DPP NEET-UG CLASS XI PHYSICS

TOPIC – WAVES

1.
With propagation of longitudinal waves through a medium, the quantity transmitted is

(a) matter (b) energy
(c) energy and matter
(d) energy, matter and momentum

2
The waves produced by a motorboat sailing in water are

(a) transverse (b) longitudinal
(c) longitudinal and transverse
(d) stationary

3
A transverse wave is represented by $y = A \sin(\omega t - kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

(a) $\pi A/2$ (b) πA (c) $2\pi A$ (d) A

4
A transverse wave propagating along X-axis is represented by

$$y(x,t) = 8.0 \sin\left(0.5\,\pi x - 4\pi t - \frac{\pi}{4}\right)$$

where, x is in metre and t is in second. The speed of the wave is

(a) $4\pi\ \text{ms}^{-1}$ (b) $0.5\,\pi\ \text{ms}^{-1}$ (c) $\frac{\pi}{4}\ \text{ms}^{-1}$ (d) $8\ \text{ms}^{-1}$

5
Sound waves of wavelength λ travelling in a medium with a speed of v m/s enter into another medium where its speed is $2v$ m/s. Wavelength of sound waves in the second medium is

(a) λ (b) $\frac{\lambda}{2}$ (c) 2λ (d) 4λ

6
Velocity of sound in a gaseous medium is $330\ \text{ms}^{-1}$. If the pressure is increased by 4 times without change in temperature, the velocity of sound in the gas is

(a) $330\ \text{ms}^{-1}$ (b) $660\ \text{ms}^{-1}$ (c) $156\ \text{ms}^{-1}$ (d) $990\ \text{ms}^{-1}$

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The velocity of sound in air at NTP is 330 m/s. What will be its value when temperature is doubled and pressure is halved?

(a) 330 m/s (b) 165 m/s
(c) $330\sqrt{2}$ m/s (d) $320/\sqrt{2}$ m/s

8
A wave of frequency 500 Hz travels between X and Y, distance of 600 m in 2 s. How many wavelength are there in distance XY?

(a) 1000 (b) 300
(c) 180 (d) 2000

9
Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air

(a) Increases by a factor 20 (b) Increases by a factor 10
(c) Decreases by a factor 20 (d) Decreases by a factor 10

10
Velocity of sound in the atmosphere of a planet is $500\ \text{ms}^{-1}$. The minimum distance between the source of sound and the obstacle to hear the echo should be

(a) 17 m (b) 20 m (c) 25 m (d) 50 m

11
The displacement Y of a particle in a medium can be expressed as

$$y = 10^{-6} \sin(100t + 20x + \pi/4)\,\text{m}$$

where, t is in second and x in metre.
The speed of the wave is

(a) $2000\ \text{ms}^{-1}$ (b) $5\ \text{ms}^{-1}$
(c) $20\ \text{ms}^{-1}$ (d) $5\pi\ \text{ms}^{-1}$

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A wave in a string has an amplitude of 2cm. The wave travels in the positive direction of x-axis with a speed of $128\ \text{ms}^{-1}$ and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is

(a) $y = (0.02)\,\text{m} \sin(7.85x + 1005t)$
(b) $y = (0.02)\,\text{m} \sin(15.7x - 2010t)$
(c) $y = (0.02)\text{m} \sin(15.7x + 2010t)$
(d) $y = (0.02)\,\text{m} \sin(7.85x - 1005t)$

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A wave is represented by the equation

$$y = 7\sin\left(7\pi t - 0.04x + \frac{\pi}{3}\right)$$

where, x in metre and t in second. The speed of the wave is

(a) 175 π ms^{-1}(b) 49 π ms^{-1} (c) 49/π ms^{-1} (d) 0.28 π ms^{-1}

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In the given progressive wave equation,

$$y = 0.5\sin(10\pi t - 2x)\,\text{cm}$$

What is the maximum velocity of particle?

(a) 5 ms^{-1} (b) 5 π ms^{-1} (c) 10 ms^{-1} (d) 10.5 ms^{-1}

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The phase difference between two waves, represented by

$$y_1 = 10^{-6}\sin\left[100t + \left(\frac{x}{50}\right) + 0.5\right]\text{m}$$

$$y_2 = 10^{-6}\cos\left[100t + \left(\frac{x}{50}\right)\right]\text{m}$$

where, x is expressed in metre and t is expressed in second, is approximately

(a) 1.07 rad (b) 2.07 rad (c) 0.5 rad (d) 1.5 rad

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The equation $y = A\cos^2\left[2\pi nt - 2\pi\frac{x}{\lambda}\right]$ represents a wave with

(a) amplitude $A/2$, frequency $2n$ and wavelength λ
(b) amplitude $A/2$, frequency $2n$ and wavelength $\lambda/2$
(c) amplitude A, frequency n and wavelength λ
(d) amplitude A, frequency $2n$ and wavelength 2λ

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A wave travelling in the positive x-direction having displacement along y-direction as 1 m, wavelength 2π m and frequency of $\frac{1}{\pi}$ Hz is represented by

(a) $y = \sin(x - 2t)$ (b) $y = \sin(2\pi x - 2\pi t)$
(c) $y = \sin(10\pi x - 20\pi t)$ (d) $y = \sin(2\pi x + 2\pi t)$

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Ratio of amplitude of two interfering waves is 2:1, then ratio of amplitude of maxima to minima is

(a) 4 : 1 (b) 9 : 1 (c) 3 : 1 (d) 9 : 4

19

If two waves of amplitude a produce a resultant wave of amplitude a, then the phase difference between them will be

(a) 60° (b) 90° (c) 120° (d) 180°

20

A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 2 m and 3 m respectively, from the source. The ratio of the intensities of the waves at P and Q is

(a) 9 : 4 (b) 2 : 3
(c) 3 : 2 (d) 4 : 9

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The equation of a stationary wave is

$$y = 0.8\cos\left(\frac{\pi x}{20}\right)\sin 200\pi t$$

where x is in cm and t is in second. The separation between consecutive nodes will be

(a) 20 cm (b) 10 cm (c) 40 cm (d) 30 cm

22

Standing waves are produced in 10 m long stretched string. If the string vibrates in five segments and wave velocity is 20 ms^{-1}, then its frequency will be

(a) 5 Hz (b) 2 Hz (c) 10 Hz (d) 15 Hz

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The length of a sonometer wire AB is 110 cm. Where should the two bridges be placed from A to divide the wire in three segments whose fundamental frequencies are in the ratio of 1 : 2 : 3.

(a) 30 cm and 90 cm (b) 40 cm and 80 cm
(c) 60 cm, 30 cm and 20 cm (d) 30 cm and 60 cm

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If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

(a) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$ (b) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$
(c) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$ (d) $n = n_1 + n_2 + n_3$

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When a string is divided into three segments of lengths l_1, l_2 and l_3, the fundamental frequencies of these three segments are v_1, v_2 and v_3, respectively. The original fundamental frequency (v) of the string is

(a) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$ (b) $v = v_1 + v_2 + v_3$

(c) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$ (d) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

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An organ pipe, open from both ends produced 5 beats/s when vibrated with a source of frequency 200 Hz in its fundamental mode. The second harmonic of the same pipe produces 10 beats/s with a source of frequency 420 Hz. The fundamental frequency of pipe is

(a) 195 Hz (b) 205 Hz (c) 190 Hz (d) 210 Hz

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The fundamental frequency of a closed pipe is 220 Hz. If $\frac{1}{4}$ of the pipe is filled with water, the frequency of the Ist overtone of the pipe now is

(a) 220 Hz (b) 440 Hz (c) 880 Hz (d) 1760 Hz

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An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is?

(a) 4 (b) 13 (c) 6 (d) 9

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The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is

(a) 80 cm (b) 100 cm (c) 120 cm (d) 140 cm

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The number of possible natural oscillations of air column in pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are (velocity of sound $= 340\ ms^{-1}$)

(a) 4 (b) 5 (c) 7 (d) 6

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The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is

(a) 12.5 cm (b) 8 cm (c) 13.3 cm (d) 16 cm

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The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

(a) 10 Hz (b) 20 Hz
(c) 30 Hz (d) 40 Hz

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A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio λ_2/λ_1 is

(a) $\sqrt{\frac{m_1+m_2}{m_2}}$ (b) $\sqrt{\frac{m_2}{m_1}}$ (c) $\sqrt{\frac{m_1+m_2}{m_1}}$ (d) $\sqrt{\frac{m_1}{m_2}}$

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The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be

(a) L (b) $2L$ (c) $L/2$ (d) $4L$

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If we study the vibration of a pipe open at both ends, which of the following statements is not true?

(a) Open end will be antinode
(b) Odd harmonics of the fundamental frequency will be generated
(c) All harmonics of the fundamental frequency will be generated
(d) Pressure change will be maximum at both ends

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Two sound waves with wavelengths 5.0 m and 5.5 m respectively, each propagate in a gas with velocity 330 ms^{-1}. We expect the following number of beats per second

(a) 12 (b) 0 (c) 1 (d) 6

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If two waves of wavelengths 50 cm and 51 cm produced 12 beats/s, the velocity of sound is

(a) 360 ms^{-1} (b) 306 ms^{-1} (c) 331 ms^{-1} (d) 340 ms^{-1}

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Two wave of wavelengths 99 cm and 100 cm both travelling with velocity 396 ms^{-1} are made of interfere. The number of beats produced by them per second are

(a) 1 (b) 2 (c) 4 (d) 8

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Three sound waves of equal amplitudes have frequencies $(n-1)$, n, $(n+1)$. They superimpose to give beats. The number of beats produced per second will be

(a) 1 (b) 4
(c) 3 (d) 2

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Two sources of sound placed closed to each other, are emitting progressive waves given by $y_1 = 4\sin 600\pi t$ and $y_2 = 5\sin 608\pi t$

An observer located near these two sources of sound will hear

(a) 4 beat/s with intensity ratio 25 : 16 between waxing and waning
(b) 8 beat/s with intensity ratio 25 : 16 between waxing and waning
(c) 8 beat/s with intensity ratio 81 : 1 between waxing and waning
(d) 4 beat/s with intensity ratio 81 : 1 between waxing and waning

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A source of unknown frequency gives 4 beat/s when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives 5 beat/s when sounded with a source of frequency 513 Hz. The unknown frequency is

(a) 254 Hz (b) 246 Hz
(c) 240 Hz (d) 260 Hz

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A tuning fork of frequency 512 Hz makes 4 beat/s with the vibrating string of a piano. The beat frequency decreases to 2 beat/s when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

(a) 510 Hz (b) 514 Hz (c) 516 Hz (d) 508 Hz

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A sound source is moving towards stationary listener with 1/10th of the speed of sound. The ratio of apparent to real frequency is

(a) $\frac{11}{10}$ (b) $\left(\frac{11}{10}\right)^2$ (c) $\left(\frac{9}{10}\right)^2$ (d) $\frac{10}{9}$

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A tuning fork is used to produce resonance in a glass tube. The length of the air column in this tube can be adjusted by a variable piston. At room temperature of 27° C, two successive resonances are produced at 20 cm and 73 cm of column length. If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27° C is

(a) 350 m/s (b) 339 m/s (c) 330 m/s (d) 300 m/s

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A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of a 9 kg is suspended from a wire. When this mass is replaced by a mass M, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. The value of M is

(a) 25 kg (b) 5 kg (c) 12.5 kg (d) 1/25 kg