer:

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116. Choose the correct option?

According to Laplace, the adiabatic modulus of elasticity for air medium is given by

A. $E = \gamma P$

B. $E = \dfrac{P}{\gamma}$

C. $E = \dfrac{\gamma}{P}$

D. $P = \gamma E$

Answer:

117. Choose the correct option?

The value of γ for air is

A. 1.31

B. 1.41

C. 1.15

D. 1.61

Answer:

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118. Choose the correct option?

Loudness of the sound depends upon

A. square of the amplitude

B. amplitude

C. reciprocal of the amplitude

D. square root of the amplitude

Answer:

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119. Choose the correct option?

The characteristic of sound which distinguishes a sharp sound from a grave or dull sound is

    A. Intensity

    B. Echo

    C. Pitch

    D. Resonance

Answer:

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120. Choose the correct option?

The unit of loudness is

A. Bel

B. W/m^2

C. Decibel

D. All the above

    A. Bel

    B. W/m^2

    C. Decible

D. All the above

Answer:

121. Choose the correct option?

An observer is standing at the bank of sea and finds that 54 waves are reaching the bank per minute. If the wavelength of waves is 10 meter then their speed will be

A. $3 \, m/s$

B. 9 m/s

C. 332m/s

D. zero

A. 3 m/s

B. 9 m/s

C. 332m/s

D. zero

Answer:

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122. Choose the correct option?

The frequency of transmission of a radio station is 30MHz, the wavelength of the waves transmitted by the centre will be

A. 5 meter

B. 10 meter

C. 15 meter

D. 20 meter

    A. 5 meter

    B. 10 meter

    C. 15 meter

D. 20 meter

Answer:

123. Choose the correct option?

In a transverse wave, angle between the direction of oscillation of particle of a medium and direction of propagation of energy is

A. $60°$

B. $45°$

C. 90°

D. 0°

A. 60°

B. 45°

C. 90°

D. 0°

Answer:

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124. Choose the correct option?

A source of frequency 500 Hz produces waves.

If wavelength is 0.1 m, the waves travel a

distance of 300 m in

A. 7.2 sec

B. 6 sec

C. 3.6 sec

D. 0.6 sec

Answer:

125. Choose the correct option?

A tuning fork vibrates and produces concentric circular transverse waves on the surface of water. If distance between 10 crests is 9.0 m and velocity of wave on the surface of water is 450 m/s, then frequency of the tuning fork is

A. 500 Hz

B. 250 Hz

C. 225 Hz

D. 450 Hz

A. 500 Hz

B. 250 Hz

C. 225 Hz

D. 450 Hz

Answer:

126. Choose the correct option?

The distance between two consecutive crests in a wave train produced in a string is 5 cm. If

2 complete waves pass through any point per

second, the velocity of the wave is

A. 10 cm/s

B. 2.5 cm/s

C. 5 cm/s

D. 15 cm/s

Answer:

127. Choose the correct option?

The wave number of two sound waves are $0.625 \ m^{-1}$ and $1.25 \ m^{-1}$. The difference between their wavelength is

    A. 0.8 m

    B. 0.08 m

    C. 0.625

    D. 1.25

Answer:

128. Choose the correct option?

The echo and the original sound differ in the following characteristics in musical note

A. intensity

B. quality

C. pitch

D. All of the above

A. intensity

B. quality

C. pitch

D. All of the above

Answer:

129. Choose the correct option?

The minimum distance between the source of sound and reflection surface for the clear of

hearing of sound is

A. 17.2 m

B. 20 m

C. 1.7 m

D.19.2 m

A. 17 m

B. 20 m

C. 1.7 m

D. 19.2 m

Answer:

130. Choose the correct option?

The Doppler's Effect is not applicable

A. When the source and observer are at

rest

B. When there is relative motion between

the source and the observer.

C. When the source is at rest and observer

is moving.

D. When the source is moving and observer

is at rest.

Answer:

131. The velocity of sound islargest in

A. Vacuum

B. Water

C. Iron

D. Air

Answer:

132. The loudness of a sound depends upon ....

A. square of the amplitude

B. amplitude

C. reciprocal of the amplitude

D. square root of the amplitude

Answer:

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