CHAPTER

17

Wave Motion

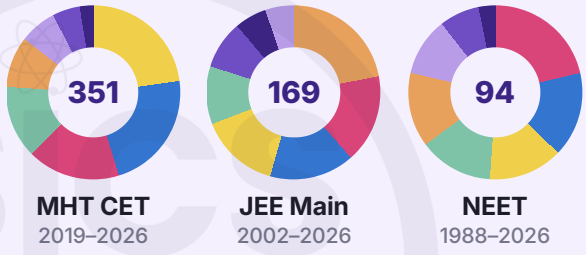
MHT CET · JEE · NEET Physics

PHYSICS CIRCLE

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EXAM WEIGHTAGE



	CET	JEE	NEET
Organ Pipes & Resonance Tube	79 23%	27 16%	15 16%
Stationary Waves & Vibrating Strings	80 23%	25 15%	13 14%
Progressive Wave Equation	61 17%	28 17%	20 21%
Doppler Effect	33 9%	37 22%	13 14%
Beats	47 13%	18 11%	13 14%
Wave Basics & Properties of Sound	24 7%	9 5%	10 11%
Speed of Waves	18 5%	15 9%	7 7%
Reflection, Superposition & Interference	9 3%	10 6%	3 3%

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01 CONCEPT Wave Basics & Properties of Sound

IN ONE LINE

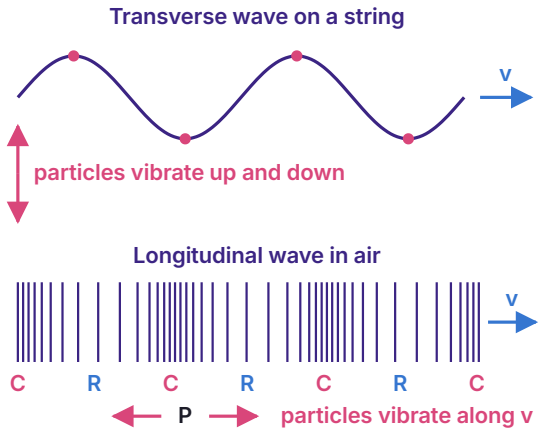
A wave carries **energy and shape** through a medium; the particles only vibrate about their mean positions.

17.1.1 Characteristics of wave motion

- Particles vibrate about their mean position; they do not travel with the wave.
- Energy moves forward with no net transport of the medium.
- Particle velocity changes from point to point; wave speed in a medium is constant.
- Wave speed depends on the medium, not on frequency, wavelength or intensity.
- A medium needs **elasticity**, **inertia** and low friction.

17.1.2 Classifying waves

- **Mechanical** waves need a medium: string waves, sound, seismic waves.
- **Non-mechanical** waves need no medium: light, radio waves, X-rays.
- Sound cannot travel through vacuum.

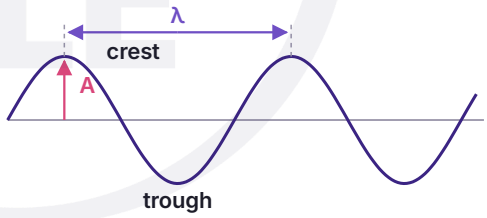


Transverse wave: crests and troughs. Longitudinal wave: compressions (C) and rarefactions (R)

Transverse	Longitudinal
vibration perpendicular to wave	vibration along the wave
crests and troughs	compressions and rarefactions
needs rigidity	needs volume elasticity
solids, liquid surface	solids, liquids, gases
can be polarised	cannot be polarised
string of sitar, tabla skin	sound in air, air in organ pipes

- Sound in air is longitudinal; light is transverse.
- **Progressive** waves carry energy forward; **stationary** waves do not.
- Audible range: 20 Hz to 20 kHz. Below it infrasonic; above it ultrasonic.
- Ultrasonic uses: SONAR, ultrasonography.

17.1.3 Amplitude, wavelength, frequency, time period



Wavelength is the distance between two successive points in the same phase

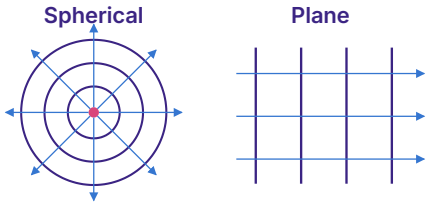
- **Amplitude** a: largest displacement from the mean position.
- **Wavelength** λ: distance travelled in one time period; crest to next crest.
- Crest to neighbouring trough = half a wavelength.
- **Frequency** n: vibrations per second, in hertz.

$$T = \frac{1}{n}$$

$$v = n\lambda$$

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- The frequency is fixed by the source and stays the same in every medium.
- Going to a new medium: v and λ change together, $\lambda \propto v$.
- x vibrations of a fork: wave travels distance xλ.
- N waves counted in time t: $n = \frac{N}{t}$.
- A wave front is a surface of equal phase: spherical from a point source, plane far from it.



Rays are perpendicular to wave fronts

17.1.4 Pitch, loudness and quality

- **Pitch** depends on frequency: high frequency sounds shrill.
- Female voice has higher pitch than male voice; a mosquito higher than a lion.
- **Loudness** is the sensation of intensity; it also depends on the ear.
- **Quality** (timbre) depends on the overtones present: it separates two sounds of equal pitch and intensity.
- Percussion instruments are struck: tabla, drum, dholak. Flute is a wind instrument; sitar and violin are string instruments.

17.1.5 Energy flow per unit area per second

$$I = 2\pi^2 n^2 a^2 \rho v$$

- At fixed medium: $I \propto a^2 n^2$.
- From a point source, the energy spreads over a sphere.

$$I = \frac{P}{4\pi r^2}$$

- So $I \propto \frac{1}{r^2}$ and $a \propto \frac{1}{r}$.
- Two instruments of equal energy: $a_1 n_1 = a_2 n_2$.

17.1.6 The decibel scale

$$L = 10 \log_{10} \frac{I}{I_0}$$

- $I_0 = 10^{-12}$ W m^{-2} is the threshold of hearing.
- Every extra 10 dB multiplies the intensity by 10.
- Level difference of 30 dB: intensity ratio 1000.
- Doubling the intensity adds about 3 dB.

JEE · NEET Corner

Shock waves and Mach number

- A body faster than sound (supersonic) leaves a cone-shaped shock wave behind it.

$$\text{Mach number} = \frac{\text{speed of source}}{\text{speed of sound}}$$

Reverberation and Sabine's law

- Reverberation: sound persists in a hall after the source stops.
- V = volume of the hall, A = total absorption of its surfaces.

$$T = \frac{0.16\ V}{A}$$

- All dimensions doubled: V becomes 8 times and A becomes 4 times, so T doubles.

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Solved Examples 01 Wave Basics & Properties of Sound

SOLVED 1 MHT CET 2024 · 11 May · Shift 2

Which of the following statements is NOT true?

(a) Sound wave travels in a straight line.
(b) Sound is propagated as waves.
(c) Sound can travel through vacuum.
(d) Sound is a form of energy.

STEP 1 Sound is a mechanical wave and needs a material medium.
STEP 2 It cannot travel through vacuum, so statement (C) is false.
STEP 3 Statement NOT true: **(C)**

Answer: **(c)**

SOLVED 2 MHT CET 2026 · 20 May · Shift 1

A body sends waves 150 mm long through medium P and 0.30 m long in medium Q. If the velocity of wave in medium P is 80 cm/s, the velocity of wave in medium Q in m/s is

(a) 1.6 (b) 2.0
(c) 3.2 (d) 3.8

STEP 1 Frequency is the same in both media, so $v \propto \lambda$.
STEP 2 $v_Q = v_P \times \frac{\lambda_Q}{\lambda_P} = 0.8 \times \frac{0.30}{0.15}$
STEP 3 v_Q = **1.6 m/s**

Answer: **(a)**

SOLVED 3 MHT CET 2026 · 18 Apr · Shift 1

The number of waves counted by an observer on the sea-coast in one minute is 54. If the wavelength of the waves is 5 m then the velocity of the waves in m/s will be

(a) 4.5 (b) 5.4
(c) 6.3 (d) 7.2

STEP 1 $n = \frac{54}{60} = 0.9$ Hz
STEP 2 $v = n\lambda = 0.9 \times 5$
STEP 3 v = **4.5 m/s**

Answer: **(a)**

SOLVED 4 MHT CET 2026 · 13 Apr · Shift 2

Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. Which of the following is correct about the wavelength of a 700 Hz acoustic wave as it enters brass from warm air?

(a) It increase by a factor 20
(b) It decrease by a factor 10
(c) It increase by a factor 10
(d) It decrease by a factor 20

STEP 1 Frequency stays 700 Hz when the medium changes.
STEP 2 $\lambda = \frac{v}{n}$: $\lambda_{air} = 0.5$ m, $\lambda_{brass} = 5$ m
STEP 3 Wavelength **increases 10 times**

Answer: **(c)**

SOLVED 5 MHT CET 2024 · 10 May · Shift 2

Prong of a vibrating tuning fork is in contact with water surface. It produces concentric circular waves on the surface of water. The distance between five consecutive crests is 0.8 m and the velocity of wave on the water surface is 56 m/s. The frequency of tuning fork is

(a) 256 Hz (b) 280 Hz
(c) 341 Hz (d) 512 Hz

STEP 1 Five consecutive crests span 4 wavelengths: $4\lambda = 0.8$ m, $\lambda = 0.2$ m.
STEP 2 $n = \frac{v}{\lambda} = \frac{56}{0.2}$
STEP 3 n = **280 Hz**

Answer: **(b)**

SOLVED 6 AIEEE 2007

A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(a) 100 (b) 1000
(c) 10000 (d) 10

STEP 1 Drop in level: $10 \log_{10} \frac{I_1}{I_2} = 20$
STEP 2 $\log_{10} \frac{I_1}{I_2} = 2$
STEP 3 Intensity falls by a factor **100**

Answer: **(a)**

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Solved Examples 01 Wave Basics & Properties of Sound (contd.)

SOLVED 7 MHT CET 2023 · 11 May · Shift 2

A sound of frequency 480 Hz is emitted from the stringed instrument. The velocity of sound in air is 320 m/s. After completing 180 vibrations, the distance covered by a wave is

(a) 60 m (b) 90 m
(c) 120 m (d) 180 m

STEP 1 Time for 180 vibrations: $t = \frac{180}{480} = 0.375$ s
STEP 2 Distance = $v\,t = 320 \times 0.375$
STEP 3 Distance = **120 m**

Answer: **(c)**

SOLVED 8 MHT CET 2026 · 20 Apr · Shift 1

The 'Loudness' and 'Pitch' of sound respectively are the human perception to

(a) intensity of sound and frequency of sound.
(b) intensity of sound and velocity of sound.
(c) frequency of sound and velocity of sound.
(d) frequency of sound and intensity of sound.

STEP 1 Loudness is the ear's response to the intensity (energy) of sound.
STEP 2 Pitch is the ear's response to the frequency of sound.
STEP 3 Correct pair: **(A)**

Answer: **(a)**

SOLVED 9 MHT CET 2026 · 19 Apr · Shift 1

Which one of the following statements regarding pitch of sound is 'WRONG'?
(A) Pitch refers to sharpness of sound. (B) Tone refers to the single frequency of that wave. (C) High pitch sound need not be louder. (D) In general male sound is sharper than that of a female.

(a) D (b) A
(c) C (d) B

STEP 1 Pitch means sharpness and depends on frequency, not on loudness.
STEP 2 A female voice has the higher frequency, so it is sharper.
STEP 3 Statement (D) is wrong: option **(A)**

Answer: **(a)**

SOLVED 10 MHT CET 2026 · 19 May · Shift 1

The amplitude of a sound wave at a distance r from a point source is A. The amplitude at a distance 2r from the point source is

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

STEP 1 Intensity $I \propto A^2$ and $I \propto \frac{1}{r^2}$, so $A \propto \frac{1}{r}$.
STEP 2 Distance doubles, so amplitude halves.
STEP 3 $A' = \frac{A}{2}$

Answer: **(b)**

SOLVED 11 MHT CET 2024 · 16 May · Shift 1

How many times more intense is a 60 dB sound than a 30 dB sound?

(a) 2 (b) 4
(c) 1000 (d) 10000

STEP 1 $\beta_2 - \beta_1 = 10 \log_{10} \frac{I_2}{I_1} = 30$
STEP 2 $\log_{10} \frac{I_2}{I_1} = 3$
STEP 3 $\frac{I_2}{I_1} = \mathbf{1000}$

Answer: **(c)**

SOLVED 12 MHT CET 2026 · 13 Apr · Shift 1

Waves having a velocity 10 m/s, strike a stationary boat near the sea shore. The distance between two consecutive crests of the waves is 40 m. After how many seconds, the consecutive waves strike the boat?

(a) 8 s (b) 6 s
(c) 4 s (d) 2 s

STEP 1 Crest to crest distance is the wavelength: $\lambda = 40$ m.
STEP 2 $T = \frac{\lambda}{v} = \frac{40}{10}$
STEP 3 $T = \mathbf{4\ s}$

Answer: **(c)**

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02 CONCEPT Speed of Waves on a String

IN ONE LINE

Speed of a wave on a string depends only on the **tension** and the **mass per unit length**.

17.2.1 Transverse wave on a stretched string

$$v = \sqrt{\frac{T}{\mu}}$$

- T = tension, μ = mass per unit length.
- $\mu = \pi r^2 \rho$ for a wire of radius r and density ρ.
- Stress $S = \frac{T}{\text{area}}$, so:

$$v = \sqrt{\frac{S}{\rho}}$$

- Thicker wire, same tension and material: $v \propto \frac{1}{r}$.
- Frequency does not change the speed; it only changes the wavelength.

17.2.2 Quick changes

- $v \propto \sqrt{T}$, so $T = k v^2$: to make v thrice, T must be 9 times.
- Small changes: percentage change in v is half the percentage change in T.

$$\frac{\Delta v}{v} = \frac{1}{2}\frac{\Delta T}{T}$$

- Large changes: use the ratio, never the half rule. 40% more v needs T × 1.96.
- Stretched elastically: T = YA × strain, so

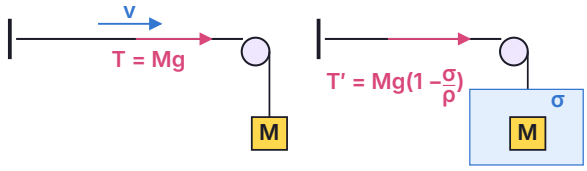
$$v = \sqrt{\frac{Y \times \text{strain}}{\rho}}$$

17.2.3 Pulse on a string

$$t = \frac{l}{v}$$

- Two wires joined: add the times, $t = t_1 + t_2$; the tension is common, and v differs in each.

17.2.4 Hanging mass, in air and in a liquid



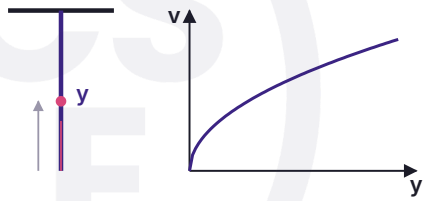
Immersing the load reduces the tension by the buoyant force

$$v = \sqrt{\frac{Mg}{\mu}}$$

- ρ is the density of the load, σ the density of the liquid.

$$v' = v\sqrt{1 - \frac{\sigma}{\rho}}$$

17.2.5 Tension varies along the rope



Speed grows as the square root of the height from the free end

- At height y from the lower end, tension = weight of the rope below it.

$$v = \sqrt{gy}$$

- At the top of a rope of length L: $v = \sqrt{gL}$. At the middle: $v = \sqrt{\frac{gL}{2}}$.
- Time for a pulse to climb the whole rope does not depend on its mass:

$$t = 2\sqrt{\frac{L}{g}}$$

17.2.6 Rope of mass m_1 with block m_2 at the end

- The pulse is made at the bottom and read at the top.
- Frequency stays constant, so $\lambda \propto v \propto \sqrt{T}$.

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WAVE MOTION

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

320	34	8
questions	concepts	topics

CONTENTS

01	Wave Basics & Properties of Sound	Q 1–33	33 Qs
02	Speed of Waves	Q 34–52	19 Qs
03	Progressive Wave Equation	Q 53–133	81 Qs
04	Reflection, Superposition & Interference	Q 134–147	14 Qs
05	Stationary Waves & Vibrating Strings	Q 148–206	59 Qs
06	Organ Pipes & Resonance Tube	Q 207–249	43 Qs
07	Beats	Q 250–286	37 Qs
08	Doppler Effect	Q 287–320	34 Qs
	Answer key		

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TOPIC 01

Wave Basics & Properties of Sound

33 PYQs · Easy 33 · Medium 0 · Difficult 0 | MHT CET 20 · NEET 9 · JEE 4

Concepts covered: Nature and types of waves (4) · Wave relation v = nλ (16) · Pitch, loudness and musical instruments (4) · Intensity and sound level (6) · Related oscillation questions (3)

LEVEL 1 · EASY 33 questions

◆ Nature and types of waves 4 Qs

1. Which of the following statements is NOT true?
MHT CET 2024 · 11 MAY · SHIFT 2
(a) Sound wave travels in a straight line.
(b) Sound is propagated as waves.
(c) Sound can travel through vacuum.
(d) Sound is a form of energy.

2. Which one of the following statements is true?
MHT CET 2021 · 20 SEP · SHIFT 2
(a) The sound waves in air are longitudinal while the light waves in air are transverse.
(b) Both light and sound waves in air are transverse.
(c) Both light and sound waves in air are longitudinal.
(d) The sound waves are transverse and light waves are longitudinal.

3. Which one of the following statements is true?
AIPMT 2006
(a) both light and sound waves can travel in vacuum
(b) both light and sound waves in air are transverse
(c) The sound waves in air are longitudinal while the light waves are transverse
(d) both light and sound waves in air are longitudinal

4. With the propogation of a longitudinal wave through a material medium, the quantities transmitted in the propogation direction are
AIPMT 1992
(a) energy, momentum and mass
(b) energy
(c) energy and mass
(d) energy and linear momentum

◆ Wave relation v = nλ 16 Qs

5. A body sends waves 150 mm long through medium P and 0.30 m long in medium Q. If the velocity of wave in medium P is 80 cm/s, the velocity of wave in medium Q in m/s is
MHT CET 2026 · 20 MAY · SHIFT 1
(a) 1.6 (b) 2.0 (c) 3.2 (d) 3.8

6. A body sends a wave 150 mm long through medium P and 0.30 m long in medium Q. If velocity of the wave in medium P is 80 cm s^{-1}, the velocity of wave in medium Q is
MHT CET 2026 · 19 APR · SHIFT 2
(a) 4.0 m s^{-1} (b) 3.2 m s^{-1}
(c) 2.0 m s^{-1} (d) 1.6 m s^{-1}

7. The number of waves counted by an observer on the sea-coast in one minute is 54. If the wavelength of the waves is 5 m then the velocity of the waves in m/s will be
MHT CET 2026 · 18 APR · SHIFT 1
(a) 4.5 (b) 5.4 (c) 6.3 (d) 7.2

8. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. Which of the following is correct about the wavelength of a 700 Hz accoustic wave as it enters brass from warm air?
MHT CET 2026 · 13 APR · SHIFT 2
(a) It increase by a factor 20
(b) It decrease by a factor 10
(c) It increase by a factor 10
(d) It decrease by a factor 20

9. Waves having a velocity 10m/s, strike a stationary boat near the sea shore. The distance between two consecutive crests of the waves is 40m. After how many second, the consecutive waves strike the boat?
MHT CET 2026 · 13 APR · SHIFT 1
(a) 8 s (b) 6 s (c) 4 s (d) 2 s

10. An observer on sea-coast counts 45 waves in one minute. If the wavelength of the waves is 7 m, then the velocity of the waves will be
MHT CET 2025 · 21 APR · SHIFT 1
(a) 4.75 m/s (b) 5.25 m/s
(c) 7.5 m/s (d) 8.65 m/s

11. Prong of a vibrating tuning fork is in contact with water surface. It produces concentric circular waves on the surface of water. The distance between five consecutive crests is 0.8 m and the velocity of wave on the water surface is 56 m/s. The frequency of tuning fork is
MHT CET 2024 · 10 MAY · SHIFT 2
(a) 256 Hz (b) 280 Hz (c) 341 Hz (d) 512 Hz

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12. A sound of frequency 480 Hz is emitted from the stringed instrument. The velocity of sound in air is 320 m/s. After completing 180 vibrations, the distance covered by a wave is

MHT CET 2023 · 11 MAY · SHIFT 2

(a) 60 m (b) 90 m (c) 120 m (d) 180 m

13. Two tuning forks of frequencies 320 Hz and 480 Hz are sounded together to produce sound waves. The velocity of sound in air is 320 ms^{-1}. The difference between wavelengths of these waves is nearly

MHT CET 2021 · 24 SEP · SHIFT 1

(a) 48 cm (b) 16.5 cm (c) 33 cm (d) 42 cm

14. The frequency of a tuning fork is 220 Hz and the velocity of sound in air is 330 m/s. When the tuning fork completes 80 vibrations, the distance travelled by the sound wave is

MHT CET 2021 · 23 SEP · SHIFT 2

(a) 120 m (b) 60 m (c) 53 m (d) 100 m

15. The frequency of a tuning fork is 'n' Hz and velocity of sound in air is 'V' m/s. When the tuning fork completes 'x' vibrations, the distance travelled by the wave is

MHT CET 2021 · 20 SEP · SHIFT 1

(a) $\frac{V}{xn}$ (b) $\frac{Vn}{x}$ (c) $\frac{xV}{n}$ (d) $\frac{x}{Vn}$

16. 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

AIPMT 2011 · PRELIMS

(a) decrease by a factor 10
(b) increase by a factor 20
(c) increase by a factor 10
(d) decrease by a factor 20

17. In a sinusoidal wave, the time required for a particular point, to move from maximum displacement to zero displacement is 0.170 s. The frequency of the wave is

AIPMT 1998

(a) 1.47 Hz (b) 0.36 Hz (c) 0.73 Hz (d) 2.94 Hz

18. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating frequency of the scanner is 4.2 MHz. The speed of sound in a tissue is 1.7 km/s. The wavelength of sound in the tissue is close to

AIPMT 1995

(a) 4×10^{-3} m (b) 8×10^{-3} m
(c) 4×10^{-4} m (d) 8×10^{-4} m

19. If a wave gets refracted into a denser medium, then which of the following is true?

JEE MAIN 2022 · 27 JUN · SHIFT 2

(a) wavelength, speed and frequency decreases.
(b) wavelength increases, speed decreases and frequency remains constant.
(c) wavelength and speed decreases but frequency remains constant.
(d) wavelength, speed and frequency increases.

20. In a transverse wave the distance between a crest and neighbouring trough at the same instant is 4.0 cm and the distance between a crest and trough at the same place is 1.0 cm. The next crest appears at the same place after a time interval of 0.4 s. The maximum speed of the vibrating particles in the medium is:

JEE MAIN 2013 · 25 APR · SHIFT 1

(a) $\frac{3\pi}{2}$ cm/s (b) $\frac{5\pi}{2}$ cm/s
(c) $\frac{\pi}{2}$ cm/s (d) 2π cm/s

◆ Pitch, loudness and musical instruments 4 Qs

21. The 'Loudness' and 'Pitch' of sound respectively are the human perception to

MHT CET 2026 · 20 APR · SHIFT 1

(a) intensity of sound and frequency of sound.
(b) intensity of sound and velocity of sound.
(c) frequency of sound and velocity of sound.
(d) frequency of sound and intensity of sound.

22. Which one of the following statements regarding pitch of sound is 'WRONG'?

(A) Pitch refers to sharpness of sound.
(B) Tone refers to the single frequency of that wave.
(C) High pitch sound need not be louder.
(D) In general male sound is sharper than that of a female.

MHT CET 2026 · 19 APR · SHIFT 1

(a) D (b) A (c) C (d) B

23. Out of the following musical instruments which is ' NOT ' a percussion instrument?

MHT CET 2026 · 17 APR · SHIFT 1

(a) Drum (b) Saxophone
(c) Daphali (d) Xylophone

24. Out of the following musical instruments, which is 'NOT' a percussion instrument?

MHT CET 2024 · 9 MAY · SHIFT 1

(a) Daphali (b) Sambal (c) Cymbals (d) Clarinet

◆ Intensity and sound level 6 Qs

25. The amplitude of a sound wave at a distance r from a point source is A. The amplitude at a distance $2r$ from the point source is

MHT CET 2026 · 19 MAY · SHIFT 1

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

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26. How many times more intense is a 60 dB sound than a 30 dB sound?

MHT CET 2024 · 16 MAY · SHIFT 1

(a) 2 (b) 4 (c) 1000 (d) 10000

27. The time of reverberation of a room A is one second. What will be the time (in seconds of reverberation of a room, having all the dimensions double of those of room A?

AIPMT 2006

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

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

AIPMT 2005

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

29. A point source is kept at the center of a spherically enclosed detector. If the volume of the detector increased by 8 times, the intensity will

JEE MAIN 2026 · 24 JAN · SHIFT 2

(a) increase by 64 times (b) decrease by 4 times
(c) decrease by 8 times (d) increase by 8 times

30. A point source is emitting sound waves of intensity $16 \times 10^{-8}\ \mathrm{Wm}^{-2}$ at the origin. The difference in intensity (magnitude only) at two points located at distances of $2m$ and $4m$ from the origin respectively will be _____ $\times 10^{-8}\ \mathrm{Wm}^{-2}$.

JEE MAIN 2024 · 30 JAN · SHIFT 2 *(Numerical)*

◆ Related oscillation questions 3 Qs

31. A rectangular block of mass 'm' and crosssectional area A, floats on a liquid of density 'ρ'. It is given a small vertical displacement from equilibrium, it starts oscillating with frequency 'n' equal to ($g =$ acceleration due to gravity)

MHT CET 2023 · 11 MAY · SHIFT 2

(a) $\frac{1}{2\pi}\sqrt{\frac{\mathrm{Apg}}{\mathrm{m}}}$ (b) $2\pi\sqrt{\frac{\mathrm{Apg}}{\mathrm{m}}}$
(c) $\frac{1}{2\pi}\sqrt{\frac{\mathrm{m}}{\mathrm{Apg}}}$ (d) $2\pi\sqrt{\frac{\mathrm{m}}{\mathrm{Apg}}}$

32. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = a sin(ωt + π/6). After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

AIPMT 2008

(a) T/3 (b) T/12 (c) T/8 (d) T/6

33. The equations of two waves acting in perpendicular directions are given as
x = $a$cos(ωt +δ) and y = $a$cos(ωt + α), where $\delta = \alpha + \frac{\pi}{2}$, the resultant wave represents

AIPMT 2000

(a) a parabola (b) a circle
(c) an ellipse (d) a straight line

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TOPIC 02

Speed of Waves

19 PYQs · Easy 19 · Medium 0 · Difficult 0 | MHT CET 7 · NEET 4 · JEE 8

Concepts covered: Speed on a stretched string (10) · Speed of sound in solids, liquids and gases (5) · Effect of temperature, pressure and humidity (4)

LEVEL 1 · EASY 19 questions

◆ Speed on a stretched string 10 Qs

34. The speed of a wave on a string is 150 m/s when the tension is 120 N. The percentage increase in the tension to raise the wave speed by 20% is
MHT CET 2026 · 15 MAY · SHIFT 1
(a) 44% (b) 40% (c) 20% (d) 10%

35. A wire is under tension of 2 kg wt and a wave is travelling through it with some speed. Tension in the wire is so increased that the wave travels through it with thrice the original speed. The increase in tension is (in kg wt)
MHT CET 2026 · 15 APR · SHIFT 1
(a) 4 (b) 8 (c) 16 (d) 12

36. A string of mass 0.2 Kg is under a tension of 2.5 N. The length of the string is 2 m. A transverse wave starts from one end of the string. The time taken by the wave to reach the other end is
MHT CET 2024 · 9 MAY · SHIFT 2
(a) 0.2 s (b) 0.4 s (c) 0.6 s (d) 0.8 s

37. A uniform metal wire has length L, mass M and density ρ. It is under tension T and v is the speed of transverse wave along the wire. The area of cross-section of the wire is
MHT CET 2020 · 19 OCT · SHIFT 2
(a) $\frac{T}{v^2\rho}$ (b) $\frac{v^2\rho}{T}$ (c) $T^2\rho V$ (d) $Tv^2\rho$

38. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is
NEET 2022 · PHASE 1
(a) 1: 1 (b) $\sqrt{2}$: 1 (c) 1: $\sqrt{2}$ (d) 1: 2

39. A 5.5 metre length of string has a mass of 0.035 kg. If the tension in the string in 77 N, the speed of a wave on the string is
AIPMT 1989
(a) 110 m s^{-1} (b) 165 m s^{-1}
(c) 77 m s^{-1} (d) 102 m s^{-1}

40. Two strings with circular cross section and made of same material, are stretched to have same amount of tension. A transverse wave is then made to pass through both the strings. The velocity of the wave in the first string having the radius of cross section R is v_1, and that in the other string having radius of cross section R/2 is v_2. Then $\frac{v_2}{v_1}$ =
JEE MAIN 2025 · 8 APR · SHIFT 2
(a) 8 (b) 4 (c) 2 (d) $\sqrt{2}$

41. A steel wire with mass per unit length 7.0×10^{-3} kg m^{-1} is under tension of 70 N. The speed of transverse waves in the wire will be:
JEE MAIN 2023 · 1 FEB · SHIFT 1
(a) 10 m/s (b) 50 m/s
(c) 100 m/s (d) 200π m/s

42. A transverse wave travels on a taut steel wire with a velocity of v when tension in it is 2.06 × 104 N. When the tension is changed to T, the velocity changed to v/2. The value of T is close to:
JEE MAIN 2020 · 8 JAN · SHIFT 2
(a) 30.5 × 104 N (b) 2.50 × 104 N
(c) 10.2 × 102 N (d) 5.15 × 103 N

43. The percentage increase in the speed of transverse waves produced in a stretched string if the tension is increased by 4%, will be _____%.
JEE MAIN 2021 · 25 FEB · SHIFT 2 *(Numerical)*

◆ Speed of sound in solids, liquids and gases 5 Qs

44. The wavelength of sound in any gas depends upon
MHT CET 2021 · 24 SEP · SHIFT 1
(a) intensity of sound waves only
(b) wavelength of sound only
(c) density and elasticity of the gas
(d) amplitude and frequency of sound

45. The velocity of sound in any gas depends upon
AIPMT 1988
(a) wavelength of sound only
(b) density and elasticity of gas
(c) intensity of sound waves only
(d) amplitude and frequency of sound

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46. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason **R**

Assertion A: A sound wave has higher speed in solids than gases.

Reason R: Gases have higher value of Bulk modulus than solids.

In the light of the above statements, choose the correct answer from the options given below

JEE MAIN 2025 · 28 JAN · SHIFT 1

(a) Both **A** and **R** are true and **R** is the correct explanation of **A**
(b) **A** is false but **R** is true
(c) **A** is true but **R** is false
(d) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

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47. The speed of sound in oxygen at S.T.P. will be approximately: (given, $R = 8.3\ \text{JK}^{-1}, \gamma = 1.4$)

JEE MAIN 2024 · 31 JAN · SHIFT 2

(a) 341 m/s (b) 333 m/s (c) 325 m/s (d) 315 m/s

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48. The ratio of speed of sound in hydrogen gas to the speed of sound in oxygen gas at the same temperature is:

JEE MAIN 2023 · 6 APR · SHIFT 2

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

◆ Effect of temperature, pressure and humidity 4 Qs

49. What is the effect of humidity on sound waves when humidity increases?

MHT CET 2026 · 11 APR · SHIFT 1

(a) Speed of sound waves is more.
(b) Speed of sound waves is less.
(c) Speed of sound waves remains same.
(d) Speed of sound waves becomes zero.

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50. What is the effect of pressure on the speed of sound in a medium, if pressure is doubled at constant temperature?

MHT CET 2021 · 23 SEP · SHIFT 2

(a) Remains same (b) Reduced to half
(c) Gets doubled (d) Becomes 4 times

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51. The temperature at which the speed of sound becomes double as was at 27°C is

AIPMT 1993

(a) 273°C (b) 0°C (c) 927°C (d) 1027°C

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52. The velocity of sound in air is doubled when the temperature is raised from 0°C to $\alpha^\circ\text{C}$. The value of α is ____.

JEE MAIN 2026 · 23 JAN · SHIFT 2 *(Numerical)*

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TOPIC 03

Progressive Wave Equation

81 PYQs · Easy 81 · Medium 0 · Difficult 0 | MHT CET 46 · NEET 17 · JEE 18

Concepts covered: Reading the wave equation (29) · Writing the wave equation and its direction (9) · Particle velocity and wave velocity (5) · Phase difference and path difference (38)

LEVEL 1 · EASY 81 questions

◆ Reading the wave equation 29 Qs

53. The equation of a wave is $y = 0.07\sin(12\pi x - 3000\pi t)$ where x is in metre and t is in second then $_1$ m m

MHT CET 2026 · 15 MAY · SHIFT 1

(a) $\lambda = \frac{}{}$ m, $v = 250$ —

(b) $a = 0.07$ m, $v = 500$ — 6 s s m $_1$ m

(c) $n = 1500$ Hz, $v = 200$ —

(d) $\lambda = \frac{}{}$ m, $v = 500$ — s 3 s

54. The equation of a plane progressive wave is $Y = 0.025\sin(100t + 0.25x)$. The frequency of this wave would be

MHT CET 2026 · 14 MAY · SHIFT 2

(a) $__^{50}$ Hz (b) $___^{100}$ Hz

(c) 100 Hz (d) 50 Hz π π

55. The equation of wave motion is $Y = 6\sin\left(12\pi t - 0.02\pi x + \frac{\pi}{3}\right)$ where x is in metre and time in second. The velocity of the wave is

MHT CET 2026 · 16 APR · SHIFT 1

(a) 200 m/s (b) 300 m/s (c) 400 m/s (d) 600 m/s

56. A traveling wave is described by the equation $y(x,t) = [0.05\sin(8x - 4t)]$ m

The velocity of the wave is [All the quantities are in SI unit]

MHT CET 2026 · 13 APR · SHIFT 2

(a) 4 ms^{-1} (b) 2 ms^{-1} (c) 0.5 ms^{-1} (d) 8 ms^{-1}

57. The equation of a progressive wave is $Y = 3\sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where X and Y are in metre and time in second. Which of the following is correct?

MHT CET 2026 · 11 APR · SHIFT 2

(a) Velocity = 1.5 m/s (b) Amplitude = 30 cm

(c) Wavelength = 10 m (d) Frequency = 0.2 Hz

58. The equation of a progressive wave is $Y = 3\sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where x and y are in meter and time in second. Which of the following is correct?

MHT CET 2025 · 21 APR · SHIFT 2

(a) Wavelength = 10 m (b) Velocity = 1.5 m/s

(c) Amplitude = 3 cm (d) Frequency = 0.2 Hz

59. A wave is given by $Y = 3\sin 2\pi\left(\frac{t}{0.04} - \frac{x}{0.01}\right)$ where Y is in cm. Frequency of the wave and maximum acceleration will be $(\pi^2 = 10)$

MHT CET 2024 · 15 MAY · SHIFT 2

(a) 100 Hz, 4.7×10^4 cm/s^2

(b) 50 Hz, 7.5×10^3 cm/s^2

(c) 25 Hz, 4.7×10^4 cm/s^2

(d) 25 Hz, 7.5×10^4 cm/s^2

60. The equation of wave motion is $Y = 5\sin(10\pi t - 0.02\pi x + \pi/3)$ where x is in metre and t in second. The velocity of the wave is

MHT CET 2023 · 12 MAY · SHIFT 2

(a) 300 m/s (b) 400 m/s (c) 500 m/s (d) 600 m/s

61. The equation of wave is $Y = 6\sin\left(12\pi t - 0.02\pi x + \frac{\pi}{3}\right)$ where 'x' is in m and 't' in s. The velocity of the wave is

MHT CET 2023 · 10 MAY · SHIFT 2

(a) 200 m/s (b) 300 m/s (c) 400 m/s (d) 600 m/s

62. Equation of two simple harmonic waves are given by $Y_1 = 2\sin 8\pi\left(\frac{t}{0.2} - \frac{x}{2}\right)m$ and $Y_2 = 4\sin 8\pi\left(\frac{t}{0.16} - \frac{x}{1.6}\right)m$ then both waves have

MHT CET 2021 · 21 SEP · SHIFT 2

(a) same period (b) same frequency

(c) same wavelength (d) same velocity

63. The displacement of a travelling wave $y = C\sin\frac{2\pi}{\lambda}(at - x)$ where t is time, x is distance and λ is the wavelength, all in S.I. units. Then the frequency of the wave is

NEET 2024

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

64. A transverse wave propagating along x-axis is represented by y(x, t) = 8.0 sin (0.5 πx − 4πt − π/4) where x is in metres and t is in seconds. The speed of the wave is

AIPMT 2006

(a) 8 m/s (b) 4π m/s

(c) 0.5π m/s (d) π/4 m/s.

65. The equation of a wave is represented by y = 10^{-4} sin(100t − $\frac{x}{10}$) m. then the velocity of wave will be

AIPMT 2001

(a) 100 m/s (b) 4 m/s (c) 1000 m/s (d) 10 m/s

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66. The equation of a sound wave is $y = 0.0015\sin(62.4x + 316t)$. The wavelength of this wave is
AIPMT 1996
(a) 0.3 unit (b) 0.2 unit
(c) 0.1 unit (d) cannot be calculated

67. The frequency of sinusodial wave $y = 0.40\cos[2000t + 0.80]$ would be
AIPMT 1992
(a) 1000π Hz (b) 2000 Hz
(c) 20 Hz (d) $\frac{1000}{\pi}$ Hz

68. Equation of progressive wave is given by $y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{\pi}{6}\right]$ where y, x are in cm and t is in seconds. Then which of the following is correct?
AIPMT 1988
(a) $v = 5$ cm (b) $\lambda = 18$ cm
(c) $a = 0.04$ cm (d) $f = 50$ Hz

69. The equation of a plane progressive wave is given by $y = 5\cos\pi\left(200t - \frac{x}{150}\right)$ where x and y are in cm and t is in second. The velocity of the wave is _____ m/s.
JEE MAIN 2026 · 2 APR · SHIFT 1
(a) 120 (b) 150 (c) 200 (d) 300

70. Displacement of a wave is expressed as $x(t) = 5\cos\left(628t + \frac{\pi}{2}\right)$m. The wavelength of the wave when its velocity is 300 m/s is:
$(\pi = 3.14)$
JEE MAIN 2025 · 4 APR · SHIFT 2
(a) 0.33 m (b) 0.5 m (c) 3 m (d) 5 m

71. The equation of a transverse wave travelling along a string is
$y(x,t) = 4.0\sin\left[20 \times 10^{-3}x + 600t\right]$mm, where x is in mm and t is in second. The velocity of the wave is:
JEE MAIN 2025 · 23 JAN · SHIFT 2
(a) -60 m/s (b) $+60$ m/s
(c) $+30$ m/s (d) -30 m/s

72. A plane progressive wave is given by $y = 2\cos 2\pi(330t - x)$m. The frequency of the wave is:
JEE MAIN 2024 · 8 APR · SHIFT 2
(a) 660 Hz (b) 340 Hz (c) 330 Hz (d) 165 Hz

73. A travelling wave is described by the equation
$y(x,t) = [0.05\sin(8x - 4t)]$ m
The velocity of the wave is: [all the quantities are in SI unit]
JEE MAIN 2023 · 24 JAN · SHIFT 1
(a) 4 ms^{-1} (b) 2 ms^{-1}
(c) 8 ms^{-1} (d) 0.5 ms^{-1}

74. In the wave equation
$y = 0.5\sin\frac{2\pi}{\lambda}(400t - x)$ m
the velocity of the wave will be:
JEE MAIN 2022 · 28 JUL · SHIFT 1
(a) 200 m/s (b) $200\sqrt{2}$ m/s
(c) 400 m/s (d) $400\sqrt{2}$ m/s

75. A travelling harmonic wave is represented by the equation y(x,t) = 10–3sin (50t + 2x), where, x and y are in metre and t is in seconds. Which of the following is a correct statement about the wave?
JEE MAIN 2019 · 12 JAN · SHIFT 1
(a) The wave is propagating along the positive x-axis with speed 100 ms–1
(b) The wave is propagating along the positive x-axis with speed 25 ms–1
(c) The wave is propagating along the negative x-axis with speed 25 ms–1
(d) The wave is propagating along the negative x-axis with speed 100 ms–1

76. A wave travelling along the x-axis is described by the equation $y(x,t) = 0.005\cos(\alpha x - \beta t)$. If the wavelength and the time period of the wave are 0.08 m and 2.0s, respectively, then α and β in appropriate units are
AIEEE 2008
(a) $\alpha = 25.00\pi$, $\beta = \pi$ (b) $\alpha = \frac{0.08}{\pi}$, $\beta = \frac{2.0}{\pi}$
(c) $\alpha = \frac{0.04}{\pi}$, $\beta = \frac{1.0}{\pi}$ (d) $\alpha = 12.50\pi$, $\beta = \frac{\pi}{2.0}$

77. The displacement y of a particle in a medium can be expressed as, $y = 10^{-6}\sin\left(100t + 20x + \frac{\pi}{4}\right)$ m where t is in second and x in meter. The speed of the wave is
AIEEE 2004
(a) 20 m/s (b) 5 m/s
(c) 2000 m/s (d) 5 π m/s

78. The displacement y of a wave travelling in the x-direction is given by
$y = 10^{-4}\sin\left(600t - 2x + \frac{\pi}{3}\right)$ $metres$
where x is expressed in metres and t in seconds. The speed of the wave - motion, in ms^{-1}, is
AIEEE 2003
(a) 300 (b) 600 (c) 1200 (d) 200

79. A transverse wave on a string is described by $y = 3\sin(36t + 0.018x + \pi/4)$, where x, y are in cm and t in seconds. The least distance between the two successive crests in the wave is ____ cm. (Nearest integer)
$(\pi = 3.14)$
JEE MAIN 2026 · 5 APR · SHIFT 1 *(Numerical)*

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80. The equation of wave is given by
$Y = 10^{-2}\sin 2\pi(160t - 0.5x + \pi/4)$
where x and Y are in m and t in s. The speed of the wave is _____ km h^{-1}.
JEE MAIN 2023 · 11 APR · SHIFT 1 *(Numerical)*

81. A transverse harmonic wave on a string is given by
$y(x,t) = 5\sin(6t + 0.003x)$
where x and y are in cm and t in sec. The wave velocity is _____ ms^{-1}.
JEE MAIN 2023 · 10 APR · SHIFT 1 *(Numerical)*

◆ Writing the wave equation and its direction 9 Qs

82. A wave travelling in the positive x -direction having displacement along y-direction as $\frac{1}{1}$ m, wavelength 2π m and frequency $\frac{}{\pi}$ Hz is represented by
MHT CET 2026 · 14 MAY · SHIFT 1
(a) $y = \sin(x - 2t)$ (b) $y = \sin(2\pi x - 2\pi t)$
(c) $y = \sin(10\pi x - 20\pi t)$ (d) $y = \sin(2\pi x + 2\pi t)$

83. The displacement of a wave is given by $y = 0.002\sin(100t + x)$ where ' x 'and ' y ' are in metre and ' t ' is in second. This represents a wave
MHT CET 2024 · 3 MAY · SHIFT 1
(a) of wavelength one metre
(b) travelling with a velocity of 100 m/s in the negative x-direction
(c) of frequency $\left(\frac{100}{\pi}\right)$ Hz
(d) travelling with a velocity of $\left(\frac{50}{\pi}\right)$m/s in the positive x -direction

84. A wave travelling in the + ve x-direction having displacement along y-direction as 1 m, wavelength 2π m and frequency of $\frac{1}{\pi}$ Hz is represented by
NEET 2013
(a) $y = \sin(10\pi x - 20\pi t)$
(b) $y = \sin(2\pi x + 2\pi t)$
(c) $y = \sin(x - 2t)$
(d) $y = \sin(2\pi x - 2\pi t)$

85. The wave described by $y = 0.25\ \sin(10\pi x - 2\pi t)$, where x and y are in metres and t in seconds, is a wave travelling along the
AIPMT 2008
(a) +ve x direction with frequency 1 Hz and wavelength $\lambda = 0.2$ m.
(b) –ve x direction with amplitude 0.25 m and wavelength $\lambda = 0.2$ m.
(c) –ve x direction with frequency 1 Hz.
(d) +ve x direction with frequency π Hz and wavelength $\lambda = 0.2$ m.

86. A wave travelling in positive X-direction with a = 0.2 m, velocity = 360 ms^{-1} and $\lambda = 60$ m, then correct expression for the wave is
AIPMT 2002
(a) $y = 0.2\sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$
(b) $y = 0.2\sin\left[\pi\left(6t + \frac{x}{60}\right)\right]$
(c) $y = 0.2\sin\left[2\pi\left(6t - \frac{x}{60}\right)\right]$
(d) $y = 0.2\sin\left[\pi\left(6t - \frac{x}{60}\right)\right]$

87. Which one of the following represents a wave?
AIPMT 1994
(a) $y = A\sin(\omega t - kx)$
(b) $y = A\cos(at - bx + c)$
(c) $y = A\sin kx$
(d) $y = A\sin\omega t$

88. Which of the following equations correctly represents a travelling wave having wavelength λ = 4.0 cm, frequency ν = 100 Hz and travelling in positive x-axis direction?
JEE MAIN 2022 · 30 JUN · SHIFT 1
(a) $y = A\sin[(0.50\,\pi\,cm^{-1})x - (100\,\pi\,s^{-1})t]$
(b) $y = A\sin\,2\pi[(0.25\ cm^{-1})x - (50\,s^{-1})t]$
(c) $y = A\sin\left[\left(\frac{2\pi}{4}\ cm^{-1}\right)x - \left(\frac{2\pi}{100}\ s^{-1}\right)t\right]$
(d) $y = A\sin\,\pi[(0.5\ cm^{-1})x - (200\ s^{-1})t]$

89. Which of the following equations represents a travelling wave?
JEE MAIN 2021 · 24 FEB · SHIFT 2
(a) y = Aexcos(ωt − θ) (b) y = Ae−x2(vt + θ)
(c) y = A sin (15x − 2t) (d) y = A sinx cosωt

90. 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:
AIEEE 2011
(a) wave moving in $-x$ direction with speed $\sqrt{\frac{b}{a}}$
(b) standing wave of frequency $\sqrt{b}$
(c) standing wave of frequency $\frac{1}{\sqrt{b}}$
(d) wave moving in $+x$ direction with speed $\sqrt{\frac{a}{b}}$

◆ Particle velocity and wave velocity 5 Qs

91. The equation of a progressive wave is given by $y = 6\cos(100t - 4x)$ where y is in μm, x in metre and t in second. The ratio of the maximum particle velocity to the velocity of wave is
MHT CET 2026 · 19 APR · SHIFT 2
(a) 1.5×10^{-5} (b) 2.0×10^{-6}
(c) 2.4×10^{-5} (d) 2.8×10^{-6}

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92. A particle performs S.H.M. of amplitude 'A' and wavelength ' λ ', Then the velocity of the wave (V) and the maximum particle velocity (v) are related as

MHT CET 2025 · 23 APR · SHIFT 1

(a) $v = \frac{\lambda V}{4\pi A}$ (b) $V = \frac{\lambda v}{4\pi A}$
(c) $v = \frac{2\pi A}{\lambda} V$ (d) $V = \frac{2\pi A}{\lambda} v$

93. The equation of wave is $y = 60\sin(1200t - 6x)$, where ' y ' is in micron, ' t ' is in second and ' x ' is in metre. The ratio of maximum particle velocity to the wave velocity of wave propagation is

MHT CET 2025 · 22 APR · SHIFT 1

(a) 36 (b) 3.6×10^{-5}
(c) 3.6×10^{-4} (d) 3.6×10^{-6}

94. The equation of a progressive wave is $Y = a\sin 2\pi\left(nt - \frac{x}{5}\right)$. The ratio of maximum particle velocity to wave velocity is

MHT CET 2023 · 13 MAY · SHIFT 2

(a) $\frac{\pi a}{5}$ (b) $\frac{2\pi a}{5}$ (c) $\frac{3\pi a}{5}$ (d) $\frac{4\pi a}{5}$

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

AIPMT 2012 · MAINS

(a) 2π (b) $\frac{\pi}{2}\pi^3$ (c) 3π (d) $\frac{\pi}{3}\pi^2$

◆ Phase difference and path difference 38 Qs

96. In a sine wave, minimum distance between 2 particles always having same speed is

MHT CET 2026 · 15 MAY · SHIFT 2

(a) $\frac{\lambda}{2}$ (b) $\frac{\lambda}{4}$ (c) $\frac{\lambda}{3}$ (d) λ

97. Two points separated by 6 cm on a string has phase difference of 60°. If frequency of oscillation is 500 Hz, the velocity of the wave in $\frac{m}{s}$ is

MHT CET 2026 · 15 MAY · SHIFT 2

(a) 200 (b) 180 (c) 100 (d) 80

98. The path difference between two waves $Y_1 = a_1\sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $Y_2 = a_2\cos\left(\omega t - \frac{2\pi x}{\lambda} + \Phi\right)$ is

MHT CET 2026 · 13 MAY · SHIFT 2

(a) $\frac{\lambda\Phi}{2\pi}$ (b) $\frac{\lambda}{2\pi}\left(\Phi + \frac{\pi}{2}\right)$
(c) $\frac{\lambda}{2\pi}\left(\Phi - \frac{\pi}{2}\right)$ (d) $\frac{2\pi\Phi}{\lambda}$

99. Two points on a travelling wave having frequency 500 Hz and velocity 300 m/s are 60° out of phase, then the minimum distance between the two points is

MHT CET 2026 · 13 MAY · SHIFT 1

(a) 0.2 m (b) 0.1 m (c) 0.5 m (d) 0.4 m

100. The equation of a wave travelling on a string is $Y = \sin(20\pi x + 10\pi t)$, where x and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is

MHT CET 2026 · 12 MAY · SHIFT 2

(a) 2.5 cm (b) 5 cm (c) 20 cm (d) 10 cm

101. Two simple harmonic progressive waves have displacements $y_1 = 5\sin\left(\frac{2\pi x}{\lambda} - \omega t\right)$ and $y_2 = 5\cos\left(\frac{2\pi x}{\lambda} - \omega t + \frac{\pi}{6}\right)$. The phase difference between the two waves is

MHT CET 2026 · 12 MAY · SHIFT 1

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{2\pi}{3}$ (d) $\frac{3\pi}{2}$

102. Two waves are represented as
$y_1 = a_1\sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and
$y_2 = a_2\cos\left(\omega t - \frac{2\pi x}{\lambda} + \frac{\pi}{6}\right)$
The path difference between two waves is

MHT CET 2026 · 20 APR · SHIFT 2

(a) $\frac{\lambda}{5}$ (b) $\frac{\lambda}{4}$ (c) $\frac{\lambda}{3}$ (d) $\frac{\lambda}{2}$

103. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at given time interval of 0.01s is

MHT CET 2026 · 16 APR · SHIFT 1

(a) $-\frac{\pi}{4}$ rad (b) $-\frac{\pi}{2}$ rad
(c) π rad (d) $\frac{3\pi}{2}$ rad

104. A simple harmonic progressive wave is represented by $y = A\sin(120\pi t + 3x)$. The distance between two points on the wave at a phase difference of $\frac{\pi}{3}$ radian is

MHT CET 2026 · 15 APR · SHIFT 2

(a) $-\frac{\pi}{6}$ m (b) $-\frac{\pi}{9}$ m
(c) $\frac{2\pi}{9}$ m (d) $\frac{\pi}{18}$ m

105. Two waves are represented by the equations, $y_1 = a\sin(\omega t + kx + 0.57)$ m and $y_2 = a\cos(\omega t + kx)$ m, where x is in metre and t is in second. What is the phase difference between them? ($\pi = 3.14$)

MHT CET 2026 · 13 APR · SHIFT 2

(a) 0.57 radian (b) 1.57 radian
(c) 1.25 radian (d) 1.0 radian

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106. The distance between two consecutive points with phase difference of 60° in a wave of frequency n is x meter. The velocity with which wave is traveling is

MHT CET 2026 · 13 APR · SHIFT 2

(a) nx (b) $2nx$ (c) $3nx$ (d) $6nx$

107. The distance between two consecutive points with phase difference of 45° in a wave of frequency 300 Hz is 4.0 m. The velocity of the travelling wave is (in km/s)

MHT CET 2025 · 5 MAY · SHIFT 2

(a) 1.6 (b) 3.6 (c) 4.8 (d) 9.6

108. A progressive wave of frequency 400 Hz is travelling with velocity 336 m/s. How far apart are the two points on a wave which are 60° out of phase?

MHT CET 2025 · 19 APR · SHIFT 2

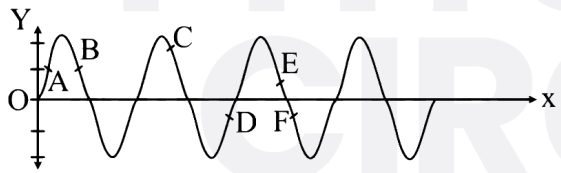
(a) 0.12 m (b) 0.14 m (c) 0.21 m (d) 0.28 m

109. Velocity of sound waves in air is 330 m/s. For a particular sound wave in air, path difference of 40 cm is equivalent to phase difference of 1.6π. frequency of this wave is

MHT CET 2024 · 15 MAY · SHIFT 2

(a) 165 Hz (b) 150 Hz (c) 660 Hz (d) 330 Hz

110. The diagram shows the propagation of a progressive wave. A, B, C, D, E are five points on this wave



Which of the following points are in the same state of vibration?

MHT CET 2024 · 9 MAY · SHIFT 2

(a) A, B (b) B, C (c) B, D (d) E, B

111. A transverse wave travelling along a stretched string has a speed of 30 m/s and a frequency of 250 Hz. The phase difference between two points on the string 10 cm apart at the same instant is

MHT CET 2024 · 4 MAY · SHIFT 2

(a) 0^c (b) $\left(\frac{\pi}{2}\right)^c$ (c) $\left(\frac{5\pi}{3}\right)^c$ (d) $\left(\frac{8\pi}{3}\right)^c$

112. The distance between two consecutive points with phase difference of 60° in wave of frequency 500 Hz is 0.6 m. The velocity with which wave is travelling is

MHT CET 2024 · 4 MAY · SHIFT 1

(a) 1.8 km/s (b) 9 km/s
(c) 3.6 km/s (d) 2.7 km/s

113. A progressive wave of frequency 400 Hz is travelling with a velocity 336 m/s. How far apart are the two points which are 60° out of phase?

MHT CET 2024 · 4 MAY · SHIFT 1

(a) 0.14 m (b) 0.21 m (c) 0.24 m (d) 0.28 m

114. The path difference between two waves $Y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $Y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$ is

MHT CET 2024 · 3 MAY · SHIFT 1

(a) $\frac{\lambda\phi}{2\pi}$ (b) $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$
(c) $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$ (d) $\frac{2\pi}{\lambda}\phi$

115. Two simple harmonic progressive waves have displacements $\rightarrow y_1 = a_1 \sin\left(\frac{2\pi x}{\lambda} - \omega t\right)$ and $y_2 = a_2 \cos\left(\frac{2\pi x}{\lambda} - \omega t + \phi\right)$ What is the phase difference between two waves?

MHT CET 2024 · 2 MAY · SHIFT 1

(a) $\left(\phi + \frac{\pi}{2}\right)$ (b) ϕ (c) $\left(\phi - \frac{\pi}{2}\right)$ (d) $(\phi + \pi)$

116. Velocity of sound waves in air is 330 m/s. For a particular sound wave in air, path difference of 40 cm is equivalent to phase difference of 1.6π. The frequency of this wave is

MHT CET 2024 · 2 MAY · SHIFT 1

(a) 165 Hz (b) 150 Hz (c) 660 Hz (d) 330 Hz

117. A progressive wave is given by, $Y = 12\sin(5t - 4x)$. On this wave, how far away are the two points having a phase difference of 90°?

MHT CET 2023 · 14 MAY · SHIFT 1

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{8}$ (c) $\frac{\pi}{16}$ (d) $\frac{\pi}{32}$

118. The displacement of two sinusoidal waves is given by the equation

$y_1 = 8\sin(20x - 30t)$

$y_2 = 8\sin(25x - 40t)$

then the phase difference between the waves after time $t = 2$ s and distance $x = 5$ cm will be

MHT CET 2023 · 12 MAY · SHIFT 1

(a) 2 radian (b) 3 radian (c) 4 radian (d) 5 radian

119. The path difference between two waves, represented by $y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$ is

MHT CET 2023 · 11 MAY · SHIFT 2

(a) $\frac{\lambda}{2\pi}(\phi)$ (b) $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$
(c) $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$ (d) $\frac{2\pi}{\lambda}(\phi)$

120. Velocity of sound waves in air is 'V' m/s. For a particular sound wave in air, path difference of 'x' cm is equivalent to phase difference $n\pi$. The frequency of this wave is

MHT CET 2021 · 24 SEP · SHIFT 2

(a) $\frac{Vn}{x}$ (b) $\frac{V}{nx}$ (c) $\frac{Vn}{2x}$ (d) $\frac{2x}{V}$

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121. Two waves are represented by the equation, $y_1 = A\sin(\omega t + kx + 0.57)$m and $y_2 = A\cos(\omega t + kx)$m, where x is in metre and t is in second. What is the phase difference between them?

MHT CET 2021 · 23 SEP · SHIFT 1

(a) 0.57 radian (b) 1.0 radian
(c) 1.57 radian (d) 1.25 radian

122. A sound wave of frequency 160 Hz has a velocity of 320 m/s. When it travels through air, the particles having a phase difference of 90°, are separated by a distance of

MHT CET 2021 · 22 SEP · SHIFT 2

(a) 50 cm (b) 1 cm (c) 25 cm (d) 75 cm

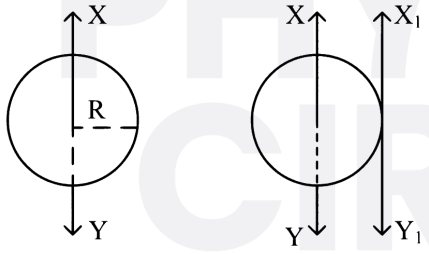
123. A sound wave is travelling with a frequency of 50 Hz. The phase difference between the two points in the path of a wave is $\frac{\pi}{3}$. The distance between those two points is (Velocity of sound in air = 330 m/s)

MHT CET 2021 · 22 SEP · SHIFT 1

(a) 1.1 m (b) 0.6 m (c) 2.2 m (d) 1.7 m

124. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at a given time interval of 0.01 second is

MHT CET 2021 · 21 SEP · SHIFT 1



(a) $\frac{\pi}{4}$ rad (b) $\frac{3\pi}{2}$ rad (c) π rad (d) $\frac{\pi}{2}$ rad

125. A simple harmonic progressive wave is represented as $y = 0.03\sin\pi(2t - 0.01x)$m. At a given instant of time, the phase difference between two particles 25 m apart is

MHT CET 2019 · 2 MAY · SHIFT 2

(a) π rad (b) $\frac{\pi}{2}$ rad (c) $\frac{\pi}{4}$ rad (d) $\frac{\pi}{8}$ rad

126. For a travelling harmonic wave $y(x,t) = 2.0\cos 2\pi(10t - 0.0080x + 0.35)$, where x and y are in cm and t in s. The phase difference between oscillatory motion of two points separated by a distance of 0.5 m is:

NEET 2026

(a) 0.08πrad (b) 0.8πrad
(c) 8πrad (d) 0.008πrad

127. Two waves are represented by the equations
y1 = $a$sin(ωt + kx + 0.57) m and
y2 = acos(ωt + kx) m, where x is in meter and t in sec. The phase difference between them is

AIPMT 2011 · PRELIMS

(a) 1.0 radian (b) 1.25 radian
(c) 1.57 radian (d) 0.57 radian

128. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/s. What is the phase difference between the oscillations of two points?

AIPMT 2008

(a) π (b) $\pi/6$ (c) $\pi/3$ (d) $2\pi/3$

129. The phase difference between two waves. represented by
y1 = 10^{-6} sin[100t + (x/50) + 0.5] m
y2 = 10^{-6} cos[100t + (x/50)] m,
where x is expressed in metres and t is exressed in secondss, is approximately.

AIPMT 2004

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

130. Two sound waves having a phase difference of 60° have path difference of

AIPMT 1996

(a) $\frac{\lambda}{6}$ (b) $\frac{\lambda}{3}$ (c) 2λ (d) $\frac{\lambda}{2}$

131. Velocity of sound waves in air is 330 m/s. For a particular sound wave in air, a path difference of 40 cm is equivalent to phase difference of 1.6π. The frequency of this wave is

AIPMT 1990

(a) 165 Hz (b) 150 Hz (c) 660 Hz (d) 330 Hz

132. The equation of a wave travelling on a string is y = sin[20πx + 10πt], where x and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is:

JEE MAIN 2025 · 7 APR · SHIFT 2

(a) 10 cm (b) 2.5 cm (c) 20 cm (d) 5.0 cm

133. The distance between two consecutive points with phase difference of 60° in a wave of frequency 500 Hz is 6.0 m. The velocity with which wave is travelling is _____ km/s

JEE MAIN 2023 · 25 JAN · SHIFT 1 *(Numerical)*

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TOPIC 04

Reflection, Superposition & Interference

14 PYQs · Easy 14 · Medium 0 · Difficult 0 | MHT CET 8 · NEET 3 · JEE 3

Concepts covered: Reflection of waves and echo (4) · Superposition: resultant amplitude (8) · Interference: maximum and minimum intensity (2)

LEVEL 1 · EASY 14 questions

◆ Reflection of waves and echo 4 Qs

134. A man standing between two parallel cliffs fires a gun. He hear two echos one after 3 second and the other after 5 second. The separation between the two cliffs is 1360 m, the speed of sound is

MHT CET 2026 · 19 MAY · SHIFT 2

(a) 320 m/s (b) 330 m/s (c) 340 m/s (d) 350 m/s

135. A person standing between two parallel cliffs fires a gun and hears two echoes, first echo after 1 second and second echo after 3 second. The distance between the two cliffs is (The velocity of sound = 330 m/s)

MHT CET 2026 · 18 APR · SHIFT 2

(a) 330 m (b) 660 m (c) 990 m (d) 1320 m

136. A person standing between two parallel cliffs fires a gun and hears two echoes, first echo after 1 second and the second echo after 3 second. The distance between the two cliffs is (Velocity of sound = 340 m/s)

MHT CET 2025 · 22 APR · SHIFT 1

(a) 340 m (b) 680 m (c) 1020 m (d) 1360 m

137. A transverse wave strike against a wall,

MHT CET 2023 · 13 MAY · SHIFT 2

(a) its phase changes by 180° but velocity does not change
(b) its phase does not change but velocity changes
(c) its velocity changes and phase changes by 180°
(d) nothing can be predicted about changes in its velocity and phase

◆ Superposition: resultant amplitude 8 Qs

138. The equations of two waves are given as

$y_1 = a\sin(\omega t + \phi_1)$

$y_2 = a\sin(\omega t + \phi_2)$

If amplitude and time period of resultant wave is same as the individual waves, then $(\phi_1 - \phi_2)$ is

MHT CET 2024 · 9 MAY · SHIFT 2

(a) $\cos^{-1}\left(\frac{-1}{2}\right)$ (b) $\cos^{-1}\left(\frac{-1}{4}\right)$
(c) $\cos^{-1}\left(-\frac{1}{6}\right)$ (d) $\cos^{-1}\left(-\frac{1}{8}\right)$

139. Two sound waves having same amplitude ' A ' and angular frequency ' ω ' but having a phase difference of $\left(\frac{\pi}{2}\right)^c$ are superimposed then the maximum amplitude of the resultant wave is

MHT CET 2024 · 9 MAY · SHIFT 1

(a) $\frac{A}{\sqrt{2}}$ (b) $\frac{A}{2}$ (c) $\sqrt{2}\,A$ (d) $2A$

140. Equation of simple harmonic progressive wave is given by $y = \frac{1}{\sqrt{a}}\sin\omega t \pm \frac{1}{\sqrt{b}}\cos\omega t$ then the resultant amplitude of the wave is $(\cos 90^\circ = 0)$

MHT CET 2023 · 9 MAY · SHIFT 1

(a) $\frac{a\pm b}{ab}$ (b) $\frac{\sqrt{a}\pm\sqrt{b}}{ab}$ (c) $\frac{\sqrt{a}\pm\sqrt{b}}{\sqrt{ab}}$ (d) $\sqrt{\frac{a+b}{ab}}$

141. Two waves having equation $x1 = a\sin(\omega t - kx + \phi 1)$, $x2 = a\sin(\omega t - kx + \phi 2)$. If in the resultant wave the frequency and amplitude remain equal to amplitude of superimposing waves, the phase difference between them is

AIPMT 2001

(a) $\frac{\pi}{6}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

142. Wave has simple harmonic motion whose period is 4 seconds while another wave which also possesses simple harmonic motion has its period 3 second. If both are combined, then the resultant wave will have the period equal to

AIPMT 1993

(a) 4 s (b) 5 s (c) 12 s (d) 3 s

143. Two waves executing simple harmonic motions travelling in the same direction with same amplitude and frequency are superimposed. The resultant amplitude is equal to the $\sqrt{3}$ times of amplitude of individual motions. The phase difference between the two motions is _____ (degree).

JEE MAIN 2022 · 25 JUL · SHIFT 2 *(Numerical)* *(Not in current JEE/NEET syllabus)*

144. The displacement equations of two interfering waves are given by

$y_1 = 10\sin\left(\omega t + \frac{\pi}{3}\right)\text{cm}, y_2 = 5[\sin\omega t + \sqrt{3}\cos\omega t]\text{cm}$ respectively.

The amplitude of the resultant wave is _____ cm.

JEE MAIN 2023 · 31 JAN · SHIFT 2 *(Numerical)*

145. Two simple harmonic waves having equal amplitudes of 8 cm and equal frequency of 10 Hz are moving along the same direction. The resultant amplitude is also 8 cm. The phase difference between the individual waves is _____ degree.

JEE MAIN 2023 · 29 JAN · SHIFT 1 *(Numerical)*

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◆ Interference: maximum and minimum intensity 2 Qs

146. Two waves are superimposed whose ratio of intensities is $9:1$. The ratio of maximum and minimum intensity is

MHT CET 2022 · 11 AUG · SHIFT 2

(a) $9:1$ (b) $4:1$ (c) $3:1$ (d) $5:3$

147. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

AIPMT 2008

(a) $\left(\sqrt{I_1}-\sqrt{I_2}\right)^2$ (b) $2\left(I_1+I_2\right)$

(c) I_1+I_2 (d) $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2$

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TOPIC 05

Stationary Waves & Vibrating Strings

59 PYQs · Easy 59 · Medium 0 · Difficult 0 | MHT CET 38 · NEET 10 · JEE 11

Concepts covered: Stationary wave equation (9) · Nodes, antinodes and properties (13) · String modes: harmonics and overtones (17) · Laws of a vibrating string (10) · Bridges, segments and composite wires (10)

LEVEL 1 · EASY 59 questions

◆ Stationary wave equation 9 Qs

148. For a stationary wave, $y = 10\cos(\pi x/15)\sin(48\pi t)$ cm, the distance between a node and the successive antinode is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) 30 cm (b) 22.5 cm (c) 15 cm (d) 7.5 cm

149. The equation of a stationary wave along a stretched string is $y = 5\sin\frac{\pi x}{3}\cos 40\pi t$ where x and y are in cm and t in second. The separation between two adjacent nodes is

MHT CET 2026 · 14 MAY · SHIFT 2

(a) 6 cm (b) 4 cm (c) 3 cm (d) 1.5 cm

150. For stationary wave, $y = 12\cos\left(\frac{\pi x}{10}\right)\sin(36\pi t)$ cm, the distance between a node and the successive antinode is

MHT CET 2026 · 19 APR · SHIFT 2

(a) 20 cm (b) 12 cm (c) 10 cm (d) 5 cm

151. A stationery wave is represented by $y = 12\cos\left(\frac{\pi}{6}x\right)\sin(8\pi t)$, where $x \& y$ are in cm and t in second. The distance between two successive antinodes is

MHT CET 2024 · 4 MAY · SHIFT 2

(a) 12 cm (b) 10 cm (c) 6 cm (d) 2 cm

152. A stationary wave is represented by $y = 10\sin\left(\frac{\pi x}{4}\right)\cos(20\pi t)$ where x and y are in cm and t in second. The distance between two consecutive nodes is

MHT CET 2022 · 11 AUG · SHIFT 2

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

153. Find the wrong statement from the following about the equation of stationary wave given by $Y = 0.04\cos(\pi x)\sin(50\pi t)$m where t is in second. Then for the stationary wave.

MHT CET 2019 · 2 MAY · SHIFT 2

(a) Time period = 0.02 s (b) Wavelength = 2 m
(c) Velocity = 50 m/s (d) Amplitude = 0.02 m

154. A standing wave is formed by the superposition of two waves travelling in opposite directions. The transverse displacement is given by
$y(x, t) = 0.5 \sin\left(\frac{5\pi}{4}x\right)\cos(200\ \pi t)$.
What is the speed of the travelling wave moving in the positive x direction?
(x and t are in meter and second, respectively.)

JEE MAIN 2017 · 9 APR · SHIFT 1

(a) 160 m/s (b) 90 m/s (c) 180 m/s (d) 120 m/s

155. Two travelling waves of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a stationary wave whose equation is given by $y = (10\cos\pi x \sin\frac{2\pi t}{T})$ cm
The amplitude of the particle at $x = \frac{4}{3}$ cm will be _____ cm.

JEE MAIN 2022 · 24 JUN · SHIFT 2 *(Numerical)*

156. Two travelling waves produce a standing wave represented by equation,
$y = 1.0$ mm $\cos(1.57\ cm^{-1})\ x \sin(78.5\ s^{-1})t$.
The node closest to the origin in the region $x > 0$ will be at x = ... cm.

JEE MAIN 2021 · 26 AUG · SHIFT 1 *(Numerical)*

◆ Nodes, antinodes and properties 13 Qs

157. Two waves of same frequency (n) approaching each other with same velocity of 18 m/s interfere. The distance between two consecutive antinodes is

MHT CET 2026 · 19 APR · SHIFT 2

(a) $\frac{18}{n}$ (b) $\frac{10}{n}$ (c) $\frac{9}{n}$ (d) $\frac{n}{18}$

158. In case of stationary wave pattern, which of the following statement is CORRECT?

MHT CET 2026 · 17 APR · SHIFT 1

(a) The distance between consecutive antinodes is equal to the wavelength.
(b) In a pipe open at both ends when an air column is vibrated, only even harmonics are present.
(c) When an air column is vibrated in a pipe closed at one end, all harmonics are present.
(d) In the case of a stretched string, when vibrated frequency of the first overtone is same as the second harmonic.

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159. In a stationary wave, all the particles
MHT CET 2026 · 13 APR · SHIFT 1
(a) except at node vibrate in S.H.M. of same period but of different amplitudes
(b) vibrate in S.H.M. of same period and amplitude
(c) except at nodes vibrate in S.H.M. of same period and same amplitude
(d) vibrate in S.H.M. of different periods and different amplitudes

160. Two waves of same frequency (n) are approaching each other with same velocity $12\ \mathrm{m/s}$ along the same linear path and interfere. The distance between two consecutive nodes is
MHT CET 2025 · 22 APR · SHIFT 1
(a) 12 n (b) $\frac{12}{n}$ (c) 6 n (d) $\frac{6}{n}$

161. When the string is stretched between two rigid supports, under certain tension and vibrated
MHT CET 2024 · 10 MAY · SHIFT 1
(a) antinodes at both ends and at least one node in between
(b) Nodes at both ends and at least one antinode in between
(c) Nodes at both ends and no antinode in between
(d) antinodes at both ends and no node in between

162. In a vibrating string with fixed ends the waves are of type
MHT CET 2024 · 2 MAY · SHIFT 2
(a) stationary longitudinal.
(b) stationary transverse.
(c) progressive transverse.
(d) progressive longitudinal.

163. Two progressive waves are travelling towards each other with velocity $50\ \mathrm{m/s}$ and frequency 200 Hz. The distance between the two consecutive antinodes is
MHT CET 2023 · 11 MAY · SHIFT 2
(a) 0.125 m (b) 0.150 m (c) 0.175 m (d) 0.200 m

164. A string fixed at both the ends forms standing wave with node separation of $5\ \mathrm{cm}$. If the velocity of the wave on the string is $2\ \mathrm{m/s}$, then the frequency of vibration of the string is
MHT CET 2023 · 11 MAY · SHIFT 1
(a) 0.2 Hz (b) 10 Hz (c) 20 Hz (d) 40 Hz

165. In case of a stationary wave pattern which of the following statements is CORRECT?
MHT CET 2023 · 10 MAY · SHIFT 1
(a) The distance between the consecutive nodes is equal to the wavelength.
(b) In a pipe at both ends only even harmonics are present in an air column.
(c) In a pipe closed at one end, all harmonics are present in an air column.
(d) In case of a stretched string when vibrated, frequency of first overtone is same as second harmonic.

166. Stationary waves can be produced in
MHT CET 2023 · 9 MAY · SHIFT 2
(a) only solid and gaseous media
(b) only liquid and gaseous media
(c) only solid and liquid media
(d) solid, liquid and gaseous media

167. Consider the following statements about stationary waves.
A. The distance between two adjacent nodes or antinodes is equal to $\frac{\lambda}{2}$ (λ = wavelength of the wave)
B. A node is always formed at the open end of the open organ pipe.
Choose the correct option from the following.
MHT CET 2022 · 11 AUG · SHIFT 2
(a) Both statements A and B are wrong.
(b) Only the statement B is true.
(c) Only the statement A is true.
(d) Both statements A and B are true.

168. A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance $1.21\ \text{Å}$ between them. The wavelength of the standing wave is
AIPMT 1998
(a) $1.21\ \text{Å}$ (b) $1.42\ \text{Å}$ (c) $6.05\ \text{Å}$ (d) $3.63\ \text{Å}$

169. A wave of frequency $100\ \mathrm{Hz}$ travels along a string towards its fixed end. When this wave travels back, after reflection, a node is formed at a distance of $10\ \mathrm{cm}$ from the fixed end. The speed of the wave (incident and reflected) is
AIPMT 1994
(a) $20\ \mathrm{m/s}$ (b) $40\ \mathrm{m/s}$ (c) $5\ \mathrm{m/s}$ (d) $10\ \mathrm{m/s}$

◆ String modes: harmonics and overtones 17 Qs

170. A stretched string of length 'L' is fixed at both the ends, has 'n' nodes ($n > 2$). The length of the string in terms of n and wavelength λ is
MHT CET 2026 · 19 MAY · SHIFT 1
(a) $(n+1)\frac{\lambda}{2}$ (b) $n\lambda$
(c) $\frac{n\lambda}{2}$ (d) $(n-1)\frac{\lambda}{2}$

171. The fundamental frequency 'n' of the tuning fork is 288 Hz, it will not resonate with the frequency
MHT CET 2026 · 18 APR · SHIFT 2
(a) 288 Hz (b) 576 Hz (c) 844 Hz (d) 864 Hz

172. When a sonometer wire vibrates in the third overtone, the number of antinodes and nodes formed on the wire are respectively
MHT CET 2026 · 16 APR · SHIFT 1
(a) 4, 5 (b) 5, 4 (c) 3, 4 (d) 4, 3

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173. A sonometer wire is vibrating in third overtone. There are
MHT CET 2026 · 13 APR · SHIFT 1
(a) 5 nodes and 4 antinodes
(b) 4 nodes and 5 antinodes
(c) 4 nodes and 4 antinodes
(d) 5 nodes and 5 antinodes

174. In Sonometer experiment, the frequency of a tuning fork used is 288 Hz. Harmonics will 'NOT' be produced at the frequency
MHT CET 2025 · 26 APR · SHIFT 1
(a) 288 Hz (b) 576 Hz (c) 844 Hz (d) 864 Hz

175. The frequency of a tuning fork is 256 Hz. It will not resonate with the tuning fork of frequency
MHT CET 2025 · 19 APR · SHIFT 2
(a) 256 Hz (b) 512 Hz (c) 754 Hz (d) 768 Hz

176. When a sonometer wire vibrates in third overtone there are
MHT CET 2024 · 15 MAY · SHIFT 1
(a) 4 nodes and 3 antinodes.
(b) 6 nodes and 5 antinodes.
(c) 5 nodes and 4 antinodes.
(d) 4 nodes and 5 antinodes.

177. Stationary wave is produced along the stretched string of length 80 cm. The resonant frequencies of string are 90 Hz, 150 Hz and 210 Hz. The speed of transverse wave in the string is
MHT CET 2024 · 10 MAY · SHIFT 2
(a) 45 m/s (b) 75 m/s (c) 48 m/s (d) 80 m/s

178. A stationary wave is formed having 3 nodes along the length of the string 90 cm. The wavelength of the wave is
MHT CET 2024 · 9 MAY · SHIFT 2
(a) 60 cm (b) 75 cm (c) 90 cm (d) 30 cm

179. A stretched string is fixed at both ends. It is made to vibrate so that the total number of nodes formed in it is ' x '. The length of the string in terms of the wavelength of waves formed in it is (λ = wavelength)
MHT CET 2024 · 2 MAY · SHIFT 2
(a) $\frac{X\lambda}{2}$ (b) $\left(X+\frac{1}{2}\right)\frac{\lambda}{2}$
(c) $(X+1)\frac{\lambda}{2}$ (d) $(X-1)\frac{\lambda}{2}$

180. A stretched string fixed at both ends has ' m ' nodes, then the length of the string will be
MHT CET 2019 · 2 MAY · SHIFT 2
(a) $(m-1)\frac{\lambda}{2}$ (b) $\frac{(m+1)\lambda}{2}$
(c) $\frac{m\lambda}{2}$ (d) $(m-2)\frac{\lambda}{2}$

181. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. The lowest resonant frequency for this string is
AIPMT 2015
(a) 10.5 Hz (b) 105 Hz (c) 155 Hz (d) 205 Hz

182. Standing waves are produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity is 20 m/s, the frequency is
AIPMT 1997
(a) 5 Hz (b) 10 Hz (c) 2 Hz (d) 4 Hz

183. A string 2.0 m long and fixed at its ends is driven by a 240 Hz vibrator. The string vibrates in its third harmonic mode. The speed of the wave and its fundamental frequency is :-
JEE MAIN 2019 · 9 APR · SHIFT 2
(a) 180m/s, 80 Hz (b) 180m/s, 120 Hz
(c) 320m/s, 120 Hz (d) 320m/s, 80 Hz

184. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is
AIEEE 2006
(a) 105 Hz (b) 1.05 Hz (c) 1050 Hz (d) 10.5 Hz

185. length of a string tied to two rigid supports is 40 cm. Maximum length (wavelength in cm) of a stationary wave produced on it is
AIEEE 2002
(a) 20 (b) 80 (c) 40 (d) 120

186. A wire having a linear mass density 9.0×10^{-4} kg/m is stretched between two rigid supports with a tension of 900 N. The wire resonates at a frequency of 500 Hz. The next higher frequency at which the same wire resonates is 550 Hz. The length of the wire is _____ m.
JEE MAIN 2021 · 31 AUG · SHIFT 1 *(Numerical)*

◆ Laws of a vibrating string 10 Qs

187. A uniform wire of length L, diameter D and density ρ is stretched under tension T. The relation between its fundamental frequency f, length L and diameter D is
MHT CET 2026 · 15 MAY · SHIFT 1
(a) $f\propto\frac{1}{LD}$ (b) $f\propto\frac{1}{\ell\sqrt{D}}$
(c) $f\propto\frac{1}{D^2}$ (d) $f\propto\frac{1}{\ell D^2}$

188. To increase the frequency of transverse oscillations of a stretched string by 40%, the tension must be increased by
MHT CET 2026 · 15 APR · SHIFT 2
(a) 100% (b) 40% (c) 96% (d) 140%

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189. Fundamental frequency of sonometer wire is ' n '. If the tension and length are increased 3 times and diameter is increased twice, the new frequency will be
MHT CET 2025 · 26 APR · SHIFT 1
(a) $2n$ (b) $\frac{\sqrt{3}}{2}n$ (c) $\frac{n}{2\sqrt{3}}$ (d) $\sqrt{3}n$

190. The fundamental frequency of sonometer wire is ' n '. If the tension and length are increased 3 times and diameter is increased twice, the new frequency will be
MHT CET 2025 · 23 APR · SHIFT 2
(a) $\sqrt{\frac{3}{2}}$n (b) $\frac{\sqrt{3}}{2}n$ (c) $\frac{n}{2\sqrt{3}}$ (d) $2\sqrt{3}n$

191. When the tension in string is increased by 3 kgωt, the frequency of the fundamental mode increases in the ratio 2 : 3. The initial tension in the string is
MHT CET 2024 · 9 MAY · SHIFT 1
(a) 1.6 kgωt (b) 2.0 kgωt (c) 2.4 kgωt (d) 2.8 kgωt

192. A violin emits sound waves of frequency ' n_1 ' under tension T. When tension is increased by 44%, keeping the length and mass per unit length constant, frequency of sound waves becomes ' n_2 '. The ratio of frequency ' n_2 ' to frequency ' n_1 ' is
MHT CET 2024 · 3 MAY · SHIFT 2
(a) 5 : 6 (b) 6 : 7 (c) 6 : 5 (d) 7 : 6

193. The length of the string of a musical instrument is 90 cm and has a fundamental frequency of 120 Hz. Where should it be pressed to produce fundamental frequency of 180 Hz?
NEET 2020 · PHASE 2
(a) 80 cm (b) 75 cm (c) 60 cm (d) 45 cm

194. Two identical strings X and Z made of same material have tension TX and TZ in them. If their fundamental frequencies are 450 Hz and 300 Hz, respectively, then the ratio TX/TZ is
JEE MAIN 2020 · 2 SEP · SHIFT 1
(a) 2.25 (b) 0.44 (c) 1.25 (d) 1.5

195. A sonometer wire of resonating length 90 cm has a fundamental frequency of 400 Hz when kept under some tension. The resonating length of the wire with fundamental frequency of 600 Hz under same tension _____ cm.
JEE MAIN 2024 · 5 APR · SHIFT 2 *(Numerical)*

196. A guitar string of length 90 cm vibrates with a fundamental frequency of 120 Hz. The length of the string producing a fundamental frequency of 180 Hz will be _____ cm.
JEE MAIN 2023 · 8 APR · SHIFT 2 *(Numerical)*

◆ Bridges, segments and composite wires 10 Qs

197. A stretched wire of length 110 cm is divided in to 3 segments whose frequencies are in the ratio 1 : 2 : 3. Their respective lengths must be
MHT CET 2026 · 13 MAY · SHIFT 1
(a) 20 cm, 30 cm, 60 cm (b) 60 cm, 30 cm, 20 cm
(c) 60 cm, 20 cm, 30 cm (d) 30 cm, 60 cm, 20 cm

198. The length of a sonometer wire 'AB' is 110 cm. Where should the two bridges be placed from end ' A ' to divide the wire in three segments whose fundamental frequencies are in the ratio 1 : 2 : 3?
MHT CET 2024 · 10 MAY · SHIFT 2
(a) 60 cm and 90 cm (b) 90 cm and 100 cm
(c) 40 cm and 80 cm (d) 50 cm and 90 cm

199. When a string of length ' l ' is divided into three segments of length l_1, l_2 and l_3. The fundamental frequencies of three segments are n_1, n_2 and n_3 respectively. The original fundamental frequency 'n' of the string is
MHT CET 2023 · 9 MAY · SHIFT 1
(a) $n = n_1 + n_2 + n_3$
(b) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$
(c) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$
(d) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

200. A stretched wire of length 260 cm is set into vibrations. It is divided into three segments whose frequencies are in the ratio 2 : 3 : 4. Their lengths must be
MHT CET 2019 · 2 MAY · SHIFT 2
(a) 80 cm, 60 cm, 120 cm (b) 120 cm, 80 cm, 60 cm
(c) 60 cm, 80 cm, 120 cm (d) 120 cm, 60 cm, 80 cm

201. If n1, n2 and n3 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
AIPMT 2014
(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 = n1 + n2 + n3

202. The length of the wire between two ends of a sonometer is 100 cm. What should be the positions of two bridges below the wire so that the three segments of the wire have their fundamental frequencies in the ratio 1: 3: 5.
NEET 2013
(a) $\frac{1500}{23}cm, \frac{500}{23}cm$ (b) $\frac{1500}{23}cm, \frac{300}{23}cm$
(c) $\frac{300}{23}cm, \frac{1500}{23}cm$ (d) $\frac{1500}{23}cm, \frac{2000}{23}cm$

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203. When a string is divided into three segments of length $l1$, 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

AIPMT 2012 · PRELIMS

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

---

204. A string is cut into three parts, having fundamental frequencies n1, n2, n3 respectively. Then original fundamental frequency n related by the expression as

AIPMT 2000

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

(c) $\mathrm{n} = \mathrm{n1} + \mathrm{n2} + \mathrm{n3}$ (d) $n = \frac{n_1 + n_2 + n_3}{3}$

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

AIPMT 1995

(a) 60 cm and 90 cm (b) 30 cm and 60 cm

(c) 30 cm and 90 cm (d) 40 cm and 80 cm

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206. A sonometer wire of length 114 cm is fixed at both the ends. Where should the two bridges be placed so as to divide the wire into three segments whose fundamental frequencies are in the ratio 1: 3: 4?

JEE MAIN 2013 · 23 APR · SHIFT 1

(a) At 36 cm and 84 cm from one end

(b) At 24 cm and 72 cm from one end

(c) At 48 cm and 96 cm from one end

(d) At 72 cm and 96 cm from one end

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TOPIC 06

Organ Pipes & Resonance Tube

43 PYQs · Easy 43 · Medium 0 · Difficult 0 | MHT CET 23 · NEET 7 · JEE 13

Concepts covered: Closed organ pipe (9) · Open organ pipe (6) · Comparing closed and open pipes (10) · Pipe dipped in water, cut or filled (12) · Resonance tube and end correction (6)

LEVEL 1 · EASY 43 questions

◆ Closed organ pipe 9 Qs

207. In a pipe closed at one end, air column is vibrating in the fourth overtone so the vibrating air column has 'x' nodes and 'y' antinodes. The values of x and y are respectively

MHT CET 2026 · 17 APR · SHIFT 2

(a) $4, 4$ (b) $4, 5$ (c) $5, 4$ (d) $5, 5$

208. An air column in a pipe which is closed at one end will be in resonance with a vibrating tuning fork of frequency 415 Hz for various vibrating air columns. Which one of the following lengths is not in resonance? (velocity of sound in air = 332 m/s) (Neglect end correction)

MHT CET 2026 · 16 APR · SHIFT 2

(a) 20 cm (b) 40 cm (c) 60 cm (d) 100 cm

209. In a pipe closed at one end, air column is vibrating in its second overtone. The column has

MHT CET 2025 · 22 APR · SHIFT 2

(a) three nodes and three antinodes.
(b) three nodes and four antinodes.
(c) two nodes and three antinodes.
(d) four nodes and three antinodes.

210. An air column in a closed organ pipe vibrating in unison with a fork, produces second overtone. The vibrating air column has

MHT CET 2024 · 2 MAY · SHIFT 1

(a) three nodes and two antinodes.
(b) three nodes and three antinodes.
(c) four nodes and three antinodes.
(d) three nodes and four antinodes.

211. An air column in a pipe, which is closed at one end will be in resonance with a vibrating tuning fork of frequency 264 Hz for various lengths. Which one of the following lengths is not possible? (V = 330 m/s)

MHT CET 2021 · 20 SEP · SHIFT 2

(a) 62.50 cm (b) 93.75 cm
(c) 156.25 cm (d) 31.25 cm

212. 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?

NEET 2017

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

213. A closed organ pipe (closed at one end) is excited to support the third overtone. It is found that air in the pipe has

AIPMT 1991

(a) three nodes and three antinodes
(b) three nodes and four antinodes
(c) four nodes and three antinodes
(d) four nodes and four antinodes

214. A closed organ pipe has a fundamental frequency of 1.5 kHz. The number of overtones that can be distinctly heard by a person with this organ pipe will be (Assume that the highest frequency a person can hear is 20,000 Hz)

JEE MAIN 2019 · 10 JAN · SHIFT 2 *(Not in current JEE/NEET syllabus)*

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

215. A tuning fork is vibrating at 250 Hz. The length of the shortest closed organ pipe that will resonate with the tuning fork will be _____ cm. (Take speed of sound in air as 340 ms $^{-}$1)

JEE MAIN 2021 · 27 AUG · SHIFT 2 *(Numerical)*

◆ Open organ pipe 6 Qs

216. In an open end organ pipe of length ' L ', if the velocity of sound is ' V ', then the fundamental frequency will be (Neglect end correction)

MHT CET 2025 · 25 APR · SHIFT 2

(a) $\frac{V}{2L}$ and all harmonics are present.
(b) $\frac{V}{4L}$ and all harmonics are present.
(c) $\frac{V}{2L}$ and even harmonics are present.
(d) $\frac{V}{4L}$ and even harmonics are present.

217. A pipe 60 cm long and open at both the ends produces harmonics. Which harmonic mode of pipe resonates a 2.2 KHz source? (Speed of sound in air $= 330\ \mathrm{m/s}$)(Neglect end correction)

MHT CET 2024 · 16 MAY · SHIFT 2

(a) First (b) Eighth (c) Third (d) Second

218. If the length of an open organ pipe is $33.3\ \mathrm{cm}$, then the frequency of fifth overtone is [Neglect end correction, velocity of sound $= 333\ \mathrm{m/s}$]

MHT CET 2023 · 9 MAY · SHIFT 2

(a) 3500 Hz (b) 3000 Hz (c) 2500 Hz (d) 2000 Hz

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219. When an air column in a pipe open at both ends vibrates such that four antinodes and three nodes are formed, then the corresponding mode of vibration is
MHT CET 2021 · 24 SEP · SHIFT 1
(a) first overtone (b) second overtone
(c) fourth overtone (d) third overtone

220. If we study the vibration of a pipe open at both ends. then the following statement is not true.
NEET 2013
(a) All harmonics of the fundamental frequency will be generated.
(b) Pressure change will be maximum at both ends.
(c) end will be antinode.
(d) Odd harmonics of the fundamental frequency will be generated.

221. An organ pipe $40\ \text{cm}$ long is open at both ends. The speed of sound in air is $360\ \text{ms}^{-1}$. The frequency of the second harmonic is _____ Hz.
JEE MAIN 2023 · 8 APR · SHIFT 1 *(Numerical)*

◆ Comparing closed and open pipes 10 Qs

222. The fundamental frequency of an air column in a pipe closed at one end is 150 Hz. If the same pipe is open at both the end, the frequencies produced in Hz are
MHT CET 2025 · 26 APR · SHIFT 2
(a) $150, 300, 450, 600, \ldots\ldots$
(b) $300, 450, 600, 750, \ldots\ldots$
(c) $300, 400, 500, 600, \ldots\ldots$
(d) $300, 600, 900, 1200, \ldots\ldots$

223. The fundamental frequencies of vibrations of air column in pipe open at both ends and in pipe closed at one end are ' n_1 ' and ' n_2 ' respectively, then
MHT CET 2025 · 25 APR · SHIFT 2
(a) $n_1 = n_2$ (b) $n_1 = 2n_2$
(c) $2n_1 = n_2$ (d) $3n_1 = 4n_2$

224. An organ pipe has fundamental frequency 80 Hz. If its one end is closed, the frequencies produced will be (in Hz) (Neglect end correction)
MHT CET 2025 · 22 APR · SHIFT 1
(a) $40, 80, 120, 160$ (b) $40, 80, 160, 240$
(c) $40, 120, 200, 280$ (d) $80, 160, 240, 320$

225. The pipe open at both ends and pipe closed at one end have same length and both are vibrating in fundamental mode. Air column vibrating in open pipe has resonance frequency n_1 and air column vibrating in closed pipe has resonance frequency n_2, then
MHT CET 2024 · 10 MAY · SHIFT 1
(a) $n_1 = 2n_2$ (b) $n_1 = n_2$
(c) $2n_1 = n_2$ (d) $3n_1 = 4n_2$

226. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is
NEET 2023
(a) 2 : 1 (b) 1 : 3 (c) 3 : 1 (d) 1 : 2

227. The fifth harmonic of a closed organ pipe is found to be in unison with the first harmonic of an open pipe. The ratio of lengths of closed pipe to that of the open pipe is $5/x$. The value of x is ____
JEE MAIN 2026 · 24 JAN · SHIFT 2
(a) 3 (b) 2 (c) 4 (d) 1

228. The fundamental frequency of a closed organ pipe is equal to the first overtone frequency of an open organ pipe. If length of the open pipe is $60\ \text{cm}$, the length of the closed pipe will be:
JEE MAIN 2024 · 31 JAN · SHIFT 1
(a) 15 cm (b) 60 cm (c) 45 cm (d) 30 cm

229. Tube A has both ends open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is
AIEEE 2002
(a) 1 : 2 (b) 1 : 4 (c) 2 : 1 (d) 4 : 1

230. A closed and an open organ pipe have same lengths. If the ratio of frequencies of their seventh overtones is $\left(\frac{a-1}{a}\right)$ then the value of a is _____.
JEE MAIN 2024 · 8 APR · SHIFT 1 *(Numerical)*

231. The first overtone frequency of an open organ pipe is equal to the fundamental frequency of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is _____ cm.
JEE MAIN 2022 · 25 JUN · SHIFT 1 *(Numerical)*

◆ Pipe dipped in water, cut or filled 12 Qs

232. A pipe open at both ends has a frequency f in air. The pipe is dipped vertically in water, so that its $(1/3)$ part of its length is in water. The fundamental frequency of the air column is now xf, the value of x is
MHT CET 2026 · 19 MAY · SHIFT 2
(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{3}{2}$ (d) 1

233. In an experiment with a closed organ pipe, it is filled with water by $\left(\frac{1}{5}\right)^{th}$ of its volume. The frequency of the fundamental note will change by
MHT CET 2026 · 15 MAY · SHIFT 2
(a) 25% (b) 20% (c) −20% (d) −25%

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234. In an organ pipe closed at one end produces a fundamental note of frequency 'ν'. The pipe is cut into two pipes of equal length. The fundamental frequencies produced in the two pipes are

MHT CET 2026 · 18 APR · SHIFT 2

(a) ν, 2ν (b) $\frac{\nu}{2}$, ν

(c) 2ν, 4ν (d) $\frac{\nu}{2}$, 2ν

235. A pipe open at both ends has a fundamental frequency 'f' in air. The pipe is dipped in water, so that $\frac{2}{3}^{rd}$ length of pipe is in water, Now the fundamental frequency of the air column is

MHT CET 2026 · 15 APR · SHIFT 2

(a) $\frac{1}{2}f$ (b) $\frac{3}{2}f$ (c) $\frac{5}{2}f$ (d) $\frac{7}{2}f$

236. A pipe open at both ends produces a fundamental frequency n_1. When the pipe is kept with $\frac{3^{th}}{4}$ of its length in water, it produces a note of fundamental frequency n_2. The ratio of $\frac{n_1}{n_2}$ is

MHT CET 2025 · 23 APR · SHIFT 1

(a) $\frac{4}{3}$ (b) $\frac{3}{4}$ (c) 2 (d) $\frac{1}{2}$

237. The fundamental frequency of an air column in a pipe open at both ends is ' f_1 '. Now 80% of its length is immersed in water, the fundamental frequency of the air column becomes f_2. The ratio of $f_1 : f_2$ is

MHT CET 2024 · 3 MAY · SHIFT 1

(a) 5 : 2 (b) 4 : 5 (c) 5 : 4 (d) 2 : 5

238. A cylindrical tube open at both ends has fundamental frequency 'n' in air. The tube is dipped vertically in water so that one-fourth of it is in water. The fundamental frequency of the air column becomes

MHT CET 2021 · 24 SEP · SHIFT 2

(a) $\frac{3n}{4}$ (b) $\frac{n}{2}$ (c) n (d) $\frac{2n}{3}$

239. A pipe open at both ends has a fundamental frequency f in air. The pipe is now dipped vertically in a water drum to half of its length. The fundamental frequency of the air column is now equal to:

NEET 2025

(a) $\frac{3f}{2}$ (b) $2f$ (c) $\frac{f}{2}$ (d) f

240. A cylindrical tube, open at both ends has fundamental frequency f in air. The tube is dipped vertically in water, so that half of it is in water. The fundamental frequency of air column is now

AIPMT 1997

(a) $f/2$ (b) $3f/4$ (c) $2f$ (d) f

241. In an experiment with a closed organ pipe, it is filled with water by $\left(\frac{1}{5}\right)$ th of its volume. The frequency of the fundamental note will change by

JEE MAIN 2025 · 4 APR · SHIFT 1

(a) 20% (b) 25% (c) −20% (d) −25%

242. A pipe open at both ends has a fundamental frequency f in air. The pipe is dipped vertically in water so that half of it is in water. The fundamental frequency of the air column is now:

JEE MAIN 2016

(a) $2f$ (b) f (c) $\frac{f}{2}$ (d) $\frac{3f}{4}$

243. A cylindrical tube, open at both ends, has a fundamental frequency, f, in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of the air-column is now:

AIEEE 2012

(a) f (b) $f/2$ (c) $3/4$ (d) $2f$

◆ Resonance tube and end correction 6 Qs

244. If ' l ' is the length of pipe, ' r ' is the internal radius of the pipe and ' v ' is the velocity of sound in air then fundamental frequency of open pipe is

MHT CET 2024 · 3 MAY · SHIFT 2

(a) $\frac{V}{2(l+1\cdot2r)}$ (b) $\frac{V}{(l+1\cdot2r)}$ (c) $\frac{V}{(l+0.3r)}$ (d) $\frac{V}{(l+0\cdot6r)}$

245. If 'l' is the length of the open pipe, 'r' is the internal radius of the pipe and 'V ' is the velocity of sound in air then fundamental frequency of open pipe is

MHT CET 2023 · 14 MAY · SHIFT 1

(a) $\frac{V}{(l+0.3r)}$ (b) $\frac{V}{(l+1.2r)}$ (c) $\frac{V}{(l+0.6r)}$ (d) $\frac{V}{2(l+1.2r)}$

246. If the end correction of an open pipe is 0.8 cm, then the inner radius of that pipe is

MHT CET 2023 · 9 MAY · SHIFT 2

(a) $\frac{1}{3}$ cm (b) $\frac{2}{3}$ cm (c) $\frac{3}{2}$ cm (d) 0.2 cm

247. An air column, closed at one end open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is

NEET 2016 · PHASE 1

(a) 150 cm (b) 200 cm (c) 66.7 cm (d) 100 cm

248. In a resonance tube experiment when the tube is filled with water up to a height of 17.0 cm from bottom, it resonates with a given tuning fork. When the water level is raised the next resonance with the same tuning fork occurs at a height of 24.5 cm. If the velocity of sound in air is 330 m/s, the tuning fork frequency is:

JEE MAIN 2020 · 5 SEP · SHIFT 1

(a) 2200 Hz (b) 3300 Hz (c) 1100 Hz (d) 550 Hz

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249. The end correction of a resonance column is 1 cm. If the shortest length resonating with the tuning fork is 10 cm, the next resonating length should be:

JEE MAIN 2018 · 16 APR · SHIFT 1

(a) 28 cm (b) 32 cm (c) 36 cm (d) 40 cm

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TOPIC 07

Beats

37 PYQs · Easy 37 · Medium 0 · Difficult 0 | MHT CET 21 · NEET 7 · JEE 9

Concepts covered: Beat frequency from two waves (22) · Series of tuning forks (5) · Loading, filing and unknown frequency (6) · Beats with strings and sonometer wires (4)

LEVEL 1 · EASY 37 questions

◆ Beat frequency from two waves 22 Qs

250. Two simple harmonic sound waves travelling in the same direction are given by $y_1(x,t) = A\sin(0.5\pi x - 100\pi t)$ and $y_2(x,t) = A\sin(0.46\pi x - 92\pi t)$
The number of times, a stationary listener can hear sound of maximum intensity in one second is
MHT CET 2026 · 19 MAY · SHIFT 1
(a) 3 (b) 4 (c) 6 (d) 8

251. Two sources of sound are emitting progressive waves $y_1 = 4\sin 708\,\pi t$ and $y_2 = 3\sin 700\,\pi t$. The sources are placed close to each other. The number of beats heard per second and intensity ratio between waxing and wanning are respectively
MHT CET 2026 · 18 APR · SHIFT 1
(a) 4, 16 : 9 (b) 8, 16 : 9 (c) 8, 49 : 1 (d) 4, 49 : 1

252. The beats are produced when there is a superposition of two sound waves which will have
MHT CET 2026 · 17 APR · SHIFT 2
(a) same amplitude and same frequency.
(b) different amplitude but same frequency.
(c) same amplitude but slightly different frequencies.
(d) different amplitude and different frequencies.

253. Two waves $Y_1 = 0.25\sin 316t$ and $Y_2 = 0.25\sin 310t$ are propagating along the same direction. The number of beats produced per second are
MHT CET 2026 · 16 APR · SHIFT 2
(a) $\frac{3}{}$ (b) $\frac{\pi}{3}$ (c) $\frac{2}{}$ (d) $\frac{\pi}{2}$ π π

254. Two tuning forks of frequencies 256 Hz and 258 Hz are sounded together. The time interval between two consecutive maxima is
MHT CET 2025 · 25 APR · SHIFT 1
(a) 250 s (b) 252 s (c) 2 s (d) 0.5 s

255. Two sound waves travelling in the same direction have displacement $y_1 = a\sin(0.2\pi x - 50\pi t)$ and $y_2 = a\sin(0.15\pi x - 46\pi t)$.
How many times, a listener can hear sound of maximum intensity in one second?
MHT CET 2025 · 23 APR · SHIFT 2
(a) 1 (b) 2 (c) 3 (d) 4

256. Two sources of sound are emitting progressive waves $y_1 = 4\sin 710\pi t$ and $y_2 = 3\sin 702\pi t$. The sources are placed close to each other. The number of beats heard per second and intensity ratio between waxing and waning are respectively
MHT CET 2025 · 21 APR · SHIFT 1
(a) 4, 16 : 9 (b) 8, 16 : 9 (c) 4, 49 : 1 (d) 8, 49 : 1

257. Two sound waves having frequencies 250 Hz and 256 Hz superimpose to produce beat wave. The resultant beat wave has intensity maximum at $t = 0$. After how much time an intensity will be minimum produced at the same point?
MHT CET 2024 · 16 MAY · SHIFT 2
(a) $\frac{1}{6}$ s (b) $\frac{1}{24}$ s (c) $\frac{1}{18}$ s (d) $\frac{1}{12}$ s

258. If the two waves of same amplitude, having frequencies 340 Hz and 335 Hz, are moving in same direction, then the time interval between two successive maxima formed (in second) is
MHT CET 2024 · 11 MAY · SHIFT 2
(a) 0.1 (b) 0.2 (c) 0.3 (d) 0.5

259. Two sound waves having displacements $x_1 = 2\sin(1000\pi t)$ and $x_2 = 3\sin(1006\pi t)$, when interfere, produce
MHT CET 2024 · 10 MAY · SHIFT 1
(a) 5 beats/s with maximum intensity 25 units
(b) 6 beats/s with maximum intensity 16 units
(c) 3 beats/s with maximum intensity 25 units
(d) 1 beats/s with maximum intensity 5 units

260. Two waves $Y_1 = 0.25\sin 316t$ and $Y_2 = 0.25\sin 310t$ are propagating along the same direction. The number of beats produced per second are
MHT CET 2024 · 4 MAY · SHIFT 1
(a) $\frac{\pi}{3}$ (b) $\frac{3}{\pi}$ (c) $\frac{2}{\pi}$ (d) $\frac{\pi}{2}$

261. Two sound waves having wavelengths 5.0 m and 5.5 m propagate in a gas with velocity 300 m/s. The number of beats produced per second is
MHT CET 2021 · 23 SEP · SHIFT 2
(a) six (b) two (c) three (d) one

262. Two waves $Y_1 = 0.25\sin 316t$ and $Y_2 = 0.25\sin 310t$ are propagation same direction. The number of beats produced per second are
MHT CET 2021 · 23 SEP · SHIFT 1
(a) $\frac{3}{\pi}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{2}{\pi}$

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263. Beats are produced by waves $y_1 = a\sin 2000\pi t$ and $y_2 = a\sin 2008\pi t$. The number of beats heard per second is

MHT CET 2021 · 20 SEP · SHIFT 2

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

264. Two waves $Y_1 = 0.25\sin 316t$ and $Y_2 = 0.25\sin 310t$ are propagating along the same direction. The number of beats produced per second are

MHT CET 2020 · 16 OCT · SHIFT 1

(a) $\frac{\pi}{2}$ (b) $\frac{2}{\pi}$ (c) $\frac{3}{\pi}$ (d) $\frac{\pi}{3}$

265. For formation of beats, two sound notes must have

MHT CET 2019 · 3 MAY · SHIFT 1

(a) different amplitudes and different frequencies
(b) exactly equal frequencies only
(c) exactly equal amplitudes only
(d) nearly equal frequencies and equal amplitudes

266. 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

NEET 2016 · PHASE 2

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

267. Two sources of sound placed close to each other, are emitting progressive waves given by y1 = 4sin600πt and y2 = 5sin608πt
An observer located near these two sources of sound will hear

AIPMT 2012 · PRELIMS

(a) 4 beats per second with intensity ratio 25: 16 between waxing and waning.
(b) 8 beats per second with intensity ratio 25: 16 between waxing and waning.
(c) 8 beats per second with intensity ratio 81: 1 between waxing and waning.
(d) 4 beats per second with intensity ratio 81: 1 between waxing and waning.

268. Two sound waves with wavelengths 5.0 m and 5.5. m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second.

AIPMT 2006

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

269. Two vibrating tuning forks produce progressive waves given by $y_1 = 4\sin 500\pi t$ and $y_2 = 2\sin 506\pi t$. Number of beats produced per minute is

AIPMT 2005

(a) 360 (b) 180 (c) 120 (d) 30

270. For production of beats the two sources must have

AIPMT 1992

(a) different frequencies and same amplitude
(b) different frequencies
(c) different frequencies, same amplitude and same phase
(d) different frequencies and same phase

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

AIEEE 2009

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

◆ Series of tuning forks 5 Qs

272. A set of 8 tuning forks is arranged in ascending order of frequencies. Each fork produces 4 beats with the next one and frequency of last fork is octave of first. The frequency of 5^{th} fork is

MHT CET 2026 · 19 MAY · SHIFT 2

(a) 22 Hz (b) 33 Hz (c) 44 Hz (d) 55 Hz

273. A set of 14 tuning forks is arranged in a series of increasing frequencies. Each fork produces 'x' beats per second with the preceding fork and the last fork is an octave of the first fork. If the seventh fork has the frequency of 114 Hz, the value of x is

MHT CET 2026 · 19 APR · SHIFT 1

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

274. A set of 28 turning forks is arranged in an increasing order of frequencies. Each fork produces ' x ' beats per second with the preceding fork and the last fork is an octave of the first. If the frequency of the 12^{th} fork is 152 Hz, the value of ' x ' (no. of beats per second) is

MHT CET 2024 · 4 MAY · SHIFT 2

(a) 2 (b) 4 (c) 6 (d) 8

275. 41 tuning forks are arranged in increasing order of frequency such that each produces 5 beats/second with next tuning fork. If frequency of last tuning fork is double that of frequency of first fork. Then frequency of first and last fork is

MHT CET 2023 · 12 MAY · SHIFT 1

(a) 400, 200 Hz (b) 200, 400 Hz
(c) 100, 200 Hz (d) 205, 410 Hz

276. A set of 20 tuning forks is arranged in a series of increasing frequencies. If each fork gives 4 beats with respect to the preceding fork and the frequency of the last fork is twice the frequency of the first, then the frequency of last fork is _____ Hz.

JEE MAIN 2022 · 26 JUN · SHIFT 2 *(Numerical)*

◆ Loading, filing and unknown frequency 6 Qs

277. A tuning fork A produces 5 beats per second with a tuning fork of frequency 480 Hz. When a little wax is stuck to a prong of fork A, the number of beats heard per second becomes 2. What is the frequency of tuning fork A before the wax is stuck to it?

MHT CET 2020 · 19 OCT · SHIFT 2

(a) 475 Hz (b) 482 Hz (c) 478 Hz (d) 485 Hz

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278. A tuning fork A of unknown frequency produces 5 beats/s with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats/s. What is the frequency of fork A?

JEE MAIN 2021 · 26 FEB · SHIFT 2

(a) 335 Hz (b) 345 Hz (c) 338 Hz (d) 342 Hz

279. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heated. Now, some tape is attached on the prong of the fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, then what was the original frequency of fork 2?

AIEEE 2005

(a) 202 Hz (b) 200 Hz (c) 204 Hz (d) 196 Hz

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

AIEEE 2002

(a) 286 cps (b) 292 cps (c) 294 cps (d) 288 cps

281. When temperature increases, the frequency of a tuning fork

AIEEE 2002

(a) increases
(b) decreases
(c) remains same
(d) increases or decreases depending on the material

282. Two tuning forks A and B are sounded together giving rise to 8 beats in 2 s. When fork A is loaded with wax, the beat frequency is reduced to 4 beats in 2 s. If the original frequency of tuning fork B is 380 Hz then original frequency of tuning fork A is _____ Hz.

JEE MAIN 2026 · 28 JAN · SHIFT 2 *(Numerical)*

◆ Beats with strings and sonometer wires 4 Qs

283. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases. If the frequency of A is 530 Hz, the original frequency of B will be:

NEET 2020 · PHASE 1

(a) 524 Hz (b) 536 Hz (c) 537 Hz (d) 523 Hz

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

AIPMT 2010 · PRELIMS

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

285. A tuning fork of known frequency 256 Hz makes 5 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per second when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

AIEEE 2003

(a) $256 + 2Hz$ (b) $256 - 2Hz$
(c) $256 - 5Hz$ (d) $256 + 5Hz$

286. Two sitar strings, A and B, playing the note 'Dha' are slightly out of tune and produce beats of frequency 5 Hz. The tension of the string B s slightly increased and the beat frequency is found to decrease by 3Hz. If the frequency of A is 425 Hz, the original frequency of B is:

JEE MAIN 2018 · 16 APR · SHIFT 1 *(Not in current JEE/NEET syllabus)*

(a) 430 Hz (b) 420 Hz (c) 428 Hz (d) 422 Hz

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TOPIC 08

Doppler Effect

34 PYQs · Easy 34 · Medium 0 · Difficult 0 | MHT CET 16 · NEET 7 · JEE 11

Concepts covered: Moving source (9) · Moving observer (6) · Source and observer both moving (13) · Reflection from a wall or moving obstacle (3) · Beats from the Doppler effect (3)

LEVEL 1 · EASY 34 questions

◆ Moving source 9 Qs

287. A whistle sends out 256 waves in a second. If the whistle approaches the observer with velocity $\left(\frac{1}{3}\right)^{rd}$ of the velocity of sound in air. The number of waves per second observer will receive is

MHT CET 2026 · 13 MAY · SHIFT 1

(a) 384 (b) 192 (c) 300 (d) 200

288. A whistle giving out 400 Hz approaches a stationary observer at a speed of 34 m/s. The frequency heard by the observer (in Hz) is nearly (speed of sound= 340 m/s)

MHT CET 2026 · 12 MAY · SHIFT 1

(a) 400 (b) 500 (c) 444 (d) 555

289. A train is moving towards a stationary observer with speed 34 m/s. A train sounds a whistle of frequency 450 Hz. If the speed of sound is 340 m/s, the frequency heard by the observer in Hz is

MHT CET 2026 · 20 APR · SHIFT 1

(a) 440 (b) 480 (c) 500 (d) 540

290. At what speed should a source of sound move so that the observer finds the apparent frequency equal to half the original frequency?

MHT CET 2025 · 25 APR · SHIFT 2

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

291. A sound source is moving towards a stationary observer with $\left(\frac{1}{10}\right)^{th}$ the speed of sound, The ratio of apparent to real frequency is

MHT CET 2025 · 25 APR · SHIFT 1

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

292. When source of sound moves towards a stationary observer, the apparent frequency heard by him

MHT CET 2025 · 19 APR · SHIFT 1

(a) increases and wavelength also increases.
(b) increases while wavelength decreases.
(c) remains the same while wavelength decreases.
(d) decreases and wavelength remains the same.

293. A source of sound is moving towards a stationary observer with $\left(\frac{1}{10}\right)^{th}$ the of the speed of sound. The ratio of apparent to real frequency is

MHT CET 2023 · 14 MAY · SHIFT 2

(a) 10 : 9 (b) 11 : 10
(c) $(11)^2 : (10)^2$ (d) $(9)^2 : (10)^2$

294. A vehicle, with a horn of frequency n is moving with a velocity of 30 m/s in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency $n + n_1$. Then (if the sound velocity in air is 300 m/s)

AIPMT 1998

(a) $n_1 = 10n$ (b) $n_1 = 0$
(c) $n_1 = 0.1n$ (d) $n_1 = -0.1n$

295. A train blowing a whistle of frequency 320 Hz approaches an observer standing on the platform at a speed of 66 m/s. The frequency observed by the observer will be (given speed of sound = 330 ms $^{-1}$) _____ Hz.

JEE MAIN 2023 · 25 JAN · SHIFT 2 *(Numerical)* *(Not in current JEE/NEET syllabus)*

◆ Moving observer 6 Qs

296. An observer moves towards a stationary source of sound with a velocity $\left(\frac{1}{5}\right)^{th}$ of the velocity of sound. The percentage increase in the apparent frequency is

MHT CET 2026 · 14 MAY · SHIFT 1

(a) 0.5% (b) 0% (c) 20% (d) 5%

297. An observer moves towards a stationary source of sound with a velocity of one fifth of the velocity of sound. The percentage increase in the apparent frequency is

MHT CET 2025 · 23 APR · SHIFT 1

(a) 5% (b) 10% (c) 20% (d) 25%

298. An observer moves towards a stationary source of sound with a velocity of one-fifth of the velocity of sound. The percentage increase in the apparent frequency is

MHT CET 2024 · 3 MAY · SHIFT 2

(a) 5% (b) 10% (c) 20% (d) 25%

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299. An observer moves towards a stationary source of sound with a speed 1/5th of the speed of sound. The wavelength and frequency of the source emitted are λ and f respectively. The apparent frequency and wavelength recorded by the observer are respectively

AIPMT 2003 *(Not in current JEE/NEET syllabus)*

(a) 1.2 f, 1.2 λ (b) 1.2 f, λ
(c) f, 1.2 λ (d) 0.8 f, 0.8 λ

300. An observer moves towards a stationary source of sound with a velocity equal to one-fifth of the velocity of sound. The percentage change in the frequency will be:

JEE MAIN 2022 · 27 JUN · SHIFT 1 *(Not in current JEE/NEET syllabus)*

(a) 20% (b) 10% (c) 5% (d) 0%

301. 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?

AIEEE 2005 *(Not in current JEE/NEET syllabus)*

(a) 0.5% (b) zero (c) 20% (d) 5%

◆ Source and observer both moving 13 Qs

302. A person observes two moving trains. 'A' reaching the station and 'B' leaving the station with equal speed of 30m/s. If both trains emit sounds with frequency 300 Hz, (speed of sound = 330 m/s) difference of frequencies heard by the person will be

MHT CET 2026 · 16 APR · SHIFT 2

(a) 10 Hz (b) 33 Hz (c) 55 Hz (d) 80 Hz

303. A person observes two moving trains. First reaching the station and another leaves the station with equal speed of 30 m/s. If both trains emit sounds of frequency 300 Hz, difference of frequencies heard by the person will be (speed of sound in air 330 m/s)

MHT CET 2025 · 5 MAY · SHIFT 2

(a) 80 Hz (b) 75 Hz (c) 55 Hz (d) 45 Hz

304. When source of sound and observer both are moving towards each other, the observer will hear

MHT CET 2025 · 22 APR · SHIFT 2

(a) low frequency, low wavelength.
(b) low frequency, high wavelength.
(c) high frequency, low wavelength.
(d) high frequency, high wavelength.

305. A train sounding a whistle of frequency 510 Hz approaches a station at 72 km/hr. The frequency of the note heard by an observer on the platform as the train (1) approaches the station and then (2) recedes the station are respectively (in hertz) (velocity of sound in air = 320 m/s)

MHT CET 2024 · 4 MAY · SHIFT 2

(a) 544, 480 (b) 480, 544 (c) 612, 544 (d) 544, 612

306. A passenger is sitting in a train which is moving fast. The engine of the train blows a whistle of frequency 'n '. If the apparent frequency of sound heard by the passenger is 'f' then

MHT CET 2023 · 13 MAY · SHIFT 1

(a) f = n (b) f > n (c) f < n (d) f ≤ n

307. When both source and listener are approaching each other the observed frequency of sound is given by (V_L and V_S is the velocity of listener and source respectively, n_0 = radiated frequency)

MHT CET 2023 · 9 MAY · SHIFT 1

(a) $n = n_0\left[\frac{V+V_L}{V-V_s}\right]$ (b) $n = n_0\left[\frac{V-V_L}{V+V_s}\right]$
(c) $n = n_0\left[\frac{V-V_L}{V-V_s}\right]$ (d) $n = n_0\left[\frac{V+V_L}{V+V_s}\right]$

308. Two cars moving in opposite directions approach each other with speed of 22 m^{s-1} and 16.5 m s^{-1} respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is (velocity of sound is 340 m s^{-}1)

NEET 2017 *(Not in current JEE/NEET syllabus)*

(a) 361 Hz (b) 411 Hz (c) 448 Hz (d) 350 Hz

309. Two cars X and Y are approaching each other with velocities 36 km/h and 72 km/h respectively. The frequency of a whistle sound as emitted by a passenger in car X, heard by the passenger in car Y is 1320 Hz. If the velocity of sound in air is 340 m/s, the actual frequency of the whistle sound produced is ..... Hz.

JEE MAIN 2021 · 27 AUG · SHIFT 1 *(Numerical)* *(Not in current JEE/NEET syllabus)*

310. A source and a detector move away from each other in absence of wind with a speed of 20 m/s with respect to the ground. If the detector detects a frequency of 1800 Hz of the sound coming from the source, then the original frequency of source considering speed of sound in air 340 m/s will be ..... Hz.

JEE MAIN 2021 · 26 AUG · SHIFT 1 *(Numerical)* *(Not in current JEE/NEET syllabus)*

311. A car P travelling at 20 ms^{-1} sounds its horn at a frequency of 400 Hz. Another car Q is travelling behind the first car in the same direction with a velocity 40 ms^{-1}. The frequency heard by the passenger of the car Q is approximately [Take, velocity of sound = 360 ms^{-1}]

JEE MAIN 2023 · 11 APR · SHIFT 2 *(Not in current JEE/NEET syllabus)*

(a) 485 Hz (b) 514 Hz (c) 421 Hz (d) 471 Hz

312. The engine of a train moving with speed 10 ms^{-1} towards a platform sounds a whistle at frequency 400 Hz. The frequency heard by a passenger inside the train is: (neglect air speed. Speed of sound in air = 330 ms^{-1})

JEE MAIN 2023 · 8 APR · SHIFT 1 *(Not in current JEE/NEET*

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syllabus)

(a) 200 Hz (b) 412 Hz (c) 400 Hz (d) 388 Hz

313. A person observes two moving trains, 'A' reaching the station and 'B' leaving the station with equal speed of $30\ \mathrm{m/s}$. If both trains emit sounds with frequency $300\ \mathrm{Hz}$, (Speed of sound: $330\ \mathrm{m/s}$) approximate difference of frequencies heard by the person will be:

JEE MAIN 2023 · 29 JAN · SHIFT 1 *(Not in current JEE/NEET syllabus)*

(a) 10 Hz (b) 55 Hz (c) 80 Hz (d) 33 Hz

314. Two cars A and B are moving away from each other in opposite directions. Both the cars are moving with a speed of 20 ms–1 with respect to the ground. If an observer in car A detects a frequency 2000 Hz of the sound coming from car B, what is the natural frequency of the sound source in car B?
(speed of sound in air = 340 ms–1) :-

JEE MAIN 2019 · 9 APR · SHIFT 2 *(Not in current JEE/NEET syllabus)*

(a) 2300 Hz (b) 2060 Hz (c) 2250 Hz (d) 2150 Hz

◆ Reflection from a wall or moving obstacle 3 Qs

315. The driver of a car travelling with speed 30 m/s towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by driver is

AIPMT 2009 *(Not in current JEE/NEET syllabus)*

(a) 555.5 Hz (b) 720 Hz (c) 500 Hz (d) 550 Hz

316. A car is moving towards a high cliff. The driver sounds a horn of frequency f. The reflected sound heard by the driver has frequency $2f$. If v is the velocity of sound, then the velocity of the car, in the same velocity units, will be

AIPMT 2004 *(Not in current JEE/NEET syllabus)*

(a) $v/\sqrt{2}$ (b) v/3 (c) v/4 (d) v/2

317. The frequency of echo will be _____ Hz if the train blowing a whistle of frequency 320 Hz is moving with a velocity of 36 km/h towards a hill from which an echo is heard by the train driver. Velocity of sound in air is 330 m/s.

JEE MAIN 2022 · 28 JUL · SHIFT 1 *(Numerical)* *(Not in current JEE/NEET syllabus)*

◆ Beats from the Doppler effect 3 Qs

318. Two sources P and Q produce notes of frequency 660 Hz. each. A listener moves from P to Q with a speed of 1 ms^{-1}. If the speed of sound is 330 m/s, then the number of beats heard by the listener per second will be

NEET 2013 *(Not in current JEE/NEET syllabus)*

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

319. Two stationary sources each emitting waves of wavelength λ, an observer moves from one source to another with velocity u. Then number of beats heard by him

AIPMT 2000 *(Not in current JEE/NEET syllabus)*

(a) $\frac{2u}{\lambda}$ (b) $\frac{u}{\lambda}$ (c) $\sqrt{u\lambda}$ (d) $\frac{u}{2\lambda}$

320. Two factories are sounding their sirens at 800 Hz. A man goes from one factory to other at a speed of 2 m/s. The velocity of sound is 320 m/s. The number of beats heard by the person in one second will be:

JEE MAIN 2014 · 11 APR · SHIFT 1 *(Not in current JEE/NEET syllabus)*

(a) 2 (b) 4 (c) 8 (d) 10

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ANSWER KEY

Shaded by level: **Easy**

01 Wave Basics & Properties of Sound

1. (c)	2. (a)	3. (c)	4. (b)	5. (a)	6. (d)	7. (a)	8. (c)	9. (c)	10. (b)
11. (b)	12. (c)	13. (c)	14. (a)	15. (c)	16. (c)	17. (a)	18. (c)	19. (c)	20. (b)
21. (a)	22. (a)	23. (b)	24. (d)	25. (b)	26. (c)	27. (b)	28. (c)	29. (b)	30. 3
31. (a)	32. (b)	33. (b)							

02 Speed of Waves

34. (a)	35. (c)	36. (b)	37. (a)	38. (c)	39. (a)	40. (c)	41. (c)	42. (d)	43. 2
44. (c)	45. (b)	46. (c)	47. (d)	48. (d)	49. (a)	50. (a)	51. (c)	52. 819	

03 Progressive Wave Equation

53. (a)	54. (a)	55. (d)	56. (c)	57. (c)	58. (a)	59. (d)	60. (c)	61. (d)	62. (d)
63. (d)	64. (a)	65. (c)	66. (c)	67. (d)	68. (b)	69. (d)	70. (c)	71. (d)	72. (c)
73. (d)	74. (c)	75. (c)	76. (a)	77. (b)	78. (a)	79. 349	80. 1152	81. 20	82. (a)
83. (b)	84. (c)	85. (a)	86. (c)	87. (a)	88. (d)	89. (c)	90. (a)	91. (c)	92. (c)
93. (c)	94. (b)	95. (b)	96. (a)	97. (b)	98. (b)	99. (b)	100. (b)	101. (c)	102. (c)
103. (c)	104. (b)	105. (d)	106. (d)	107. (d)	108. (b)	109. (c)	110. (d)	111. (c)	112. (a)
113. (a)	114. (b)	115. (a)	116. (c)	117. (b)	118. (d)	119. (b)	120. (c)	121. (b)	122. (a)
123. (a)	124. (c)	125. (c)	126. (b)	127. (a)	128. (d)	129. (a)	130. (a)	131. (c)	132. (d)
133. 18									

04 Reflection, Superposition & Interference

134. (c)	135. (b)	136. (b)	137. (a)	138. (a)	139. (c)	140. (d)	141. (b)	142. (c)	143. 60
144. 20	145. 120	146. (b)	147. (b)						

05 Stationary Waves & Vibrating Strings

148. (d)	149. (c)	150. (d)	151. (c)	152. (c)	153. (a)	154. (a)	155. 5	156. 1	157. (c)
158. (d)	159. (a)	160. (d)	161. (b)	162. (b)	163. (a)	164. (c)	165. (d)	166. (d)	167. (c)
168. (a)	169. (a)	170. (d)	171. (c)	172. (a)	173. (a)	174. (c)	175. (c)	176. (c)	177. (c)
178. (c)	179. (d)	180. (a)	181. (b)	182. (a)	183. (d)	184. (a)	185. (b)	186. 10	187. (a)
188. (c)	189. (c)	190. (c)	191. (c)	192. (c)	193. (c)	194. (a)	195. 60	196. 60	197. (b)
198. (a)	199. (c)	200. (b)	201. (a)	202. (d)	203. (c)	204. (a)	205. (a)	206. (d)	

06 Organ Pipes & Resonance Tube

207. (d)	208. (b)	209. (a)	210. (b)	211. (a)	212. (a)	213. (d)	214. (b)	215. 34	216. (a)
217. (b)	218. (b)	219. (b)	220. (b)	221. 900	222. (d)	223. (b)	224. (c)	225. (a)	226. (a)
227. (b)	228. (a)	229. (c)	230. 16	231. 80	232. (b)	233. (a)	234. (c)	235. (b)	236. (d)
237. (d)	238. (d)	239. (d)	240. (d)	241. (b)	242. (b)	243. (a)	244. (a)	245. (d)	246. (b)
247. (a)	248. (a)	249. (b)							

07 Beats

250. (b)	251. (d)	252. (c)	253. (a)	254. (d)	255. (b)	256. (c)	257. (d)	258. (b)	259. (c)
260. (b)	261. (a)	262. (a)	263. (a)	264. (c)	265. (d)	266. (d)	267. (d)	268. (a)	269. (b)
270. (b)	271. (b)	272. (c)	273. (c)	274. (b)	275. (b)	276. 152	277. (d)	278. (a)	279. (d)
280. (b)	281. (b)	282. 384	283. (a)	284. (d)	285. (c)	286. (b)			

08 Doppler Effect

287. (a)	288. (c)	289. (c)	290. (d)	291. (a)	292. (b)	293. (a)	294. (b)	295. 400	296. (c)
297. (c)	298. (c)	299. (b)	300. (a)	301. (c)	302. (c)	303. (c)	304. (c)	305. (a)	306. (a)
307. (a)	308. (c)	309. 1210	310. 2025	311. (c)	312. (c)	313. (b)	314. (c)	315. (b)	316. (b)
317. 340	318. (a)	319. (a)	320. (d)						

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Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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