Q1. A plane progressive wave is given by $y = 2\cos 2\pi(330t - x)$m. The frequency of the wave is : ***08 Apr 2024 (E)***

(1) 330 Hz (2) 660 Hz

(3) 340 Hz (4) 165 Hz

Q2. 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 _____ ***08 Apr 2024 (M)***

Q3. Two open organ pipes of lengths 60 cm and 90 cm resonate at 6^{th} and 5^{th} harmonics respectively. The difference of frequencies for the given modes is _____ Hz. (Velocity of sound in air $= 333$ m/s)

06 Apr 2024 (E)

Q4. 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.

05 Apr 2024 (E)

Q5. A tuning fork resonates with a sonometer wire of length 1 m stretched with a tension of 6 N. When the tension in the wire is changed to 54 N, the same tuning fork produces 12 beats per second with it. The frequency of the tuning fork is _____ Hz. ***01 Feb 2024 (M)***

Q6. The speed of sound in oxygen at S.T.P. will be approximately:
(Given, $R = 8.3$ J K^{-1}, $\gamma = 1.4$)

31 Jan 2024 (E)

(1) 310 m s^{-1} (2) 333 m s^{-1}

(3) 341 m s^{-1} (4) 325 m s^{-1}

Q7. 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 cm, the length of the closed pipe will be : ***31 Jan 2024 (M)***

(1) 60 cm (2) 45 cm

(3) 30 cm (4) 15 cm

Q8. A point source is emitting sound waves of intensity 16×10^{-8} W m^{-2} at the origin. The difference in intensity (magnitude only) at two points located at a distances of 2 m and 4 m from the origin respectively will be _____$\times 10^{-8}$ W m^{-2}. ***30 Jan 2024 (E)***

Q9. In a closed organ pipe, the frequency of fundamental note is 30 Hz. A certain amount of water is now poured in the organ pipe so that the fundamental frequency is increased to 110 Hz. If the organ pipe has a cross-sectional area of 2 cm^2, the amount of water poured in the organ tube is _____g. (Take speed of sound in air is 330 m s^{-1}) ***30 Jan 2024 (M)***

Q10. A closed organ pipe 150 cm long gives 7 beats per second with an open organ pipe of length 350 cm, both vibrating in fundamental mode. The velocity of sound is _____ m s^{-1}.

27 Jan 2024 (E)

Q11. The fundamental frequency of vibration of a string between two rigid support is 50 Hz. The mass of the string is 18 g and its linear mass density is 20 g m^{-1}. The speed of the transverse waves so produced in the string is _____ m s^{-1}. ***15 Apr 2023 (M)***

Q12. In an experiment with sonometer when a mass of 180 g is attached to the string, it vibrates with fundamental frequency of 30 Hz. When a mass m is attached, the string vibrates with fundamental frequency of 50 Hz. The value of m is _____ g.

13 Apr 2023 (E)

Q13. For a certain organ pipe, the first three resonance frequencies are in the ratio of $1:3:5$ respectively. If the frequency of fifth harmonic is 405 Hz and the speed of sound in air is 324 m s^{-1} the length of the organ pipe is _____ m.

12 Apr 2023 (M)

Q14. The equation of wave is given by $Y = 10^{-2}\sin 2\pi\left(160t - 0.5x + \frac{\pi}{4}\right)$, where x and Y are in m and t in s. The speed of the wave is _____ km h^{-1}.

11 Apr 2023 (M)

Q15. A wire of density 8×10^3 kg m^{-3} is stretched between two clamps 0.5 m apart. The extension developed in the wire is 3.2×10^{-4} m. If $Y = 8 \times 10^{10}$ N m^{-2}, the fundamental frequency of vibration in the wire will be _____ Hz

11 Apr 2023 (E)

Q16*. A car P travelling at 20 m s^{-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 m s^{-1}. The frequency heard by the passenger of the car Q is approximately [Take, velocity of sound = 360 m s^{-1}]

11 Apr 2023 (E)

(1) 421 Hz (2) 471 Hz

(3) 485 Hz (4) 514 Hz

Q17. 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 _____ m s^{-1}.

10 Apr 2023 (M)

Q18. A guitar string of length 90 cm vibrates with a fundamental frequency of 120 Hz. The length of the string producing a fundamental of 180 Hz will be _____ cm

08 Apr 2023 (E)

Q19. An organ pipe 40 cm long is open at both ends. The speed of sound in air is 360 m s^{-1}. The frequency of the second harmonic is _____ Hz.

08 Apr 2023 (M)

Q20*. The engine of a train moving with speed 10 m s^{-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 m s^{-1})

08 Apr 2023 (M)

(1) 400 Hz (2) 200 Hz

(3) 412 Hz (4) 388 Hz

Q21. The ratio of speed of sound in hydrogen gas to the speed of sound in oxygen gas at the same temperature is:

06 Apr 2023 (E)

(1) 1 : 2 (2) 4 : 1

(3) 1 : 4 (4) 1 : 1

Q22*. A person driving car at a constant speed of 15 m s^{-1} is approaching a vertical wall. The person notices a change of 40 Hz in the frequency of his car's horn upon reflection from the wall. The frequency of horn is _____Hz. (Given: Speed of sound: 30 m s^{-1})

06 Apr 2023 (M)

Q23. 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: ***01 Feb 2023 (M)***

(1) 200π m s^{-1} (2) 100 m s^{-1}

(3) 10 m s^{-1} (4) 50 m s^{-1}

Q24. For a solid rod, the Young's modulus of elasticity is 3.2×10^{11} N m^{-2} and density is 8×10^3 kg m^{-3}. The velocity of longitudinal wave in the rod will be ***31 Jan 2023 (E)***

(1) 145.75×10^3 ms^{-1} (2) 3.65×10^3 m s^{-1}

(3) 18.96×10^3 m s^{-1} (4) 6.32×10^3 m s^{-1}

Q25. The displacement equations of two interfering waves are given by $y_1 = 10 \sin\left(\omega t + \frac{\pi}{3}\right)$ cm, $y_2 = 5\left[\sin(\omega t) + \sqrt{3}\cos \omega t\right]$ cm respectively. The amplitude of the resultant wave is _____ cm.

31 Jan 2023 (E)

Q26*. A person observes two moving trains, A reaching the station and B leaving the station with equal speed of 30 m s^{-1}. If both trains emit sounds with frequency 300 Hz, (Speed of sound : 330 m s^{-1}) approximate difference of frequencies heard by the person will be : ***29 Jan 2023 (M)***

(1) 33 Hz (2) 55 Hz

(3) 80 Hz (4) 10 Hz

Q27. Match List I with List II

List I		List II
A Troposphere	I	Approximate $65-75$ km over Earth's surface
B E-Part of Stratosphere	II	Approximate 300 km over Earth's surface
C F_2-Part of Thermosphere	III	Approximate 10 km over Earth's surface
D D-Part of Stratosphere	IV	Approximate 100 km over Earth's surface

Choose the correct answer from the options given below :

25 Jan 2023 (E)

(1) A-III, B-IV, C-II, D-I (2) A-I, B-II, C-IV, D-III

(3) A-I, B-IV, C-III, D-II (4) A-III, B-II, C-I, D-IV

Q28. 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^{-1}. ***25 Jan 2023 (M)***

Q29*. A train blowing a whistle of frequency 320 Hz approaches an observer standing on the platform at a speed of 66 m s^{-1}. The frequency observed by the observer will be (given speed of sound = 330 m s^{-1}) _____ Hz.

25 Jan 2023 (E)

Q30. 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]

24 Jan 2023 (M)

(1) 4 m s^{-1} (2) 2 m s^{-1}

(3) 0.5 m s^{-1} (4) 8 m s^{-1}

Q31. Two light beams of intensities $4I$ and $9I$ interfere on a screen. The phase difference between these beams on the screen at point A is zero and at point B is π. The difference of resultant intensities, at the point A and B, will be _____ I. ***29 Jul 2022 (M)***

Q32. The speed of a transverse wave passing through a string of length 50 cm and mass 10 g is $60\ \text{m s}^{-1}$. The area of cross-section of the wire is $2.0\ \text{mm}^2$ and its Young's modulus is $1.2 \times 10^{11}\ \text{N m}^{-2}$. The extension of the wire over its natural length due to its tension will be $\text{x} \times 10^{-5}$ m. The value of x is _____ . ***29 Jul 2022 (E)***

Q33. In the wave equation $y = 0.5 \sin \frac{2\pi}{\lambda}(400t - x)m$ the velocity of the wave will be : ***28 Jul 2022 (M)***

(1) $200\ \text{m s}^{-1}$ (2) $200\sqrt{2}\ \text{m s}^{-1}$

(3) $400\ \text{m s}^{-1}$ (4) $400\sqrt{2}\ \text{m s}^{-1}$

Q34*. The frequency of echo will be _____ Hz if the train blowing a whistle of frequency 320 Hz is moving with a velocity of $36\ \text{km h}^{-1}$ towards a hill from which an echo is heard by the train driver. Velocity of sound in air is $330\ \text{m s}^{-1}$. ***28 Jul 2022 (M)***

Q35. A wire of length 30 cm, stretched between rigid supports, has it's n^{th} and $(n+1)^{\text{th}}$ harmonics at 400 Hz and 450 Hz, respectively. If tension in the string is 2700 N, it's linear mass density is _____ kg m^{-1}.

27 Jul 2022 (E)

Q36. A transverse wave is represented by $y = 2\sin(\omega t - kx)$ cm. The value of wavelength (in cm) for which the wave velocity becomes equal to the maximum particle velocity, will be ***26 Jul 2022 (E)***

(1) 4π (2) 2π

(3) π (4) 2

Q37*. When a car is approaching the observer, the frequency of horn is 100 Hz. After passing the observer, it is 50 Hz. If the observer moves with the car, the frequency will be $\frac{x}{3}$Hz where $x =$_____ . ***26 Jul 2022 (M)***

Q38*. An observer is riding on a bicycle and moving towards a hill at $18\ \text{km h}^{-1}$. He hears a sound from a source at some distance behind him directly as well as after its reflection from the hill. If the original frequency of the sound as emitted by source is 640 Hz and velocity of the sound in air is $320\ \text{m s}^{-1}$, the beat frequency between the two sounds heard by observer will be _____ Hz. ***25 Jul 2022 (M)***

Q39. Sound travels in a mixture of two moles of helium and n moles of hydrogen. If rms speed of gas molecules in the mixture is $\sqrt{2}$ times the speed of sound, then the value of n will be ***25 Jul 2022 (E)***

(1) 1 (2) 2

(3) 3 (4) 4

Q40. A longitudinal wave is represented by $y = 10 \sin 2\pi\left(nt - \frac{x}{\lambda}\right)$ cm. The maximum particle velocity will be four times the wave velocity if the determined value of wavelength is equal to ***29 Jun 2022 (M)***

(1) 2π (2) 5π

(3) π (4) $\frac{5\pi}{2}$

Q41. In an experiment to determine the velocity of sound in air at room temperature using a resonance tube, the first resonance is observed when the air column has a length of 20.0 cm for a tuning fork of frequency 400 Hz is

used. The velocity of the sound at room temperature is $336\ \text{m s}^{-1}$. The third resonance is observed when the air column has a length of _____ cm ***29 Jun 2022 (E)***

Q42. A radar sends an electromagnetic signal of electric field $(E_0) = 2.25\ \text{V m}^{-1}$ and magnetic field $(B_0) = 1.5 \times 10^{-8}\ \text{T}$ which strikes a target on line of sight at a distance of 3 km in a medium. After that, a part of signal (echo) reflects back towards the radar with same velocity and by same path. If the signal was transmitted at time $t = 0$ from radar, then after how much time echo will reach to the radar? ***28 Jun 2022 (M)***

(1) $2.0 \times 10^{-5}\ \text{s}$ (2) $4.0 \times 10^{-5}\ \text{s}$

(3) $1.0 \times 10^{-5}\text{s}$ (4) $8.0 \times 10^{-5}\text{s}$

Q43. The velocity of sound in a gas, in which two wavelengths 4.08 m and 4.16 m produce 40 beats in 12 s, will be ***28 Jun 2022 (M)***

(1) $282.8\ \text{m s}^{-1}$ (2) $175.5\ \text{m s}^{-1}$

(3) $353.6\ \text{m s}^{-1}$ (4) $707.2\ \text{m s}^{-1}$

Q44. A tunning fork of frequency 340 Hz resonates in the fundamental mode with an air column of length 125 cm in a cylindrical tube closed at one end. When water is slowly poured in it, the minimum height of water required for observing resonance once again is _____ cm.
(Velocity of sound in air is $340\ \text{ms}^{-1}$) ***28 Jun 2022 (E)***

Q45. If a wave gets refracted into a denser medium, then which of the following is true? ***27 Jun 2022 (E)***

(1) Wavelength, speed and frequency decreases.

(2) Wavelength increases, speed decreases and frequency remains constant.

(3) Wavelength and speed decreases but frequency remains constant.

(4) Wavelength, speed and frequency increases.

Q46*. An observer moves towards a stationary source of sound with a velocity one-fifth of the velocity of sound. The percentage change in the apparent frequency is ***27 Jun 2022 (M)***

(1) zero (2) 5%

(3) 10% (4) 20%

Q47. 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. ***26 Jun 2022 (E)***

Q48*. For a specific wavelength 670 nm of light coming from a galaxy moving with velocity v, the observed wavelength is 670.7 nm. The value of v is ***26 Jun 2022 (E)***

(1) $3 \times 10^{8}\ \text{m s}^{-1}$ (2) $3.13 \times 10^{5}\ \text{m s}^{-1}$

(3) $3 \times 10^{10}\ \text{m s}^{-1}$ (4) $4.48 \times 10^{5}\ \text{m s}^{-1}$

Q49. 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 ***25 Jun 2022 (M)***

Q50. The equations of two waves are given by :

$y_1 = 5\sin 2\pi(x - vt)$ cm : $:y_2 = 3\sin 2\pi(x - vt + 1.5)$ cm

These waves are simultaneously passing through a string. The amplitude of the resulting wave is :

24 Jun 2022 (M)

(1) $2\ \text{cm}$ (2) $4\ \text{cm}$

(3) $5.8\ \text{cm}$ (4) $8\ \text{cm}$

Q51. Two light beams of intensities in the ratio of $9:4$ are allowed to interfere. The ratio of the intensity of maxima and minima will be : ***24 Jun 2022 (E)***

(1) $9:4$ (2) $16:81$

(3) $25:169$ (4) $25:1$

Q52. 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 $y=\left(10\cos\pi x\sin\frac{2\pi t}{T}\right)$ cm. The amplitude of the particle at $x=\frac{4}{3}$ cm will be _____ cm. ***24 Jun 2022 (E)***

Q53. A wire having a linear mass density $9.0\times10^{-4}\ \text{kg m}^{-1}$ is stretched between two rigid supports with a tension of 900 N. The wire resonates at a frequency of $500\ \text{Hz}$. The next higher frequency at which the same wire resonates is $550\ \text{Hz}$. The length of the wire is ____ m. ***31 Aug 2021 (M)***

Q54*. Two cars X and Y are approaching each other with velocities $36\ \text{km h}^{-1}$ and $72\ \text{km h}^{-1}$ respectively. The frequency of a whistle sound as emitted by a passenger in car X, heard by the passenger in car Y is $1320\ \text{Hz}$. If the velocity of sound in air is $340\ \text{ms}^{-1}$, the actual frequency of the whistle sound produced is _____ Hz. ***27 Aug 2021 (M)***

Q55. A tuning fork is vibrating at $250\ \text{Hz}$. 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 $340\ \text{m s}^{-1}$) ***27 Aug 2021 (E)***

Q56. Two travelling waves produces a standing wave represented by equation.
$y=(1.0\ \text{mm})\cos\left[\left(1.57\ \text{cm}^{-1}\right)x\right]\ \sin\left[\left(78.5\ \text{s}^{-1}\right)\ \text{t}\right]$. The node closest to the origin in the region $x>0$ will be at $x=\ldots\ldots\ (\text{in cm})$. ***26 Aug 2021 (M)***

Q57*. A source and a detector move away from each other in absence of wind with a speed of $20\ \text{m s}^{-1}$, with respect to the ground. If the detector detects a frequency of $1800\ \text{Hz}$ of the sound coming from the source, then the original frequency of source considering the speed of sound in the air $340\ \text{m s}^{-1}$ will be _____ Hz. ***26 Aug 2021 (M)***

Q58. Two waves are simultaneously passing through a string and their equations are :
$y_1=A_1\sin k(x-vt), y_2=A_2\sin k(x-vt+x_0)$. Given amplitudes $A_1=12\ \text{mm}$ and $A_2=5\ \text{mm}$, $x_0=3.5\ \text{cm}$ and wave number $\text{k}=6.28\ \text{cm}^{-1}$. The amplitude of resulting wave will be _____ mm. ***26 Aug 2021 (E)***

Q59*. The frequency of a car horn encountered a change from $400\ \text{Hz}$ to $500\ \text{Hz}$. When the car approaches a vertical wall. If the speed of sound is $330\ \text{m s}^{-1}$. Then the speed of car is ___ km h^{-1}. ***20 Jul 2021 (M)***

Q60. The amplitude of wave disturbance propagating in the positive x-direction is given by $y=\frac{1}{(1+x)^2}$ at time $t=0$ and $y=\frac{1}{1+(x-2)^2}$ at $t=1\ s$, where x and y are in metres. The shape of wave does not change during the propagation. The velocity of the wave will be m s^{-1}. ***20 Jul 2021 (M)***

Q61*. With what speed should a galaxy move outward with respect to earth so that the sodium-D line at wavelength 5890 $\mathring{A}$ is observed at 5896 $\mathring{A}$? ***20 Jul 2021 (E)***

(1) 306 km sec^{-1} (2) 322 km sec^{-1}

(3) 296 km sec^{-1} (4) 336 km sec^{-1}

Q62*. A galaxy is moving away from the earth at a speed of 286 km s^{-1}. The shift in the wavelength of a red line at 630 nm is $x \times 10^{-10}$ m. The value of x, to the nearest integer, is ___. [Take the value of the speed of the light c, as 3×10^8 m s^{-1}]

18 Mar 2021 (E)

Q63. A sound wave of frequency 245 Hz travels with the speed of 300 m s^{-1} along the positive x-axis. Each point of the wave moves to and fro through a total distance of 6 cm. What will be the mathematical expression of this travelling wave? ***17 Mar 2021 (E)***

(1) $Y(x,t) = 0.03\left[\sin 5.1x - \left(0.2 \times 10^3\right)t\right]$ (2) $Y(x,t) = 0.06\left[\sin 5.1x - \left(1.5 \times 10^3\right)t\right]$

(3) $Y(x,t) = 0.06\left[\sin 0.8x - \left(0.5 \times 10^3\right)t\right]$ (4) $Y(x,t) = 0.03\left[\sin 5.1x - \left(1.5 \times 10^3\right)t\right]$

Q64. A 25 m long antenna is mounted on an antenna tower. The height of the antenna tower is 75 m. The wavelength (in meter) of the signal transmitted by this antenna would be : ***16 Mar 2021 (M)***

(1) 300 (2) 400

(3) 200 (4) 100

Q65. A closed organ pipe of length L and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency. The length of the open pipe is $\frac{x}{3}L\sqrt{\frac{\rho_1}{\rho_2}}$, where x is _____. (Round off to the Nearest Integer)

16 Mar 2021 (E)

Q66. The mass per unit length of a uniform wire is 0.135 g cm^{-1}. A transverse wave of the form $y = -0.21\sin(x + 30t)$ is produced in it, where x is in meter and t is in second. Then, the expected value of tension in the wire is $x \times 10^{-2}$ N. Value of x is _____ (Round-off to the nearest integer) ***26 Feb 2021 (M)***

Q67. A tuning fork A of unknown frequency produces 5 beats s^{-1} with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats s^{-1}. What is the frequency of fork A ?

26 Feb 2021 (E)

(1) 335 Hz (2) 338 Hz

(3) 345 Hz (4) 342 Hz

Q68. The percentage increase in the speed of transverse waves produced in a stretched string if the tension is increased by 4%, will be ___ %. ***25 Feb 2021 (E)***

Q69. A student is performing the experiment of the resonance column. The diameter of the column tube is 6 cm. The frequency of the tuning fork is 504 Hz. Speed of the sound at the given temperature is 336 m s^{-1}. The zero of the meter scale coincides with the top end of the resonance column tube. The reading of the water level in the column when the first resonance occurs is: ***25 Feb 2021 (M)***

(1) $14.8\ \text{cm}$ (2) $18.4\ \text{cm}$

(3) $16.6\ \text{cm}$ (4) $13\ \text{cm}$

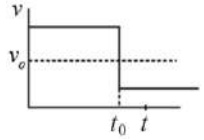
Q70. Which of the following equations represents a travelling wave? ***24 Feb 2021 (E)***

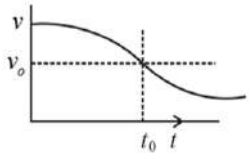
(1) $y = A\sin(15x - 2t)$ (2) $y = \text{Ae}^{x}\cos(\omega t - \theta)$

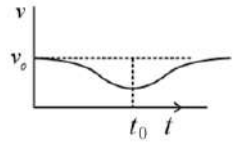
(3) $y = \text{Ae}^{-x^2}(vt + \theta)$ (4) $y = A\sin x\ \cos\omega t$

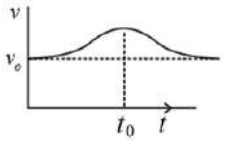
Q71*. Two cars are approaching each other at an equal speed of $7.2\ \text{km hr}^{-1}$. When they see each other, both blow horns having a frequency of $676\ \text{Hz}$. The beat frequency heard by each driver will be _____Hz. [Velocity of sound in air is $340\ \text{m s}^{-1}$. ***24 Feb 2021 (E)***

Q72*. A sound source S is moving along a straight track with speed v, and is emitting sound of frequency v_0.An observer is standing at a finite distance, at the point O, from the track. The time variation of frequency heard by observer is best represented by : (to represents the instant when the distance between the source and observer is minimum) ***06 Sep 2020 (M)***

(1) 

(2) 

(3) 

(4) 

Q73. In a resonance tube experiment when the tube is filled with water up to a height of $17.0\ \text{cm}$, 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 $24.5\ \text{cm}$. If the velocity of sound in air is $330\ \text{m s}^{-1}$, the tuning fork frequency is : ***05 Sep 2020 (M)***

(1) $2200\ \text{Hz}$ (2) $550\ \text{Hz}$

(3) $1100\ \text{Hz}$ (4) $3300\ \text{Hz}$

Q74. Assume that the displacement (s) of air is proportional to the pressure difference (Δp) created by a sound wave. Displacement (s) further depends on the speed of sound (v), density of air(ρ) and the frequency (f). If $\Delta p \sim 10\ Pa, n \sim 300\ m/s, p \sim 1\ kg/m^3\ f \sim 1000 Hz$, then s will be of the order of (take the multiplicative constant to be 1) ***05 Sep 2020 (M)***

(1) $\frac{3}{100}\text{mm}$ (2) $10\ \text{mm}$

(3) $\frac{1}{10}\text{mm}$ (4) $1\ \text{mm}$

Q75*. A driver in a car, approaching a vertical wall notices that the frequency of his car horn has changed from $440\ \text{Hz}$ to $480\ \text{Hz}$, when it gets reflected from the wall. If the speed of sound in air is $345\ \text{m s}^{-1}$, then the speed of the car is: ***05 Sep 2020 (E)***

(1) $54\ km/hr$ (2) $36\ km/hr$

(3) $18\ km/hr$ (4) $24\ km/hr$

Q76. For a transvers wave travelling, along a straight line, the distance between two peaks (crests) is 5 m, while the distance between one crest and one trough is 1.5 m. The possible wavelengths (in m) of the waves are:

04 Sep 2020 (M)

(1) $1,\ 3,\ 5$ (2) $\frac{1}{1}, \frac{1}{3}, \frac{1}{5},\ \ldots\ldots$

(3) $1,\ 2,\ 3,\ \ldots\ldots$ (4) $\frac{1}{2}, \frac{1}{4}, \frac{1}{6},\ \ldots\ldots$

Q77*. The driver of bus approaching a big wall notices that the frequency of his bus's horn changes from 420 Hz to 490 Hz when he hears it after it gets reflected from the wall. Find the speed of the bus if speed of the sound is 330 ms^{-1}:

04 Sep 2020 (E)

(1) 91 kmh^{-1} (2) 81 kmh^{-1}

(3) 61 kmh^{-1} (4) 71 kmh^{-1}

Q78. A uniform thin rope of length 12 m and mass 6 kg hangs vertically from a rigid support and a block of mass 2 kg is attached to its free end. A transverse short wave train of wavelength 6 cm is produced at the lower and the rope. What is the wavelength of the wave train (in cm) when it reaches the top of the rope?

03 Sep 2020 (M)

(1) 3 (2) 6

(3) 12 (4) 9

Q79. Two identical strings X and Z made of same material have tension T_X and T_Z in then if their fundamental frequencies are 450 Hz and 300 Hz, respectively, then the ratio T_X/T_Z is :

02 Sep 2020 (M)

(1) 2.25 (2) 0.44

(3) 1.25 (4) 1.5

Q80. Three harmonic waves having equal frequency v and same intensity I_0, have phase angles 0, $\frac{\pi}{4}$ and $-\frac{\pi}{4}$ respectively. When they are superimposed the intensity of the resultant wave is close to:

09 Jan 2020 (M)

(1) $5.8I_0$ (2) $0.2I_0$

(3) $3I_0$ (4) I_0

Q81. A wire of length L and mass per unit length 6.0×10^{-3} kg m^{-1} is put under tension of 540 N. Two consecutive frequencies that it resonates at are: 420 Hz and 490 Hz. Then L in meters is :

09 Jan 2020 (E)

(1) 2.1m (2) 1.1m

(3) 8.1m (4) 5.1m

Q82. A transverse wave travels on a taut steel wire with a velocity of v when tension in it is 2.06×10^4N. When the tension is changed to T, the velocity changed to $\frac{v}{2}$. The value of T is close to:

08 Jan 2020 (E)

(1) 2.50×10^4N (2) 5.15×10^3 N

(3) 30.5×10^4 N (4) 10.2×10^2 N

Q83. A one metre long (both ends open) organ pipe is kept in a gas that has double the density of air at STP. Assuming the speed of sound in air at STP is 300 m/s, the frequency difference between the fundamental and second harmonic of this pipe is _____ Hz.

08 Jan 2020 (M)

Q84*. A stationary observer receives sound from two identical tuning forks, one of which approaches and the other one recedes with the same speed (much less than the speed of sound). The observer hears 2 beats/sec . The

oscillation frequency of each tuning fork is $v_0 = 1400$ Hz and the velocity of sound in air is 350 m/s . The speed of each tuning fork is close to: ***07 Jan 2020 (E)***

(1) $\frac{1}{2}$m/s (2) 1m/s

(3) $\frac{1}{4}$m/s (4) $\frac{1}{8}$m/s

Q85. A progressive wave travelling along the positive $x-$ direction is represented by $y(x, \mathrm{t}) = \mathrm{A}\sin(\mathrm{k}x - \omega\mathrm{t} + \phi)$. Its snapshot at $\mathrm{t} = 0$ is given in the figure. For this wave, the phase ϕ is:

12 Apr 2019 (M)

(1) $\frac{\pi}{2}$ (2) 0

(3) π (4) $-\frac{\pi}{2}$

Q86*. Two sources of sound S_1 and S_2 produce sound waves of same frequency 660 Hz. A listener is moving from source S_1 towards S_2 with a constant speed u_0 m/s and he hears 10 beats/s. The velocity of sound is 330 m/s. Then, u_0 equals: ***12 Apr 2019 (E)***

(1) 10.0 m/s (2) 2.5 m/s

(3) 5.5 m/s (4) 15.0 m/s

Q87. A small speaker delivers 2 W of audio output. At what distance from the speaker will one detect 120 dB intensity sound? [Given reference intensity of sound as 10^{-12} W/m^2] ***12 Apr 2019 (E)***

(1) 40 cm (2) 20 cm

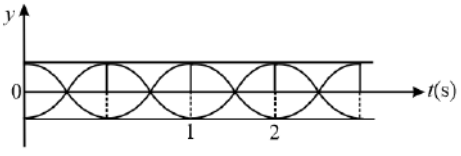
(3) 10 cm (4) 30 cm

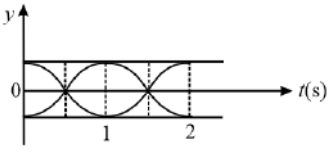
Q88*. A submarine A travelling at 18 km hr^{-1} is being chased along the line of its velocity by another submarine B travelling at 27 km hr^{-1} . B sends a sonar signal of 500 Hz to detect A and receives a reflected sound of frequency v. The value of v is closed to (Speed of sound in water 1500 m s^{-1}) ***12 Apr 2019 (M)***

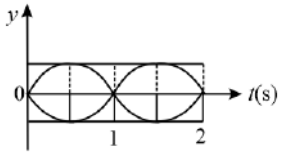
(1) 504 Hz (2) 499 Hz

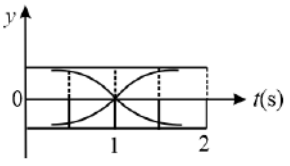
(3) 502 Hz (4) 507 Hz

Q89. The correct figure that shows, schematically, the wave pattern produced by the superposition of two waves of frequencies 9 Hz and 11 Hz, is ***10 Apr 2019 (E)***

(1) 

(2) 

(3) 

(4) 

Q90*. A stationary source emits sound waves of frequency 500 Hz . Two observers moving along a line passing through the source detect sound to be of frequencies 480 Hz and 530 Hz . Their respective speeds are, in m s^{-1}, (Given speed of sound = 300 m/s) ***10 Apr 2019 (M)***

(1) 16, 14 (2) 12, 16
(3) 12, 18 (4) 8, 18

Q91*. A source of sound S is moving with a velocity of 50 m s^{-1} towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (Take velocity of sound in air is 350 m s^{-1})

10 Apr 2019 (E)

(1) 750 Hz (2) 857 Hz
(3) 1143 Hz (4) 807 Hz

Q92. A string is clamped at both the ends and it is vibrating in its 4^{th} harmonic. The equation of the stationary wave is $y = 0.3\sin(0.157x)\cos(200\pi t)$. The length of the string is
(All quantities are in SI units.) ***09 Apr 2019 (M)***

(1) 20 m (2) 60 m
(3) 40 m (4) 80 m

Q93*. Two cars A and B are moving away from each other in opposite directions. Both the cars are moving with speed of 20 m s^{-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 m s^{-1}) ***09 Apr 2019 (E)***

(1) 2150 Hz (2) 2300 Hz
(3) 2250 Hz (4) 2060 Hz

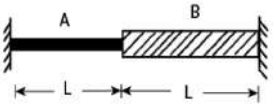
Q94. A string 2.0 m long and fixed at its ends is driven by a 240 Hz vibrator. The string vibrates in its third harmonic mode. The speed of the wave and its fundamental frequency is ***09 Apr 2019 (E)***

(1) 320 m s^{-1}, 120 Hz (2) 320 m s^{-1}, 80 Hz
(3) 180 m s^{-1}, 80 Hz (4) 180 m s^{-1}, 120 Hz

Q95. The pressure wave, $P = 0.01\sin[1000t - 3x]$N m^{-2} , corresponds to the sound produced by a vibrating blade on a day when atmospheric temperature is 0°C . On some other day when temperature is T , the speed of sound produced by the same blade and at the same frequency is found to be 336 m s^{-1} . Approximate value of T is: ***09 Apr 2019 (M)***

(1) 12° C (2) 15° C
(3) 4° C (4) 11° C

Q96. A wire of length 2L, is made by joining two wires A and B of same length but different radii r and 2r and made of the same material. It is vibrating at a frequency such that the joint of the two wires forms a node. If the number of antinodes in wire A is p and that in B is q then ratio p : q is:



08 Apr 2019 (M)

(1) 3 : 5 (2) 4 : 9
(3) 1 : 4 (4) 1 : 2

Q97. A travelling harmonic wave is represented by the equation $y(x, t) = 10^{-3}\sin(50t + 2x)$, where x and y are in meter and t is in seconds. Which of the following is a correct statement about the wave? ***12 Jan 2019 (M)***

(1) The wave is propagating along the positive x -axis with speed 25 m s^{-1}
(2) The wave is propagating along the positive x -axis with speed 100 m s^{-1}
(3) The wave is propagating along the negative x -axis with speed 25 m s^{-1}
(4) The wave is propagating along the negative x -axis with speed 100 m s^{-1}

Q98. A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60^o with ground level, but he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is: ***12 Jan 2019 (M)***

(1) $\frac{2v}{\sqrt{3}}$ (2) v
(3) $\frac{v}{2}$ (4) $\frac{\sqrt{3}}{2}v$

Q99. A resonance tube is old and has a jagged end. It is still used in the laboratory to determine the velocity of sound in air. A tuning fork of frequency 512 Hz produces first resonance when the tube is filled with water to a mark 11 cm below a reference mark, near the open end of the tube. The experiment is repeated with another fork of frequency 256 Hz which produces first resonance when water reaches a mark 27 cm below the reference mark. The velocity of sound in air, obtained in the experiment, is close to ***12 Jan 2019 (E)***

(1) 335 m s^{-1} (2) 341 m s^{-1}
(3) 322 m s^{-1} (4) 328 m s^{-1}

Q100. Equation of travelling wave on a stretched string of linear density 5 g/m is $y = 0.03\sin(450t - 9x)$ where distance and time are measured in SI units. The tension in the string is: ***11 Jan 2019 (M)***

(1) 10 N (2) 7.5 N
(3) 12.5 N (4) 5 N

Q101. 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). ***10 Jan 2019 (E)***

(1) 7 (2) 4
(3) 6 (4) 5

Q102. A string of length 1 m and mass 5 g is fixed at both ends. The tension in the string is 8 .0 N. The string is set into vibration using an external vibrator of frequency 100 Hz. The separation between successive nodes on the string is close to ***10 Jan 2019 (M)***

(1) 20. 0 cm (2) 10. 0 cm
(3) 16 .6 cm (4) 33. 3 cm

Q103*. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of the train is reduced to 17 m/s, the frequency registered is f_2. If speed of sound is 340 m/s, then the ratio f_1/f_2 is: ***10 Jan 2019 (M)***

(1) 21/20 (2) 20/19
(3) 19/18 (4) 18/17

Q104. A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m $(m \ll M)$. When the car is at rest, the speed of transverse waves in the string is $60\ \text{ms}^{-1}$. When the car has acceleration a, the wave-speed increases to $60.5\ \text{ms}^{-1}$. The value of a, in terms of gravitational acceleration g, is closed to

09 Jan 2019 (M)

(1) $\frac{g}{10}$ (2) $\frac{g}{20}$

(3) $\frac{g}{5}$ (4) $\frac{g}{30}$

Q105*. A musician using an open flute of length $50\ \text{cm}$ produces second harmonic sound waves. A person runs towards the musician from another end of a hall at a speed of $10\ \text{km h}^{-1}$. If the wave speed is $330\ \text{m s}^{-1}$, the frequency heard by the running person shall be close to

09 Jan 2019 (E)

(1) $333\ \text{Hz}$ (2) $500\ \text{Hz}$

(3) $666\ \text{Hz}$ (4) $753\ \text{Hz}$

ANSWER KEYS

1. (1)	**2.** (16)	**3.** (740)	**4.** (60)	**5.** (6)	**6.** (1)	**7.** (4)	**8.** (3)
9. (400)	**10.** (294)	**11.** (90)	**12.** (500)	**13.** (1)	**14.** (1152)	**15.** (80)	**16.** (2)
17. (20)	**18.** (60)	**19.** (900)	**20.** (1)	**21.** (2)	**22.** (420)	**23.** (2)	**24.** (4)
25. (20)	**26.** (2)	**27.** (1)	**28.** (18)	**29.** (400)	**30.** (3)	**31.** (24)	**32.** (15)
33. (3)	**34.** (340)	**35.** (3)	**36.** (1)	**37.** (200)	**38.** (20)	**39.** (2)	**40.** (2)
41. (104)	**42.** (2)	**43.** (4)	**44.** (50)	**45.** (3)	**46.** (4)	**47.** (152)	**48.** (2)
49. (80)	**50.** (1)	**51.** (4)	**52.** (5)	**53.** (10)	**54.** (1210)	**55.** (34)	**56.** (1)
57. (2025)	**58.** (7)	**59.** (132)	**60.** (2)	**61.** (1)	**62.** (6)	**63.** (4)	**64.** (4)
65. (4)	**66.** (1215)	**67.** (1)	**68.** (2)	**69.** (1)	**70.** (1)	**71.** (8)	**72.** (2)
73. (1)	**74.** (1)	**75.** (1)	**76.** (2)	**77.** (1)	**78.** (3)	**79.** (1)	**80.** (1)
81. (1)	**82.** (2)	**83.** (106)	**84.** (3)	**85.** (3)	**86.** (2)	**87.** (1)	**88.** (3)
89. (1)	**90.** (3)	**91.** (1)	**92.** (4)	**93.** (3)	**94.** (2)	**95.** (3)	**96.** (4)
97. (3)	**98.** (3)	**99.** (4)	**100.** (3)	**101.** (3)	**102.** (1)	**103.** (3)	**104.** (3)
105. (3)							