PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

SOUND WAVES

Example

1. The speed of sound in dry air at NTP is $332 m / s$. Assuming air as composed of 4 parts

of nitrogen and one parts of oxygen in volume. Calculate the velocity of sound in oxygen under similar conditions. Given density of oxygen and nitrogen at NTP are in the ratio $16:14$ respectively.

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2. The equation of a sound wave in air is given by

$\rho = \left(0.01N/m^2\right)\left[\sin\left(1000s^{-1}\right)t - \left(3.0m^{-1}\right)x\right]$

(a) Find the frequency, wavelength and the

speed of sound wave in air.

(b) If the equilibrium pressure of air is $1.0 \times 10^5 N/m^2$, what are the maximum and minimum pressure at a point as the wave passes through that point ?

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3. A source of sound operates at 2.0 kHz, 20 W emitting sound uniformly in all direction. The speed of sound in air is $340ms^{-1}$ at a distance of air is $1.2kgm^{-3}$ (a) What is the

intensity at a distance of 6.0 m from the source ? (b) What will be the pressure amplitude at this point ? (c) What will be the displacement amplitude at this point ?

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4. (a) Sound with intensity larger than $120dB$ appears painful to a person. A small speaker delivers $2.0W$ of audio output. How close can the person get to the speaker without hurting his ears?

(b) If the sound level in a room is increased from $50dB$ to $60dB$, by what factor level is the pressure amplitude increased?

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5. A sound wave of frequency 100 Hz is travelling in air. The speed of sound in air is $350ms^{-1}$ (a) By how much is the phase changed at a given point in 2.5 ms ? (b) What is the phase difference at a given instant

between two points separated by a distance of 10.0 cm along the direction of propagation ?

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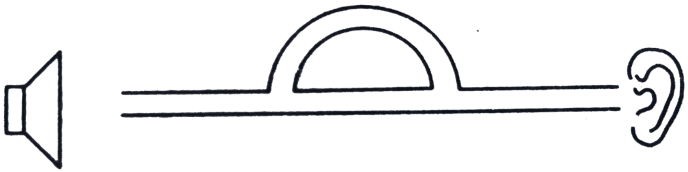
6. Figure shows a tube structure in which a sund signal is sent from one end and is received at the other end.The semicircular part has a radius of 20.0 cm. The frequency ohet sound source can be varied elertronically between 1000 and 4000 Hz. Find the frequencies at which maxima of intensity are

detected. The speed of sound in air = $3400ms^{-1}$.



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7. In a large room , a person receives waves from the same source which reach , being reflected from the $25m$ high ceiling at a point halfway between them . The two waves interfere constructively for a wavelength of

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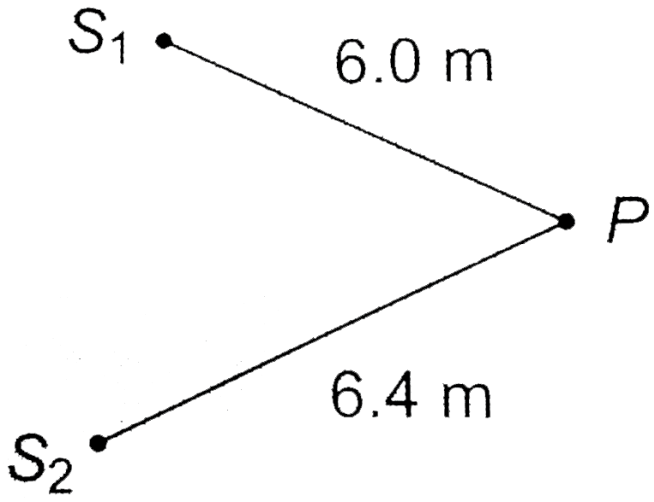
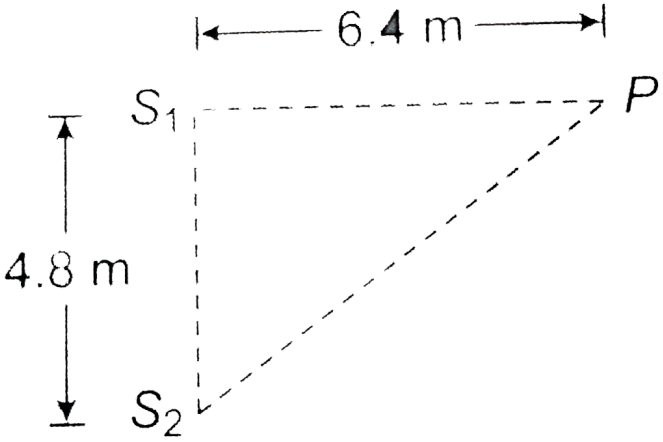
8. Two sources are placed from a person P as shown in figure. The speed of sound in air is $320 m / s$.



(a)

If sound signal is continuously varied from $500 Hz$ to $2500 Hz$, for which frequency

listener will hear minimum sound intensity.



(b)

Find the frequencies in audible range $(20 - 20000Hz)$ for which listener will hear maximum sound intensity.

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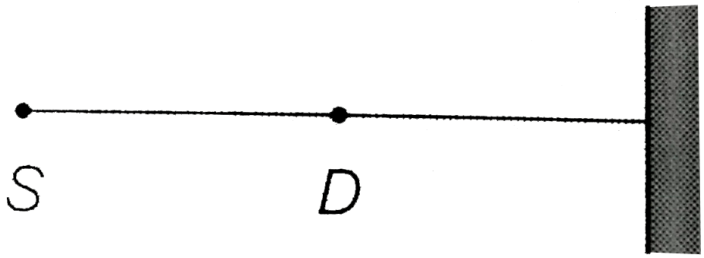
9. (a) A source of sound S and a detector D are placed at some distance from one another. A big cardboard is placed near the detector and perpendicular to the line SD as shown in figure. It is gradually moved away and it is found that the intensity changes from a maximum to a minimum as the board is moved through a distance of $20cm$. Find the frequency of the sound emitted. Velocity of sound in are is $336m/s$.



(b) A source emitting sound of frequency $180Hz$ is placed in front of a wall at a distance of $2m$ from it. A detector is also placed in front of the wall at the same distance from it. find the minimum distance between the source and the detector for which the detector detects a maximum of sound . Speed of sound in air $= 360m/s$.

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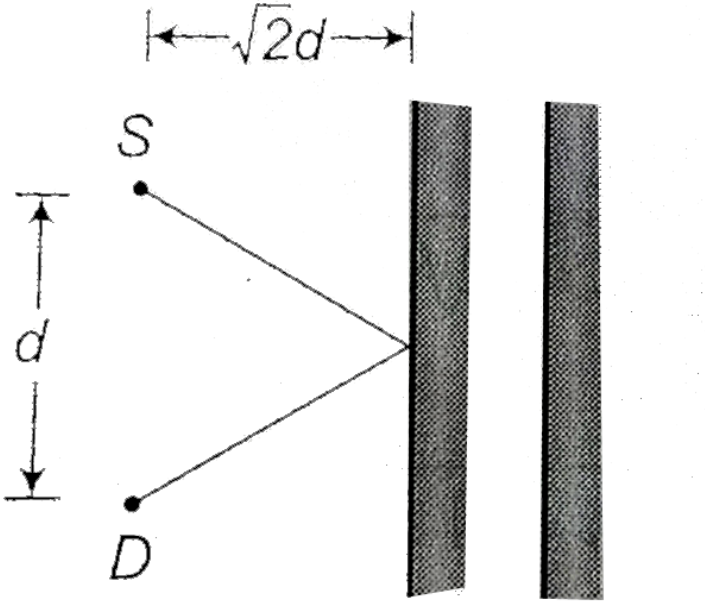
10. A source S and a detector D are placed at a distance d apart. A big cardboard is placed at a distance $\sqrt{2}d$ from the source and the detector as shown in figure. The source emits a wave of wavelength $= d/2$ which is received by the detector after reflection from the cardboard. It is found to be in phase with the direct wave received from the source. By what minimum distance should the cardboard be shifted away so that the reflected wave

becomes out of phase with the direct wave?



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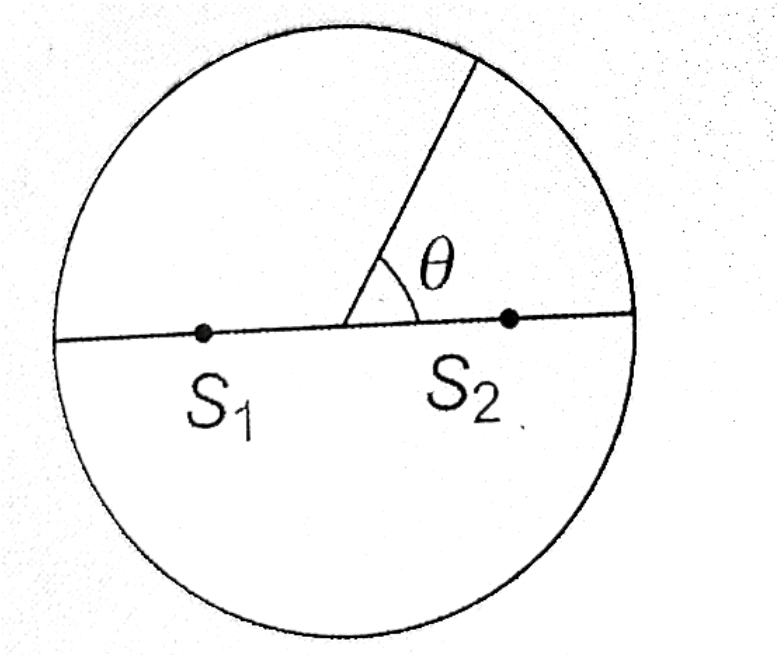
11. Figure shows two coherent sources S_1 and S_2 which emit sound of wavelength λ in

phase. The separation between the sources is 3λ. A circular wire of large radius is placed in such a way that S_1S_2 lies in its plane and the middle point of S_1S_2 is at the centre of the wire. Find the angular positions θ, on the wire for which constructive interference takes place.



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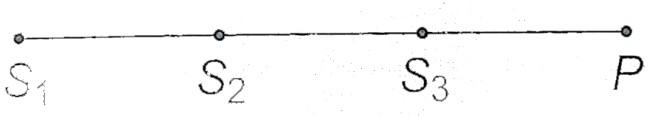
12. Three sources of sound S_1, S_2 and S_3 of equal intensity are placed in a straight line with $S_1S_2 = S_2S_3$ shown in the figure. At a point P, far away from the sources, the wave coming from S_2 is 120° ahead in phase of that from S_1, Also, the wave coming from S_3 is 120° ahead of that from S_2. What would be the resultant intensity of sound at P ?



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13. Two radio stations broadcast their programmes at the same amplitude A and at slightly different frequencies ω_1 and ω_2 respectively, where $\omega_1 - \omega_2 = 10^3 Hz$. A detector receives the signals from the two stations simultaneously, it can only detect signals of intensity $\geq 2A^2$.

(i) Find the time interval between successive maxima of the intensity of the signal received by the detector.

(ii) Find the time for which the detector remains idle in each cycle of the intensity of the signal.

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14. (a) A tuning fork produces 4 beats per second with another tuning fork of frequency $256Hz$. The first one is now loaded with a little wax and the beat frequency is found to increase to 6 per second. What was the original frequency of the tuning fork ?

(b) A plano wire A vibrates at a fundamental frequncy of $600Hz$. A second identical wire B produces 6 betas per second with it, when of the tension in A is slightly increased. Find the ratio of the tension in A to the tension to B.

(c) A tunnig fork if frequency $256Hz$ produces 4 beats per second with a wire of length $25cm$ vibrating in its fundamental mode. The beat frequency decreases when the length is slightly shortened. What could be the minimum length by whech the wire be shortened so that it produces no beats with the tuning fork?

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15. A man standing in front of a mountain beats a drum at regular intervals. The drumming rate is gradually increased and he finds that echo is not heard distinctly when the rate becomes 40 per minute. He then moves near to the mountain by 90 metres and finds that echo is again not heard distinctly when the drumming rate becomes 60 per minute. Calculate (a) the distance between the

mountain and the initial position of the man and (b) the velocity of sound.

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16. A engine is approaching a hill at constant speed. When it is at a distance of $0.9km$, it blows a whistle, whose echo is heard by the driver after $5s$. If the speed of sound is $340m/s$, calculate the speed of the engine.

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17. (a) A cylindrical metal tube has a length of $50cm$ and is open at both ends. Find the frequencies between $1000Hz$ and $2000Hz$ at which the air is $340m/s$.

(b) Find the greatest length of an organ pipe open at both ends that will have its fundamental frequency in the normal hearing range $(20 - 20000Hz)$. Speed of sound in air $= 340m/s$.

(c) Two successive resonance frequencies in an open organ pipe are $1944Hz$ and $2592Hz$.

Find the length of the tube. The speed of sound in air is $324 m / s$.

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18. The air column in a pipe closed at one end is made to vibrate in its second overtone by a tuning fork of frequency $440 Hz$. The speed of sound in air is $330 m s^{-1}$. End corrections may be neglected. Let P_0 denote the mean pressure at any point in the pipe, and ΔP the maximum amplitude of pressure variation.

(a) What the length L of the air column.

(b) What is the amplitude of pressure variation at the middle of the column?

(c) What are the maximum and minimum pressures at the open end of the pipe?

(d) What are the maximum and minimum pressures at the closed end of the pipe?

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19. The first overtone of an open orgen pipe beats with the first ouertone of a closed orgen

pipe with a beat frequency of $2.2H_Z$. The fundamental frequency of the closed organ pipe is $110H_Z$. Find the lengths of the pipes . Speed of sound in air $u = 330m/s$.

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20. Two narrow cylindrical pipes A and B have the same length. Pipe A is open at both ends and is filled with a monoatomic gas of molar mass M_A. Pipe B is open at one end and closed at the other end, and is filled with a

diatomic gas of molar mass M_B. Both gases are at the same temperature.

(a) If the frequency of the second harmonic of the fundamental mode in pipe A is equal to the frequency of the third harmonic of the fundamental mode in pipe B, determine the value of M_B / M_B.

(b) Now the open end of pipe B is also closed (so that the pipe is closed at both ends). Find the ratio of the fundamental frequency in pipe A to that in pipe B.

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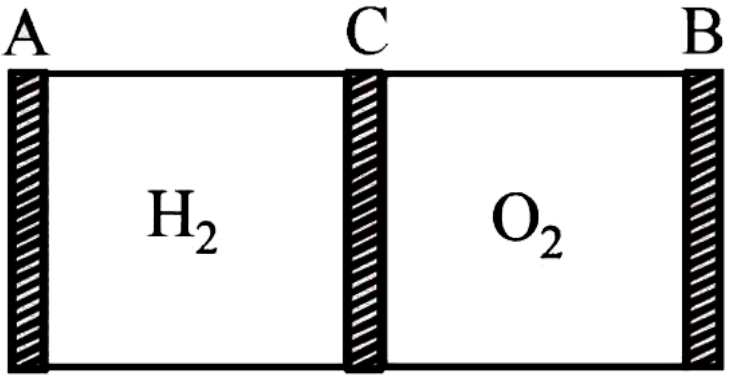
21. AB is a cylinder of length $1m$ fitted with a thin flexible diaphragm C at the middle and other thin flexible diaphragms A and B at the ends. The portions AC and BC contain hydrogen and oxygen gases respectively. The diaphragms A and B are set into vibrations of same frequency. What is the minimum frequency of these vibrations for which diaphragms C is a node? (Under the conditions of experiment $v_{H_2=1100m/s}$, v_{0_2} =

$300m/s$).



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22. A string $1m$ long and having linear mass density $10g/m$ is sounded with a closed pipe of length $75cm$. When string is vibrating in its first overtone and the air in the pipe in its

fundamental frequency, $5beats/s$ are heard. It is observed that decreasing the tension in the string decreases the beat frequency. If the speed of sound in air is $315m/s$, Find the tension in the string.

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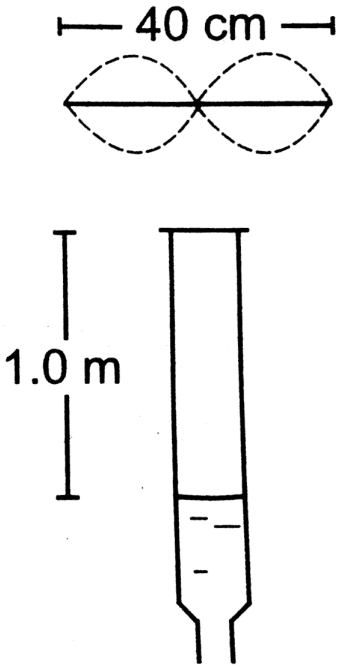
23. Consider the situation shown in figure. The wire which has a mass of 4.00 g oscillates in its second harmonic and sets the air column in the tube into vibrations in its fundamental

mode. Assuming that the speed of sound in air is $40ms^{-1}$, find the tension in the wire.



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24. A column of air at $51^\circ C$ and a tuning fork produce 4 beats per second when sounded together. As the temperature of the air column is decreased, the number of beats per second tends to decrease and when the temperature is $16^\circ C$ the two produce 1 beat per second. Find the frequency of the tuning fork.

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25. (a) In a resonance column experiment, a tuning fork of frequency $400Hz$ is used. The first resonant is observed when the air column has a length of $20.0cm$ and the second resonance is observed when the air column has a length of $62.0cm$. (i) Find the speed of sound in air. (ii) How much distance above the open end does the pressure mode form?

(b) A piston is fitted in a cylindrical tube of small crosssection with the other end of the tube open. The tube resonates with a tuning fork of frequency $512Hz$. The piston is

gradually pulled out of the tube and it is found that a second resonance occurs when the piston is pulled out through a distance of $32.0cm$. Calculate the speed of sound in the air of the tube.

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26. In a resonance tube experiment to determine the speed of sound in air, a pipe of diameter $5cm$ is used . The column in pipe resonates with a tuning fork of frequency

$480 H_Z$ when the minimum length of the air column is $16 cm$. Find the speed in air column at room temperature.

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27. A metal wire of diameter $1 mm$ is held on two knife edges by a distance $50 cm$. The tension in the wire is $100 N$. The wire vibrating with its fundamental frequency and a vibrating tuning fork together produce $5 beats / s$. The tension in the wire is then

reduced to $81N$. When the two are excited, beats are heard at the same rate. Calculate

(a) frequency of a fork and

(b) the density of material of wire.

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28. When $1m$ long metallic wire is stressed, an extension of $0.02m$ is produced. An organ pipe $0.5m$ long and open at both ends, when sounded with this stressed metallic wire, produced 8 beats in its fundamental mode. By

decreasing the stress in the wire, the number of beats are found to decrease. Find the Young's modulus of the wire. The density of metallic wire is $10^4 kg/m^3$ and velocity of sound in air is $292 m/s$.

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29. A car moving at $108 kmh^{-1}$ finds another car in front of it going in the same direction at $72 kmh^{-1}$. The first car sounds a horn that has a dominant frequency of 800 Hz. What will be

the apparent frequency heard by the driver in the front car ? Speed of sound in air $= 330 ms^{-1}$

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30. An observer standing on a railway crossing receives frequencies 2.2 kHz and 1.8 kHz when the tran approaches and recedes from the observer. Find the velocity of the train (speed of sound in air is 300 m/s).

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31. A bullet passes past a person at a speed of $220ms^{-1}$. Find the fractional change in the frequency of the whistling sound heard by the person as the bullet crosses the person. Speed of sound in air $= 330ms^{-1}$.

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32. A person going away from a factory on his scooter at a speedof $36kmh^{-1}$ listens to the siren of the factory. If the main frequency of

the siren is 600 hz and a wind is blowing alongthe direction of the scooter at $36kmh^{-1}$, find the main frequency as heard by the person.

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33. Two tuning forks with natural frequencies of $340Hz$ each move relative to a stationary observer. One fork moves away form the observer, while the other moves towards him at the same speed. The observer hears beats

of frequency $3Hz$. Find the speed of the tuning fork.

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34. Two electric trains run at the same speed of $72kmh^{-1}$ along the same track and in the same direction with a separation of 2.4 kin between them. The two trains simultaneously sound brief whistles. A person is situated at a perpendicular distance of 500 m from the track and is equidistant from the two trains at

the instant of the whistling. If both the whistles were at 500 Hz and the speed of sound in air is $340ms^{-1}$, find the frequencies heard by the person.

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35. A small source of sound vibrating at frequency $500Hz$ is rotated in a circle of radius $100/\pi cm$ at a constant angular speed of 5.0 revolutions per second. A listener situates himself in the plane of the circle. Find

the minimum and the maximum frequency of the sound observed. Speed of sound in air $= 332m/s.$

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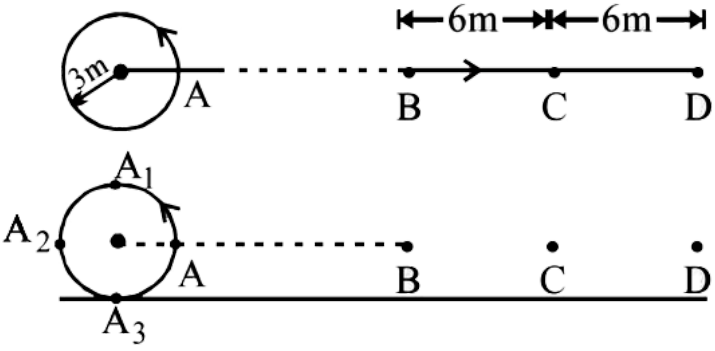
36. A source of sound is moving along a circular orbit of radius $3meter$ with an angular velocity of $10rad/s$. A sound detector located far away from the source is executing linear simple harmonic motion along the line BD with an amplitude $BC = CD = 6meters$

. The frequency of oscillation of the detector is $\frac{5}{\pi}$ per second. The source is at the point A when the detector is at the point B. If the source emits a continuous sound wave of frequency $340Hz$, Find the maximum and the minimum frequencies recorded by the detector.



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37. A small source of sound S of frequency 500 Hz is attached to the end of a light string and is whirled in a vertical circle of radius 1.6 in. The string just remains tight when the source is at the highest point. (a) An observer is located in the same vertical plane at a large distance and at the same height as the centre of the circle. The speed of sound in air $= 330ms^{-1}$ and g = 10ms^-2`. Find the maximum frequency heard by the observer. (b) An observer is situated at a large distance

vertically above the centre of the circle. Find the frequencies heard by the observer corresponding to the sound emitted by the source When it is at the same height as the centre. ltbr.

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38. The driver of as car approaching a vertical wall notices that the frequency of his car's

horn charges from 440 Hz to 480 Hz when it gets reflected from the wal. Find the speed of the car if that of the sound is $330ms^{-1}$.

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39. A band playing music at a frequency f is moving towards a wall at a speed v_b. A motorist is following the band with a speed v_m. If v is the speed of sound, obtain an expression for the beat frequency heard by the motorist.

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40. A bat emitting an ultrasonic wave of frequecy 4.5×10^4 Hz flies at a speed of $6ms^{-1}$ between two parallel walls. Find the two frequecies heard by the bat and the beat frequecy between the two. The speed of sound is $330ms^{-1}$

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41. A car moves with a speed of $54kmh^{-1}$ towards a cliff. The horn of the car emits sound of frequency 400 Hz at a speed of $335ms^{-1}$. (a) Find the wavelength of the sound emitted by the horn in front of the car. (b) Find the wavelength of the wave reflected from the cliff (c) What frequency does a person sitting in the car hear for the reflected sound wave ? (d) How many beats does he hear in 10 seconds between the sound coming directly from the horn and that coming after the reflection ?

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42. A train approaching a hill at a speed of $40km/hr$ sounds a whistle of frequency $580Hz$ when it is at a distance of $1km$ from a hill. A wind with a speed of $40km/hr$ is blowing in the direction of motion of the train Find

(i) the frequency of the whistle as heard by an observer on the hill,

(ii) the distance from the hill at which the echo from the hill is heard by the driver and its

frequency.

(Velocity of sound in air $= 1,200 km/hr$)

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43. A boat is travelling in a driver in river with a speed $10 m/s$ along the stream flowing with a speed $2 m/s$. From this, boat, a sounjd transmitter is lowered into the river through a right support. The wavelength of the sound emitted from the transmitter inside the water is $14.45 mm$. Assume that attention of sound

in water and air is negligible.

(a) What will be frequency detected by receiver kept inside downstream?

(b) The transmitter and the receiver are now pulled up into air. The air is blowing with a speed $5m/s$ in the direction opposite the river stream. Determine the frequency of the sound detected by the receiver. (Temperature of the air and water $= 20^{\circ}C$, Density of river water $= 10^{3}kg/m^{3}$. Bulk modulus of the water $= 2.088 \times 10^{6}Pa$, Gas constant $R = 8.31J/mol - K$, Mean molecular mass

of air $= 28.8 \times 10^{-3} kg/mol$, C_P/C_V for air $= 1.4$).

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44. A source of sound emitting a 1200 Hz note travels along a straight line at a speed of $170 ms^{-1}$. A detector is placed at a distance of 200 m from the line of motion of the source. (a) Find the frequency of sound received by the detector at the instant when the source gets closest to it. (b) Find the distance

between the source and the detector at the instant it detects the frequency 1200 Hz. Velocity of sound in air $= 340ms^{-1}$.

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45. The wavelength of light coming from a distant galaxy is found to be $0.5\,\%$ more than that coming from a source on earth. Calculate the velocity of galaxy.

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46. An astronaut is approaching the moon. He sends a ratio signal of frequency $5 \times 10^9 Hz$ and find that the frequency shift in echo received is $10^3 Hz$. Find his speed of approach.

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Exercises

1. Choose the correct statement.

A. Sound waves are transverse waves

B. Sound travels faster through vacuum

C. Sound travels faster in solids than in gases

D. Sound travels faster in gases than in liquids

Answer: C

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2. Velocity of sound in air is 332 ms^{-1}. Its velocity in vacuum will be

A. $> 332m/s$

B. $= 332m/s$

C. $< 332m/s$

D. meaningless

Answer: D

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3. A big explosion on the moon cannot be heard on the earth because

A. the explosion produces high frequency sound waves which are inaudible

B. sound waves require a material medium for propagation

C. sound waves are absorbed in the moon's atmosphere

D. sound waves are absorbed in the earth's atmosphere

Answer: B

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4. The speed of sound in a medium depends on

A. the elastic property but not on the inertia property

B. the inertia property but not on the elastic property

C. the elastic property as well as the inertia property

D. neither the elastic property nor the inertia property

Answer: C

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5. Consider the following statements:

Assertion (A) The velocity of sound in air increases due to the presence of moisture in

it.

Reason (R): The presence of moisture in air lowers the density of air.

Of these statements-

A. both A and R are true and R is the correct explanation of A

B. both A and R are true but R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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6. How does the speed v of sound in air depend on the atmospheric pressure P?

A. $v \propto P^{-1}$

B. $v \propto P^{-2}$

C. $v \propto P^{1/2}$

D. $v \propto P^{0}$

Answer: D

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7. The velocity of sound in air is affected by change in the

(i) atmospheric pressure

(ii) moisture content of air

(iii) temperature of air

(iv) composition of air.

A. (i), (ii), (iii)

B. (i), (ii), (iv)

C. (ii), (iii), (iv)

D. (ii), (iii)

Answer: C

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8. Laplace's correction in the formula for the speed of sound given by Newton was needed because sound waves

A. are longitudinal

B. propagate isothermally

C. propagate adiabatically

D. have long wavelengths

Answer: C

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9. Speed of sound in gas is proportional to

A. square root of isothermal elasticity

B. square root pf adiabatic elasticity

C. isothermal elasticity

D. adiabatic elasticity

Answer: B

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10. Velocity of sound in air

(i) increases with temperature

(ii) decreases with temperature

(iii) increases with pressure

(iv) is independent of pressure

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. (i) and (iv)

Answer: D

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11. The density of oxygen is 16 times the density of hydrogen. What is the ratio of speeds of sound in them?

A. $1:4$

B. $4:1$

C. $2:1$

D. $1:16$

Answer: A

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12. The temperature at which the speed of sound in air becomes double of its value at $0^\circ C$ is

A. $1092^\circ C$

B. $819K$

C. $819^\circ C$

D. $546^\circ C$

Answer: C

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13. A sample of oxygen at NTP has volume V and a sample of hydrogen at NTP has volume $4V$. Both the gases are mixed and the mixture is maintained at NTP if the speed of sound in hydrogen at NTP is $1270m/s$, that in the mixture will be

A. $317m/s$

B. $635m/s$

C. $830m/s$

D. $950m/s$

Answer: B

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14. The ratio of the velocity of sound in hydrogen gas to that in helium gas at the same temperature is

A. $\sqrt{21}/5$

B. $\sqrt{42}/5$

C. $5/42$

D. $5/\sqrt{21}$

Answer: B

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15. If c_0 and c denote the sound velocity and the rms velocity of the molecules in a gas, then

A. $c_0 > c$

B. $c_0 = c$

C. $c_0 = c(\gamma/3)^{1/2}$

D. no relation

Answer: C

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16. A source emits sound of frequency 600Hz inside water. The frequency heard in air will be equal to (velocity of sound in water $= 1500\frac{m}{s}$, velocity of sound in air=300(m)/(s))

A. $200Hz$

B. $3000Hz$

C. $120Hz$

D. $600Hz$

Answer: D

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17. A stone is dropped into a well. If the depth of water below the top be h and velocity of sound is v then the splash in water is heard after T sec. Then:

A. $T = \sqrt{\left(\frac{2h}{g}\right)} = \frac{h}{v}$

B. $T = 2\sqrt{\left(\frac{2h}{g}\right)}$

C. $T = \frac{2h}{v}$

D. $T = \sqrt{\left(\frac{2h}{g}\right)} \times \frac{h}{v}$

Answer: A

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18. The speed of sound waves having a frequency of $256Hz$ compared with the speed of sound waves having a frequency of $512Hz$ is :

A. half

B. twice

C. four times

D. same

Answer: D

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19. The extension in a string, obeying Hooke's law, is x. The speed of sound in the stretched

string is v. If the extension in the string is increased to $1.5x$, the speed of sound will be

A. $1.22v$

B. $1.61v$

C. $1.50v$

D. $0.75v$

Answer: A

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20. It is possible to distinguish between the transverse and longitudinal waves by studying the property of

A. interference

B. diffraction

C. relflection

D. polarisation

Answer: D

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21. An electrically maintained tuning fork vibrates with constant frequency and constant amplitude. If the temperature of the surrounding air increases but pressure remains constant, the sound produced will have

(i) larger wavelength

(ii) larger frequency

(iii) larger velocity

(iv) larger time period

A. $(i), (iv)$

B. $(i), (iii)$

C. $(iii), (iv)$

D. $(ii), (iv)$

Answer: B

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22. A tuning fork sends sound waves in air. If the temperature of the air increases, which of the following parameters will changes?

A. Displacement amplitude

B. Frequency

C. Wavelength

D. Time period

Answer: C

Watch Video Solution

23. When you speak to your friend, which of the following parameters have a unique value in the sound produced?

A. Frequency

B. Wavelength

C. Amplitude

D. Wave velocity

Answer: D

 Watch Video Solution

24. When we clap our hands, the sound produced is best described by Here p denotes

the change in pressure from the equilibrium value

A. $p = p_0 \sin(kx - \omega t)$

B. $p = p_0 \sin kx \cos \omega t$

C. $p = p_0 \cos kx \sin \omega t$

D. $p = \Sigma p_0 \sin(k_n x - \omega_n t)$

Answer: D

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25. Consider the following statements about and passing through a gas.

A. the pressure of the gas at a point oscillates with time.

B. The position of a small layer of the gas oscillates with time.

A. Both (i) and (ii) are correct.

B. i is correct but (ii) is wrong

C. (ii) is correct but (i) is wrong

D. Both (i) and (ii) are wrong

Answer: A

 Watch Video Solution

26. As a wave propagates

(i) the wave intensity remains constant for a plane wave

the wave intensity decreases as the inverse of the distance from the source for a spherical wave

(iii) the wave intensity decreases as the inverse square of the distance from the source for a

spherical wave

(iv) total intensity of the spherical wave over the spherical surface centred at the source remains constant at all times

A. (i), (ii)

B. (i), (iii)

C. (i), (iii), (iv)

D. (i), (iii), (iv)

Answer: D

 Watch Video Solution

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

A. $9:4$

B. $2:3$

C. $3:2$

D. $4:9$

Answer: A

Watch Video Solution

28. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at the distance of $9meters$ and 25 meters respectively from the source. The ratio of amplitudes of the waves at P and Q is.....

A. $3/5$

B. $5/3$

C. $9/25$

D. $25/9$

Answer: D

Watch Video Solution

29. Two sound waves move in the same direction in the same medium. The pressure amplitudes of the waves are equal but the wavelength of the first wave is double the

second. Let the average power transmitted across a cross-section by the first wave be P_1 and that by the second wave be P_2. Then

A. $P_1 = P_2$

B. $P_1 = 4P_2$

C. $P_2 = 2P_1$

D. $P_2 = 4P_1$

Answer: A

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30. The intensity of a plane progressive wave of frequency $1000Hz$ is $10^{-10}Wm^{-2}$. Given that the speed of sound is $330m/s$ and density of air is $1.293kg/m^3$. Then the maximum change in pressure in N/m^2 is

A. 3×10^{-4}

B. 3×10^{-5}

C. 3×10^{-3}

D. 3×10^{-2}

Answer: A

Watch Video Solution

31. If the displacement amplitude of sound is doubled and the frequency reduced to one-fourth, the intensity will become

A. double

B. half

C. one-fourth

D. same

Answer: C

Watch Video Solution

32. If the amplitude of a wave at a distance r from a point source is A, the amplitude at a distance $2r$ will be

A. $2A$

B. A

C. $A/2$

D. $A/4$

Answer: C

Watch Video Solution

33. A line source emits a cylindrical expanding wave. Assuming the medium absorbs no energy find how the ampitude and intensity of wave depend on the distance from the source?

A. r^{-1}

B. r^{-2}

C. $r^{-1/2}$

D. $r^{1/2}$

Answer: C

Watch Video Solution

34. A spherical source of power $4W$ and frequency $800Hz$ is emitting sound waves. The intensity of waves at a distance $200m$ is

A. $8 \times 10^{-6} W/m^2$

B. $2 \times 10^{-4} W/m^2$

C. $1 \times 10^{-4} W/m^2$

D. $4W/m^2$

Answer: A

Watch Video Solution

35. A sound has an intensity of $2 \times 10^{-8} W/m^2$. Its intensity level in decibels is $(\log_{10} 2 = 0.3)$

A. 23

B. 3

C. 43

D. 4.3

Answer: C

Watch Video Solution

36. A person speaking normally produces a sound intensity of $40dB$ at a distance of $1m$. If the threshold intensity for reasonable audibility is $20dB$, the maximum distance at which he can be heard cleary is.

A. $4m$

B. $5m$

C. $10m$

D. $20m$

Answer: C

Watch Video Solution

37. If the pressure amplitude in a sound wave is tripled, then by what factor the intensity of sound wave is increased?

A. 3

B. 6

C. 9

D. $\sqrt{3}$

Answer: C

Watch Video Solution

38. If the intensity of sound is doubled, by how many decibels does the sound level increase ?

A. $1dB$

B. $2dB$

C. $3dB$

D. $4dB$

Answer: C

Watch Video Solution

39. How many times more intense is a $90dB$ sound than a $40dB$ sound?

A. 2.5

B. 5

C. 50

D. 10^5

Answer: D

Watch Video Solution

40. Pitch of a sound depends on :

A. Frequency

B. wavelength

C. amplitude

D. speed

Answer: A

Watch Video Solution

41. The same notes being played on sitar and veena differ in

A. quality

B. pitch

C. both quality and pitch

D. neither quality nor pitch

Answer: A

 Watch Video Solution

42. When we hear a sound, we can identify its source from

A. amplitude of sound

B. intensity of sound

C. wavelength of sound

D. overtones present in the sound

Answer: D

 Watch Video Solution

43. In an orchestra, the musical sounds of different instruments are distinguished from one another by which of the following characteristics.

A. Pitch

B. Loudness

C. Quality

D. Overtones

Answer: C

Watch Video Solution

44. When sound wave is refracted from air to water, which of the following will remain unchanged?

A. Wave number

B. Wavelength

C. Wave velocity

D. Frequency

Answer: D

Watch Video Solution

45. A sound wave travelling with a velocity V in a medium A reaches a point on the interface of medium A and medium B. If the

velocity in the medium B be $2V$, then the angle

of incidence for total internal reflection of the wave will be greater than:

A. 15°

B. 30°

C. 45°

D. 90°

Answer: B

Watch Video Solution

46. A sound wave travels from air to water. The angle of incidence is α_1 and the angle of refraction is α_2. Assuming Snells law to be valid:

A. $\alpha_2 < \alpha_1$

B. $\alpha_2 > \alpha_1$

C. $\alpha_2 = \alpha_1$

D. $\alpha_2 > 90^\circ$

Answer: B

Watch Video Solution

47. A thin plane membrane separates hydrogen at $7^\circ C$ from hydrogen at $47^\circ C$, both being at the same pressure. If a collimated sound beam travelling from the cooler gas makes an angle of incidence of 30° at the membrane, the angle of refraction is

A. $\sin^{-1}\sqrt{\frac{7}{32}}$

B. $\sin^{-1}\sqrt{\frac{2}{7}}$

C. $\sin^{-1}\sqrt{\frac{4}{7}}$

D. $\sin^{-1}\sqrt{\frac{7}{4}}$

Answer: B

Watch Video Solution

48. The minimum distance to hear echo (speed of sound in air is $340m/s$)

A. $15m$

B. $16m$

C. $17m$

D. $18m$

Answer: C

Watch Video Solution

49. A engine is approaching a hill at constant speed. When it is at a distance of $0.9km$, it blows a whistle, whose echo is heard by the driver after $5s$. If the speed of sound is $340m/s$, calculate the speed of the engine.

A. $10m/s$

B. $20m/s$

C. $30m/s$

D. $40m/s$

Answer: C

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50. A man stands between two parallel cliffs (not in middle). When he claps his hands, he hears two echoes one after 1 second and the

other after 2 second. If the velocity of sound in air is $330ms^{-1}$, the width of the valley is

A. $330m$

B. $494m$

C. $660m$

D. $990m$

Answer: B

Watch Video Solution

51. In a hall, a person receives direct sound waves from a source $120m$ away. He also receives waves from the same source which reach him after being reflected from the $25m$ high ceiling at a point halfway between them. The two waves interfere constructively for wavelengths (in metres)

A. $10, \frac{10}{2}m\frac{10}{3}$

B. $20, \frac{20}{3}m\frac{20}{5}$

C. $30, 20, 10, \ldots$

D. $35, 25, 15, \ldots$

Answer: A

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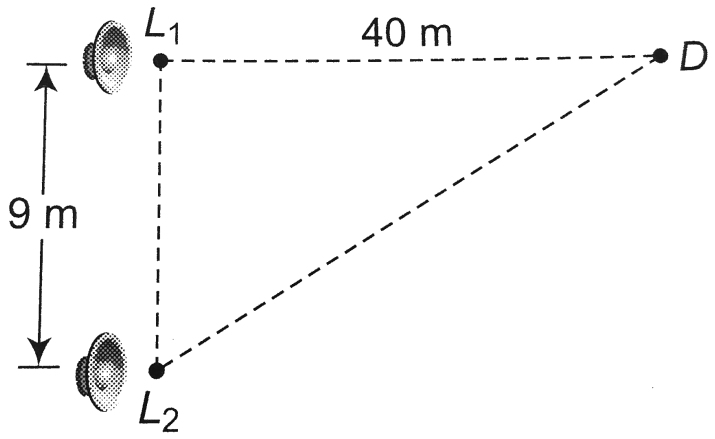
52.



Two loudspeakers L_1 and L_2 driven by a common oscillator and amplifier, are arranged

as shown. The frequency of the oscillator is gradually increased from zero and the detector at D records a series of maxima and minima. If the speed of sound is $330ms^{-1}$ then the frequency at which the first maximum is observed is

A. $165Hz$

B. $330Hz$

C. $496Hz$

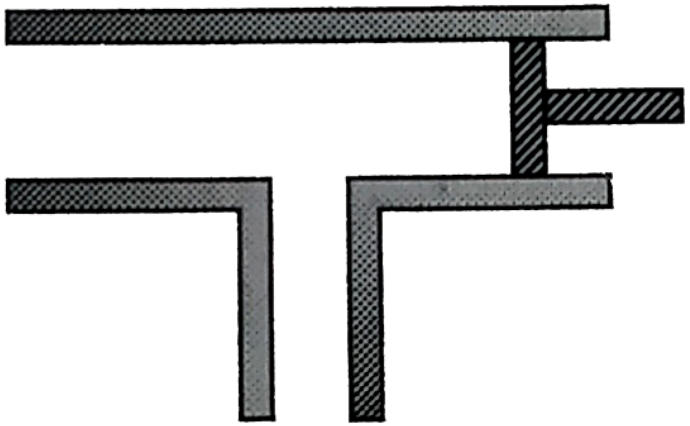
D. $660Hz$

Answer: B

Watch Video Solution

53. Vibrating tuning fork of frequency n is placed near the open end of a long cylindrical tube. The tube has a side opening and is fitted with a movable reflecting piston. As the piston is moved through $8.75cm$, the intensity of sound changes from a maximum to minimum.

If the speed of sound is $350m/s$. Then n is



A. $500Hz$

B. $1000Hz$

C. $2000Hz$

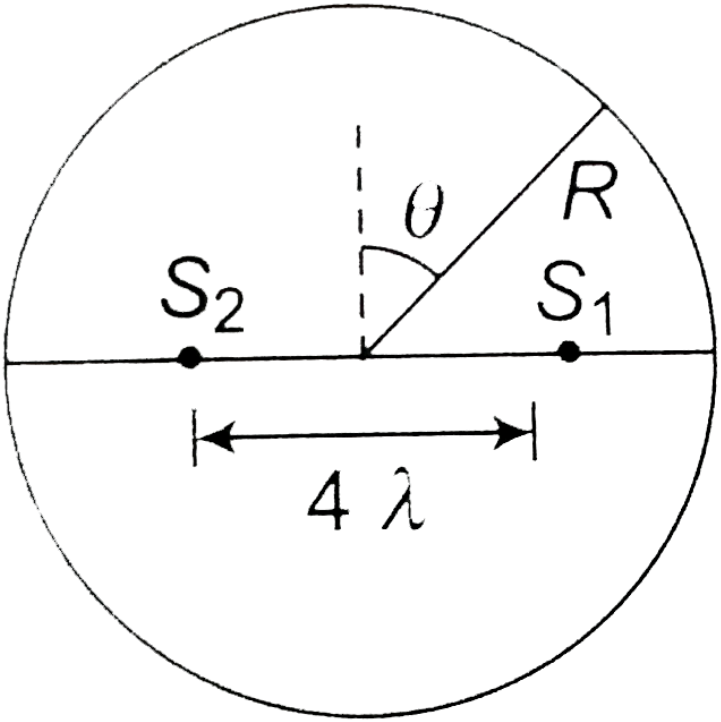
D. $4000Hz$

Answer: B

Watch Video Solution

54. Two sources of sound are placed along the diameter of a circle of radius $R(R > > 41)$. How many minima will be heard as one moves

along the perimeter of circle.



A. 12

B. 16

C. 4

D. 20

Answer: A

Watch Video Solution

55. Beats occur because of

A. interference

B. reflection

C. refraction

D. Doppler effect

Answer: A

 Watch Video Solution

56. The phenomenon of beats can take place

A. for longitudinal waves only

B. for transverse waves only

C. for both longitudinal and transverse waves

D. for sound waves only

Answer: C

Watch Video Solution

57. When beats are produced by two progressive waves of nearly the same frequency, which one of the following if correct?

A. the beat frequency depends on the position where the beats are heard

B. the beat frequency decreases as time passes

C. the particles vibrate simple harmonically with a frequency equal to the difference of the two frequencies

D. the amplitude of vibration at any point changes simple harmonically with a frequency equal to the difference of the two frequencies

Answer: D

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58. Two tuning forks of frequencies $256Hz$ and $258Hz$ are sounded together. The time interval, between two consecutive maxima heard by an observer is

A. $0.5s$

B. $2s$

C. $250s$

D. $252s$

Answer: A

Watch Video Solution

59. Two sources of sound placed close to each other are wmitting progressive waves given by $y_1 = 4\sin 600\pi t$ and $y_2 = 5\sin 608\pi t$. An observer located near these two sources of sound will hear:

A. 4 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

Answer: D

Watch Video Solution

60. Maximum number of beats frequency heard by a human being is

A. 10

B. 4

C. 20

D. 6

Answer: A

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

A. 360

B. 180

C. 3

D. 60

Answer: B

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62. When a tuning fork A of frequency $100Hz$ is sounded with a tuning fork B, the number of beats per second is 2. On putting some wax on the prongs of B, the number of beats per second becomes 1. The frequency of the fork B is

A. $98Hz$

B. $99Hz$

C. $101Hz$

D. $102Hz$

Answer: D

Watch Video Solution

63. Two tuning forks A and B vibrating simultaneously produce $5 beats / s$. Frequency of B is $512 Hz$. If one arm of A is filed, the number of beats per second increases. Frequency of A is

A. $502 Hz$

B. $507 Hz$

C. $517Hz$

D. $522Hz$

Answer: C

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64. The freuquency of tuning forks A and B are respectively 3% more and 2% less than the frequency of tuning fork C. When A and B are simultaneously excited, 5 beats per second are

produced. Then the frequency of the tuning fork A (in Hz)` Is

A. 98

B. 100

C. 103

D. 105

Answer: C

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65. Each of the two strings of length $51.6cm$ and $49.1cm$ are tensioned separately by $20N$ force. Mass per unit length of both the strings is same and equal to $1g/m$. When both the strings vibrate simultaneously, the number of beats is

A. 5

B. 7

C. 8

D. 3

Answer: B

Watch Video Solution

66. Two wires are fixed in a sanometer. Their tension are in the ratio $8:1$ The lengths are in the ratio $36:35$ The diameter are in the ratio $4:1$ Densities of the materials are in the ratio $1:2$ if the lower frequency in the setting is $360Hz$. The beat frequency when the two wires are sounded together is

A. 5

B. 8

C. 6

D. 10

Answer: D

Watch Video Solution

67. When beats are produced by two progressive waves of same amplitude and of nearly same frequencies then the maximum

loudness of the resulting sound is n times the loudness of each of the component wave trains. The value of n is

A. 1

B. 2

C. 4

D. 8

Answer: C

Watch Video Solution

68. 65 tuning forks are arranged in order of increasing frequency. Any two successive forks produce $4 beats / s$, when sounded together. If the last fork gives an octave of the first, the frequency of the first fork is

A. $252 Hz$

B. $256 Hz$

C. $260 Hz$

D. $264 Hz$

Answer: B

Watch Video Solution

69. In a stationary longitudinal wave, nodes are points of

A. maximum pressure

B. minimum pressure

C. minimum pressure variation

D. maximum pressure variation

Answer: A::D

Watch Video Solution

70. When the open organ pipe resonates in its fundamental mode then at the centre of the pipe

A. the gas molecules undergo vibrations of maximum amplitude

B. the gas molecules are at rest

C. the pressure of the gas is constant

D. the pressure of the gas undergoes maximum variation

Answer: D

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71. An organ pipe, open at both ends, contains

A. longitudinal stationary waves

B. longitudinal travelling wave

C. transverse stationary waves

D. transverse travelling waves

Answer: A

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72. Which of the following statements is wrong?

A. In an open pipe the fundamental frequency is $v/2l$

B. In a closed pipe, the closed end is a displacement node

C. In an open pipe, only the odd harmonics of fundamental frequency are present

D. In a closed pipe, the fundamental frequency is $v/4l$

Answer: C

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73. the fundamental frequency of a closed organ pipe is $50Hz$. The frequency of the second overtone is

A. $100Hz$

B. $150Hz$

C. $200Hz$

D. $250Hz$

Answer: D

Watch Video Solution

74. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by $100Hz$ then the fundamental

frequency of the open pipe. The fundamental frequency of the open pipe is

A. $200Hz$

B. $300Hz$

C. $240Hz$

D. $480Hz$

Answer: A

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75. An organ pipe P_1 open at one end vibrating in its first harmonic and another pipe P_2 open at ends vibrating in its third harmonic are in resonance with a given tuning fork. The ratio of the length of P_1 to that P_2 is

A. $8:3$

B. $1:6$

C. $1:2$

D. $1:3$

Answer: B

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76. An air column in a pipe, closed at one end, will be in resonance with a vibrating tuning fork of frequency $680Hz$ if the length of the column in metres be $v = 340m/s$

(Choose the incorrect option)

A. 0.25

B. 0.125

C. 0.375

D. 0.685

Answer: A

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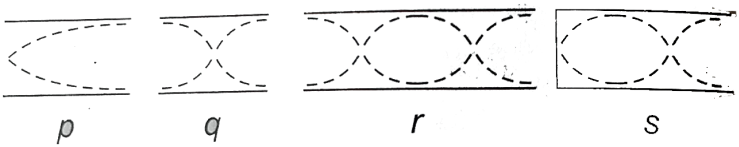
77. The vibrations of four air columns are represented in the adjoining figures. The ratio of frequencies $n_p : n_q : n_r : n_s$ is



A. $12 : 6 : 3 : 4$

B. $4:2:3:1$

C. $1:2:4:3$

D. $1:2:3:4$

Answer: C

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78. An organ pipe closed at one end has fundamental frequency of $500Hz$. The maximum number of overtones generated by this pipe which a normal person can hear is

A. 14

B. 13

C. 6

D. 9

Answer: C

Watch Video Solution

79. For a certain organ pipe, three successive resonance frequencies are observer at $425, 595$ and $765 H_Z$ respectively. Taking the speed of

sound in air to be $340m/s$, (a) explain whether the pipe is closed at one or open at boyh ends. (b) determine the fundamental frequency and length of the pipe.

A. closed pipe of length $1m$

B. closed pipe of length $2m$

C. open pipe of length $1m$

D. open pipe of length $2m$

Answer: A

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80. Velocity of sound in air is $320m/s$. A pipe closed at one end has of $1m$. Neglecting end corrections, the air column in air pipe can resonate for sound of frequency :

A. $80Hz$

B. $240Hz$

C. $320Hz$

D. $400Hz$

Answer: C

Watch Video Solution

81. An open pipe is in resonance in $2nd$ harmonic with frequency f_1. Now one end of the tube is closed and frequency is increased to f_2 such that the resonance again ocuurs in nth harmonic. Choose the correct option

A. $n = 3, f_2 = \frac{3}{4} f_1$

B. $n = 3, f_2 = \frac{5}{4} f_1$

C. $n = 5, f_2 = \frac{3}{4} f_1$

D. $n = 5, f_2 = \frac{3}{4} f_1$

Answer: C

Watch Video Solution

82. The length of two open organ pipes are l and $(l + \delta l)$ respectively. Neglecting end correction, the frequency of beats between them will b approximately.

A. $\frac{v}{2l}$

B. $\frac{v}{4l}$

C. $\frac{v\Delta l}{2l^2}$

D. $\frac{v\Delta l}{l}$

Answer: C

Watch Video Solution

83. An organ pipe filled with a gas at $27^\circ C$ resonates at $400Hz$ in its fundamental mode. If it is filled with the same gas at $90^\circ C$, the resonance frequency will be

A. $420Hz$

B. $440Hz$

C. $484Hz$

D. $512Hz$

Answer: B

Watch Video Solution

84. If frequency of organ pipe is independent of temperature, then value of α (coefficient of linear expansion of material of pipe) should be nearly

A. $\frac{1}{273}/^{\circ}C$

B. $\frac{1}{546}/^{\circ}C$

C. $\frac{1}{819}/^{\circ}C$

D. $\frac{1}{1092}/^{\circ}C$

Answer: B

Watch Video Solution

85. The fundamental frequency of a vibrating organ pipe is $200Hz$.

(i) The first overtone is $400Hz$.

(ii) The first overtone may be $400Hz$.

(iii) The first overtone may be $600Hz$.

(iv) $600Hz$ is an overtone.

A. (i), (iv)

B. (i), (i), (iii)

C. (iii), (iv)

D. (ii), (iii), (iv)

Answer: D

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86. A column of air at $51^\circ C$ and a tuning fork produce 4 beats per second when sounded together. As the temperature of the air column is decreased, the number of beats per second tends to decrease and when the temperature is $16^\circ C$ the two produce 1 beat per second. Find the frequency of the tuning fork.

A. (i), (iv)

B. (i), (iii)

C. (iii), (iv)

D. (ii),(iii),(iv)

Answer: A

Watch Video Solution

87. In an experiment, it was found that a tuning fork and sonometer wire gave 5 beats per second, both when the length of wire was 1m and 1.05m. Calculate the frequency of the fork.

A. $420Hz$

B. $410Hz$

C. $210Hz$

D. $205Hz$

Answer: D

Watch Video Solution

88. Sound waves of frequency $600H_Z$ fall normally on perfectly reflecting wall. The distance from the wall at which the air

particles have the maximum amplitude of vibration is (speed of sound in air = $330 m / s$)

A. $0.5m$

B. $0.25m$

C. $0.125m$

D. $1m$

Answer: C

Watch Video Solution

89. For a resonance tube, the air columns for the first and the second resonance differ in length by $31.5cm$. The wavelength of the wave is

A. $15.75cm$

B. $31.5cm$

C. $63.0cm$

D. $126.0cm$

Answer: C

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90. In a resonance tube, using a tuning fork of frequency $325Hz$, the first two resonance lengths are observed at $25.4cm$ and $77.4cm$. The speed of sound in air is

A. $318m/s$

B. $338m/s$

C. $358m/s$

D. $378m/s$

Answer: B

Watch Video Solution

91. In previous problem, end correction is

A. $0.2cm$

B. $0.3cm$

C. $0.4cm$

D. $0.6cm$

Answer: D

Watch Video Solution

92. An air column, closed at one end and open at the other end, resonates with a tuning fork of frequency f when its length is $45cm$, $99cm$ and at two other lengths in between these values. The wavelength of sound in the air column is

A. $180cm$

B. $108cm$

C. $54cm$

D. $36cm$

Answer: D

Watch Video Solution

93. A long glass tube is held vertically in water. A tuning fork is struck and held over the tube. Strong resonances are observed at two successive lengths $0.50m$ and $0.84m$ above the surface of water. If the velocity of sound is

$340m/s$, then the frequency of the tuning fork is

A. $128Hz$

B. $256Hz$

C. $384Hz$

D. $50Hz$

Answer: D

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94. A glass tube of $1.0m$ length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency $500c/s$ is brought at the upper end of the tube and the velocity of sound is $300m/s$, then the total number of resonances obtained will be

A. 4

B. 3

C. 2

D. 1

Answer: B

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95. A tuning fork of frequency $340 H_Z$ is sounded above an organ pipe of length $120 cm$. Water is now slowly poured in it . The minimum height of water column required for resonance is (speed of sound in air = $340 m / s$)

A. $25cm$

B. $45cm$

C. $75cm$

D. $95cm$

Answer: B

Watch Video Solution

96. On producing the waves of frequency 1000 Hz in a kundt's tube the total distance

between 6 successive nodes n 85 cm. Speed of sound in the gas filled in the tude is

A. $300m/s$

B. $330m/s$

C. $360m/s$

D. $390m/s$

Answer: B

Watch Video Solution

97. If in an experimental determination of the velocity of sound using a Kundt's tube, standing waves are set up in the metallic rod as well as in the rigid tube containing air, then both the waves have the same

A. amplitude

B. frequency

C. wavelength

D. particle velocity

Answer: B

Watch Video Solution

98. The change in frequency due to Doppler effect does not depend on

A. the actual frequency of the wave

B. the distance of the source from the listener

C. the velocity of the source

D. the velocity of the observer

Answer: B

Watch Video Solution

99. The engine of a train sound a whistle at frequency v, the frequency heard by a passenger is

A. $> f$

B. $< f$

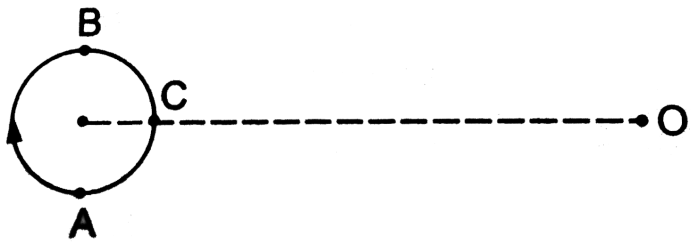
C. $= 1/f$

D. $= f$

Answer: D

Watch Video Solution

100. A small source of sound moves on a circle as shown in figure and an observer is sitting at O. Let v_1, v_2, v_3 be the frequencies heard when the source is at A,B and C respectively.



A. $f_1 > f_2 > f_3$

B. $f_1 = f_2 > f_3$

C. $f_2 > f_3 > f_1$

D. $f_1 > f_3 > f_2$

Answer: C

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101. A source of sound moves towards an observe.

A. The frequency of the sources increased

B. The velocity of sound in the medium is increased

C. The wavelength of sound in the medium towards the observer is decreased

D. The amplitude of vibration of the particles is increased

Answer: C

Watch Video Solution

102. A listener is at rest with respect to the source of sound. A wind starts blowing along the line joining the source and the observer. Which of the following quantities do not change?

(i) Frequency

(ii) Velocity of sound

(iii) Wavelength

(iv) Time period

A. $(i), (iv)$

B. $(iv), (ii)$

C. $(iii), (iv)$

D. $(ii), (iv)$

Answer: A

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103. A tuning fork of frequency $90Hz$ is sounded and moved towards an observer with a speed equal to one - tenth the speed of sound. The note heard by the observer will have a frequency

A. 100

B. 110

C. 80

D. 70

Answer: A

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104. A source and a listener are both moving towards each other with speed $v/10$, where v is the speed of sound. If the frequency of the

note emitted by the source is f, the frequency heard by the listener would be nearly

A. $1.11f$

B. $1.22f$

C. $1.27f$

D. f

Answer: B

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105. A source of sound is travelling towards a stationary observer. The frequency of sound heard by the observer is $25\,\%$ more than the actual frequency. If the speed of sound is v, that of the source is

A. $v/5$

B. $v/4$

C. $v/3$

D. $v/2$

Answer: A

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106. The difference between the apparent frequency of a sound of soun as perceived by an observer during its approach and recession is 2% of the natural frequency of the source. If the velocity of sound in air is $300m/s$, the velocity of the source is (It is given that velocity of source `ltlt velocity of sound)

A. $12m/s$

B. $6m/s$

C. $1.5m/s$

D. $3m/s$

Answer: D

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107. A train is moving at $30m/s$ in still air. The frequency of the locomotive whistle is $500Hz$ and the speed of sound is $345m/s$. The apparent wavelengths of sound in front of and behind the locomotive are respectively

A. $0.63m, 0.80m$

B. $0.63m, 0.75m$

C. $0.60m, 0.85m$

D. $0.60m, 0.75m$

Answer: B

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108. In previous question, what would be the apparent wavelengths in front of and behind the locomotive if a wind of speed $10m/s$ were

blowing in the same direction as that in which the locomotive is travelling?

A. $0.65m, 0.73m$

B. $0.60m, 0.73m$

C. $0.65m, 0.78m$

D. $0.60m, 0.71m$

Answer: C

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109. An engine is moving on a circular track with a constant speed. It is blowing a whistle of frequency $500Hz$. The frequency received by an observer standing stationary at the centre of the track is

A. $500Hz$

B. more than $500hz$

C. less than $500Hz$

D. more or less than $500Hz$ depending on the actual speed of the engine

Answer: A

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110. A train has just completed a U-curve in a trach which is a semi circle. The engine is at the forward end of the semi circular part of the trach while the last carriage is at the rear end of the semi circular track. The driver blows a whistle of frequency 200 Hz. Velocity of sound is $340\frac{m}{s}$. Then the apparent frequency as observed by a passenger in the middle of

the train, when the speed of the train is 30 m/s, is

A. $209Hz$

B. $288Hz$

C. $200Hz$

D. $181Hz$

Answer: C

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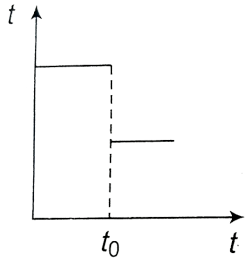
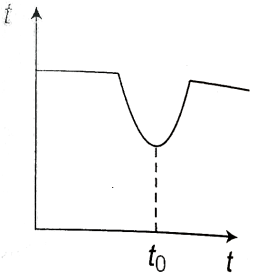
111. A man is standing on a railway platform listening to the whistle of an engine that passes the man at constant speed without stopping. If the engine passes the man at time t_0 How does the frequency f of the whistle as heard by the man changes with time.

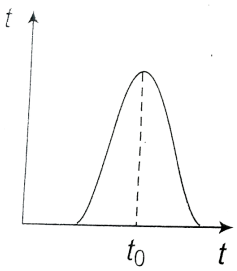
A.



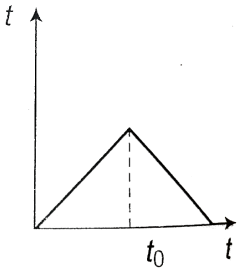
B.



C.



D.



Answer: A

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112. A car is moving with a velocity of $5m/s$ towards huge wall. The driver sounds a horn

of frequency $165Hz$. If the speed of sound in air is $335m/s$, the number of beats heard per second by the driver is

A. 6

B. 5

C. 4

D. 3

Answer: B

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113. A whistle revolves in a circle with an angular speed of $20rad/\sec$ using a string of length $50cm$. If the frequency of sound from the whistle is $385Hz$, then what is the minimum frequency heard by an observer which is far away from the centre in the same plane? $v = 340m/s$

A. $333Hz$

B. $374Hz$

C. $385Hz$

D. $394Hz$

Answer: B

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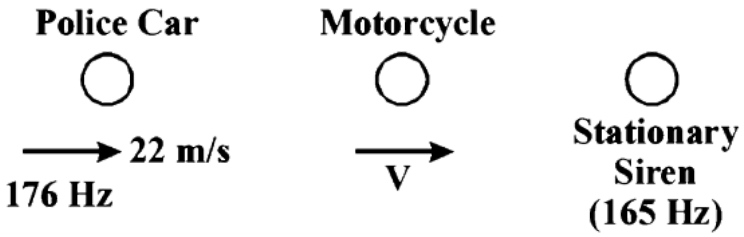
114. A police car moving at $22m/s$, chases motorcyclist. The police man sounds his horn at $176Hz$, while both of them move towards a ststionary siren of frequency $165Hz$. Calculate the speed of the motorcycle, if it is given that

he does not observes any beats.



A. $33m/s$

B. $22m/s$

C. zero

D. $11m/s$

Answer: B

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115. A train moves towards a stationary observer with speed $34m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17m/s$, the frequency registered is f_2. If the speed of sound of $340m/s$, then the ratio f_1/f_2 is

A. $18/19$

B. $1/2$

C. 2

D. $19/18$

Answer: D

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116. A siren placed at a railway platform is emitting sound of frequency $5kHz$. A passenger sitting in a moving train A records a frequency of $5.5kHz$ while the train approaches the siren. During his return

journey in a different train B he records a frequency of $6.0kHz$ while approaching the same siren. the ratio the velocity of train B to that of train A is

A. $242/252$

B. 2

C. $5/6$

D. $11/6$

Answer: B

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117. A racing car moving towards a cliff, sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If v is the velocity of sound, then the velocity of the car is

A. $\frac{v}{\sqrt{2}}$

B. $\frac{v}{2}$

C. $\frac{v}{3}$

D. $\frac{v}{4}$

Answer: C

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118. A vehicle , with a horn of frequency n is moving with a velocity of $30m/s$ in a direction prependicular to the straight line joining the observer and the vehicle . The observer perceives the sound to have a grequency $(n+n_1)$. If the sound velocity in air is $330m/s$, then

A. $n_1 = 10n$

B. $n_1 = 0$

C. $n_1 = 0.1n$

D. $n_1 = -0.1n$

Answer: B

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119. Two cars are moving on two perpendicular road towards a crossing with uniform speeds of $72km/hr$ and $36km/hr$. If first car blows

horn of frequency 280 Hz, then the frequency of horn heard by the driver of second car when line joining the cars make 45° angle with the roads, will be

A. $321Hz$

B. $298Hz$

C. $289Hz$

D. $280Hz$

Answer: B

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120. A band playing music at a frequency f is moving towards a wall at a speed v_b. A motorist is following the band with a speed v_m. If v is the speed of sound, obtain an expression for the beat frequency heard by the motorist.

A. $\dfrac{v + v_m}{v - v_b} f$

B. $\dfrac{v + v_m}{v - v_b} f$

C. $\dfrac{2v_b(v + v_m)}{v^2 - v_b^2} f$

D. $\dfrac{2v_m(v + v_b)}{v^2 - v_m^2} f$

Answer: C

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121. A sound wave of frequency f travels horizontally to the right. It is reflected from a large vertical plane surface moving to left with a speed v. The speed of sound in medium is C

A. The frequency of the reflected wave is

$$\frac{f(c+v)}{c-v}$$

B. The wavelength of the reflected wave is

$$\frac{c(c-v)}{f(c+v)}$$

C. The number of waves striking the surface per second is $\frac{f(c+v)}{c}$

D. The number of beats heard by a stationary listener to the left of the reflection surface is $\frac{fv}{c-v}$

Answer: D

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122. A motor cycle starts from rest and accelerates along a straight path at $2m/s^2$. At the starting point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was at rest ? (Speed of sound = $330ms^{-2}$)

A. $49m$

B. $98m$

C. $147m$

D. $196m$

Answer: B

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123. A star is moving away from the earth with a velocity of $100km/s$. If the velocity of light is $3 \times 10^8 m/s$ then the shift of its spectral line of wavelength $5700A$ due to Doppler effect is

A. $0.63Å$

B. 1.90Å

C. 3.80Å

D. 5.70Å

Answer: B

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124. The apparent wavelength of the light from a star, moving away from the earth is $0.01\,\%$ more than its real wavelength. The speed of the star with respect to earth is

A. $10km/s$

B. $15km/s$

C. $30km/s$

D. $60km/s$

Answer: C

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125. The frequency of a radar is 780 MHz. After getting reflected from an approaching aeroplane, the apparent frequency is more

than the actual frequency by 2.6 kHz. The aeroplane has a speed of

A. $0.25km/s$

B. $0.5km/s$

C. $1.0km/s$

D. $2.0km/s$

Answer: B

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126. Define Mach number

A. It is the ratio of the stress to the strain

B. It is the ratio of the strain to stress

C. It is the ratio of the velocity of an object to the velocity of sound

D. It is the ratio of the velocity of sound to the velocity of an object

Answer: C

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127. The musical interval between two tones of frequencies $320Hz$ and $240Hz$ is

A. 80

B. $(4/3)$

C. 560

D. 320×240

Answer: B

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

A. $1/2$

B. 1

C. 2

D. 4

Answer: C

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129. If T is the reverberation time of an auditorium of volume V then

A. $T \propto \frac{1}{V}$

B. $T \propto \frac{1}{V^2}$

C. $T \propto V^2$

D. $T \propto V$

Answer: D

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130. An earhquake generates both transverse (S) and logitudinal (P) sound wave in the earth .The speed of (S) wave is about $4.5km/s$ and that of (P) wave is about $8.0km/s$ A seismograph records P and S wave from an earthquake. The first P wave arrives $4.0\ \min$ before the first S wave. The epicenter of the earthquake is located at a distance of about

A. $25km$

B. $250km$

C. $2500km$

D. $5000km$

Answer: C

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