Progressive Waves

PYQs - DPP 1

Rahul Science Academy

Question 1

Two monoatomic ideal gases 1 and 2 of molecular masses m_1 and m_2 respectively are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by **[2000]**

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

(c) $\frac{m_1}{m_2}$ (d) $\frac{m_2}{m_1}$

Question 2

The speed of sound in oxygen (O_2) at a certain temperature is 460 ms^{-1}. The speed of sound in helium (He) at the same temperature will be (assume both gases to be ideal) **[2008]**

(a) 500 ms^{-1} (b) 650 ms^{-1}

(c) 330 ms^{-1} (d) 1420 ms^{-1}

Question 3

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

(a) 200 (b) 300

(c) 600 (d) 1200

Question 4

The equation of a wave on a string of linear mass density 0.04 $kg\,m^{-1}$ is given by $y = 0.02(m)\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$.

The tension in the string is **[2010]**

(a) 6.25 N (b) 1.0 N

(c) 12.5 N (d) 0.5 N

Question 5

Two waves $y_1 = A\cos(0.5\pi x - 100\pi t)$ and $y_2 = A\cos(0.46\pi x - 92\pi t)$ are travelling in a pipe placed along x-axis. Find the number of times intensity is maximum in time interval of 1 sec **[2006]**

(a) 4 (b) 6

(c) 8 (d) 10

Question 6

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

(a) 12.5N (b) 7.5N

(c) 10N (d) 5N

Question 7

The pressure wave, $P = 0.01\sin[1000t - 3x]Nm^{-2}$, 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 $336ms^{-1}$. Approximate value of T is **[2019]**

(a) $11°C$ (b) $12°C$

(c) $4°C$ (d) $15°C$

Question 8

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 $v/2$. The value of T is close to : **[2020]**

(a) $5.15\times10^3 N$ (b) $10.2\times10^3 N$

(c) $2.50\times10^4 N$ (d) $30.5\times10^4 Ns$

Question 9

A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio λ_2 / λ_1 is **[2016]**

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

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

Question 10

The velocity of sound is v_s in air. If the density of air is increased to 4 times, then the new velocity of sound will be **[2002]**

(a) $\frac{v_s}{2}$ (b) $\frac{v_s}{12}$

(c) $12v_s$ (d) $\frac{3}{2}v_s^2$

Question 11

The equation of a sound wave is $y = 0.0015\sin(62.4x + 316t)$. The wavelength of this wave is **[2002]**

(a) 0.2 unit (b) 0.1 unit

(c) 0.3 unit (d) Cannot be calculated

Question 12

The temperature at which the speed of sound in air becomes double of its value at 0°C is **[2002]**

(a) 273 K (b) 546 K

(c) 1092 K (d) 0 K

Question 13

The equation of a transverse wave travelling on a rope is given by $y = 10\sin\pi(0.01x - 2.00t)$ where y and x are in cm and t in seconds. The maximum transverse speed of a particle in the rope is about **[2000]**

(a) 63 cm/s (b) 75 cm/s

(c) 100 cm/s (d) 121 cm/s

Question 14

If the phase difference between two sound waves of wavelength λ is 60°, the corresponding path difference is **[2001]**

(a) $\frac{\lambda}{6}$ (b) $\frac{\lambda}{2}$

(c) 2λ (d) $\frac{\lambda}{4}$

(e) $\frac{6}{\lambda}$

Question 15

The tension in a piano wire is 10N. What should be the tension in the wire to produce a note of double the frequency **[2001]**

(a) 5 N (b) 20 N

(c) 40 N (d) 80 N

Level Up!!!

- Topics
- Wave equation
- Velocity equation
- Effect of temp, pressure on velocity

Standing Waves

PYQs - DPP 2

Rahul Science Academy

Question 1

A granite rod of 60 *cm* length is clamped at its middle point and is set into longitudinal vibrations. The density of granite is $2.7\times10^3\ kg/m^3$ and its Young's modulus is $9.27\times10^{10}Pa$. What will be the fundamental frequency of the longitudinal vibrations **[2018]**

(a) 10 *kHz* (b) 7.5 *kHz*

(c) 5 *kHz* (d) 2.5 *kHz*

Question 2

A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9 *kg* is suspended from the wire. When this mass is replaced by a mass *M*, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. The value of *M* is **[2002]**

(a) 25 *kg* (b) 5 *kg*

(c) 12.5 *kg* (d) 1/25 *kg*

Question 3

A metal wire of linear mass density of 9.8 *g/m* is stretched with a tension of 10 *kg* weight between two rigid supports 1 *metre* apart. The wire passes at its middle point between the poles of a permanent magnet, and it vibrates in resonance when carrying an alternating current of frequency *n*. The frequency *n* of the alternating source is **[2003]**

(a) 25 *Hz* (b) 50 *Hz*

(c) 100 *Hz* (d) 200 *Hz*

Question 4

A 20 *cm* long string, having a mass of 1.0 *g*, is fixed at both the ends. The tension in the string is 0.5 *N*. The string is set into vibrations using an external vibrator of frequency 100 *Hz*. Find the separation (in *cm*) between the successive nodes on the string. **[2009]**

(a) 15 *cm* (b) 5 *cm*

(c) 25 *cm* (d) 22 *cm*

Question 5

A vibrating string of certain length *l* under a tension *T* resonates with a mode corresponding to the first overtone (third harmonic) of an air column of length 75 *cm* inside a tube closed at one end. The string also generates 4 beats per second when excited along with a tuning fork of frequency *n*. Now when the tension of the string is slightly increased the number of beats reduces to 2 per second. Assuming the velocity of sound in air to be 340 *m/s*, the frequency *n* of the tuning fork in *Hz* is **[2008]**

(a) 344 (b) 336

(c) 117.3 (d) 109.3

Question 6

A pipe of length 85 *cm* is closed from one end. Find the number of possible natural oscillations of air column in the pipe whose frequencies lie below 1250 *Hz*. The velocity of sound in air is 340 *m/s* **[2014]**

(a) 12 (b) 8

(c) 6 (d) 4

Question 7

Tube A has both ends open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is **[2002]**

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

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

Question 8

A cylindrical tube, open at both ends, has a fundamental frequency, f, in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of the air-column is now **[2016]**

(a) f (b) $f/2$

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

Question 9

An open pipe is in resonance in its 2^{nd} harmonic with tuning fork of frequency f_1. Now it is closed at one end. If the frequency of the tuning fork is increased slowly from f_1 then again a resonance is obtained with a frequency f_2. If in this case the pipe vibrates n^{th} harmonics, then **[2005]**

(a) $n=3,\ f_2=\frac{3}{4}f_1$ (b) $n=3,\ f_2=\frac{5}{4}f_1$

(c) $n=5,\ f_2=\frac{5}{4}f_1$ (d) $n=5,\ f_2=\frac{3}{4}f_1$

Question 10

A string $2.0m$ long and fixed at its ends is driven by a $240Hz$ vibrator. The string vibrates in its third harmonic mode. The speed of the wave and its fundamental frequency is **[2019]**

(a) $320m/s, 120Hz$ (b) $180m/s, 80Hz$

(c) $180m/s, 120Hz$ (d) $320m/s, 80Hz$

Question 11

A hollow pipe of length 0.8 m is closed at one end. At its open end a 0.5 m long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension in the wire is 50 N and the speed of sound is $320\,ms^{-1}$, the mass of the string is **[2010]**

(a) 5 *grams* (b) 10 *grams*

(c) 20 *grams* (d) 40 *grams*

Question 12

A string of length $1m$ and mass $5g$ is fixed at both ends. The tension in the string is $8.0N$. The string is set into vibration using an external vibrator of frequency $100Hz$. The separation between successive nodes on the string is close to **[2019]**

(a) $20.0cm$ (b) $10.0cm$

(c) $33.3cm$ (d) $16.6cm$

Question 13

A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m ($m<<M$). When the car is at rest, the speed of transverse waves in the string is $60ms^{-1}$. When the car has acceleration a, the wave- speed increases to $60.5ms^{-1}$. The value of a, in terms of gravitational acceleration g, is closest to **[2019]**

(a) $\frac{g}{30}$ (b) $\frac{g}{20}$

(c) $\frac{g}{5}$ (d) $\frac{g}{10}$

Question 14

In a resonate tube with tuning fork of frequency $512Hz$, first resonance occurs at water level equal to $30.3cm$ and second resonance occurs at $63.7cm$. The maximum possible error in the speed of sound is **[2005]**

(a) 204.8 *cm/s* (b) 51.2 *cm/s*

(c) 102.4 *cm/s* (d) 153.6 *cm/s*

Question 15

In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is 0.1 m. When this length is changed to 0.35 m, the same tuning fork resonates with the first overtone. Calculate the end correction **[2003]**

(a) $0.012m$ (b) $0.025m$

(c) $0.05m$ (d) $0.024m$

Question 16

A student is performing the experiment of Resonance Column. The diameter of the column tube is 4cm. The frequency of the tuning fork is 512Hz. The air temperature is 38°C in which the speed of sound is 336m/s. The zero of the meter scale coincides with the top end of the Resonance column tube. When the first resonance occurs, the reading of the water level in the column is **[2012]**

(a) 14.0 cm (b) 15.2 cm

(c) 16.4 cm (d) 17.6 cm

Question 17

A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between two. The lowest resonant frequency for this string is **[2015]**

(a) 205 Hz (b) 10.5 Hz NEET

(c) 105 Hz (d) 155 Hz Stationary waves

Question 18

An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is **[2016]**

(a) 66.7 cm (b) 100 cm

(c) 150 cm (d) 200 cm

Question 19

The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is **[2015]**

(a) 100 cm (b) 120 cm

(c) 140 cm (d) 80 cm

Question 20

The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be **[2016]**

(a) $\frac{L}{2}$ (b) $4L$

(c) L (d) $2L$

Question 21

Question 22

The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system **[2017]**

(a) 10 Hz (b) 20 Hz

(c) 30 Hz (d) 40 Hz

Question 23

The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is **[2018]**

(a) 13.2 cm (b) 8 cm

(c) 12.5 cm (d) 16 cm

Question 24

A string is stretched between fixed points separated by 75.0cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is **[2008]**

(a) 1.05 Hz (b) 1050 Hz

(c) 10.5 Hz (d) 105 Hz

Level UP

Waves

BEATS- Doppler Effect

RANKERS

PYQs - DPP 3

Question 1

In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be

(a) 523 Hz (b) 524 Hz
(c) 536 Hz (d) 537 Hz *(2020)*

Question 2

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

(a) 1 (b) 4 (c) 3 (d) 2
(NEET-II 2016)

Question 3

A source of unknown frequency gives 4 beats/s when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is

(a) 240 Hz (b) 260 Hz
(c) 254 Hz (d) 246 Hz *(2013)*

Question 4

Two sources of sound placed close to each other, are emitting progressive waves given by

$y_1 = 4\sin 600\pi t$ and $y_2 = 5\sin 608\pi t$

An observer located near these two sources of sound will hear

(a) 4 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. *(2012)*

Question 5

Two identical piano wires, kept under the same tension T have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats/s when both the wires oscillate together would be

(a) 0.01 (b) 0.02 (c) 0.03 (d) 0.04
(Mains 2011)

Question 6

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

(a) 510 Hz (b) 514 Hz
(c) 516 Hz (d) 508 Hz *(2010)*

Question 7

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

(a) 7 (b) 8
(c) 3 (d) 5 *(2009)*

Question 8

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

(a) 360 (b) 180
(c) 60 (d) 3 *(2006)*

Question 9

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

(a) 6 (b) 12
(c) 0 (d) 1 *(2006)*

Question 10

Two waves of wavelengths 50 cm and 51 cm produced 12 beats per second. The velocity of sound is

(a) 340 m/s (b) 331 m/s
(c) 306 m/s (d) 360 m/s *(1999)*

Doppler Effect

Question 11

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

(a) 361 Hz (b) 411 Hz
(c) 448 Hz (d) 350 Hz *(2017)*

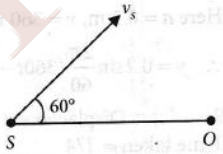
Question 12

A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of 15 m s^{-1}. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is (Take velocity of sound in air = 330 m s^{-1})

(a) 838 Hz (b) 885 Hz
(c) 765 Hz (d) 800 Hz *(NEET-I 2016)*

Question 13

A source of sound S emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of 19.4 m s^{-1} at an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air 330 m s^{-1}), is



(a) 106 Hz
(b) 97 Hz
(c) 100 Hz
(d) 103 Hz *(2015)*

Question 14

A speeding motorcyclist sees traffic jam ahead him. He slows down to 36 km $hour^{-1}$. He finds that traffic has eased and a car moving ahead of him at 18 km $hour^{-1}$ is honking at a frequency of 1392 Hz. If the speed of sound is 343 m s^{-1}, the frequency of the honk as heard by him will be

(a) 1332 Hz (b) 1372 Hz
(c) 1412 Hz (d) 1454 Hz *(2014)*

Question 15

A train moving at a speed of 220 m s^{-1} towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is (Speed of sound in air is 330 m s^{-1})

(a) 3500 Hz (b) 4000 Hz
(c) 5000 Hz (d) 3000 Hz *(Mains 2012)*

Question 16

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

(a) 555.5 Hz (b) 720 Hz
(c) 500 Hz (d) 550 Hz *(2009)*

Question 17

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

(a) $v/\sqrt{2}$ (b) $v/3$
(c) $v/4$ (d) $v/2$ *(2004)*

Question 18

A whistle revolves in a circle with angular speed ω = 20 rad/s using a string of length 50 cm. If the frequency of sound from the whistle is 385 Hz, then what is the minimum frequency heard by an observer which is far away from the centre (velocity of sound = 340 m/s)

(a) 385 Hz (b) 374 Hz
(c) 394 Hz (d) 333 Hz *(2002)*

Question 19

Two trains move towards each other with the same speed. The speed of sound is 340 m/s. If the height of the tone of the whistle of one of them heard on the other changes to 9/8 times, then the speed of each train should be

(a) 20 m/s (b) 2 m/s
(c) 200 m/s (d) 2000 m/s *(1991)*

PYQs - DPP 4 RANKERS

Progressive Waves

Rahul Sir

Question 1

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

(a) 4π (b) 2π (c) π (d) 2

(26th July 2nd Shift 2022)

Question 2

In the wave equation $y = 0.5\sin\frac{2\pi}{\lambda}(400t - x)$ m, the velocity of the wave will be

(a) 200 m/s (b) $200\sqrt{2}$ m/s
(c) 400 m/s (d) $400\sqrt{2}$ m/s

(28th July 1st Shift 2022)

Question 3

A longitudinal wave is represented by

$$x = 10\sin 2\pi\left(nt - \frac{x}{\lambda}\right)\text{cm}.$$

The maximum particle velocity will be four times the wave velocity if the determined value of wavelength is equal to

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

(29th June 1st Shift 2022)

Question 4

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?

(a) $Y(x, t) = 0.06[\sin 5.1x - (1.5 \times 10^3)t]$
(b) $Y(x, t) = 0.06[\sin 0.8x - (0.5 \times 10^3)t]$
(c) $Y(x, t) = 0.03[\sin 5.1x - (0.2 \times 10^3)t]$
(d) $Y(x, t) = 0.03[\sin 5.1x - (1.5 \times 10^3)t]$

(17th March 2nd Shift 2021)

Question 5

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

(a) 2.25 (b) 0.44
(c) 1.25 (d) 1.5

(2nd Sep 1st Shift 2020)

Question 6

A uniform thin rope of length 12 m and mass 6 kg hangs vertically from a rigid support and 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 end of the rope. What is the wavelength of the wavetrain (in cm) when it reaches the top of the rope?

(a) 3 (b) 6 (c) 12 (d) 9

(3rd Sep 1st Shift 2020)

Question 7

Speed of a transverse wave on a straight wire (mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2) is 90 m s^{-1}. If the Young's modulus of wire is 16×10^{11} N m^{-2}, the extension of wire over its natural length is

(a) 0.03 mm (b) 0.04 mm
(c) 0.02 mm (d) 0.01 mm

(7th Jan 1st Shift 2020)

Question 8

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

(a) 10.2×10^2 N (b) 5.15×10^3 N
(c) 2.50×10^4 N (d) 30.5×10^4 N

(8th Jan 2nd Shift 2020)

Question 9

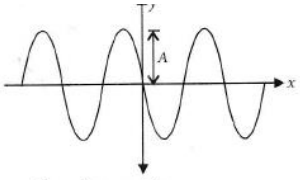
Three harmonic waves having equal frequency υ and same intensity I_0, have phase angles 0, $\frac{\pi}{4}$ and $-\frac{\pi}{4}$ respectively. When they are superimposed the intensity of the resultant wave is close to

(a) $0.2\ I_0$ (b) I_0 (c) $3\ I_0$ (d) $5.8\ I_0$

(9th Jan 1st Shift 2020)

Question 10

A progressive wave travelling along the positive x-direction is represented by $y(x, t) = A\sin(kx - \omega t + \phi)$. Its snapshot at $t = 0$ is given in the figure.



For this wave, the phase ϕ is
(a) $\pi/2$ (b) π (c) 0 (d) $-\pi/2$
(12th April 1st Shift 2019)

Question 11

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]
(a) 30 cm (b) 10 cm (c) 40 cm (d) 20 cm
(12th April 2nd Shift 2019)

Question 12

A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m ($m << M$). When the car is at rest, the speed of transverse waves in the string is 60 m s^{-1}. When the car has acceleration a, the wave speed increases to 60.5 m s^{-1}. The value of a, in terms of gravitational acceleration g, is closest to
(a) $\frac{g}{5}$ (b) $\frac{g}{20}$ (c) $\frac{g}{30}$ (d) $\frac{g}{10}$
(9th Jan 1st Shift 2019)

Question 13

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
(a) 10 N (b) 7.5 N (c) 5 N (d) 12.5 N
(11th Jan 1st Shift 2019)

Question 14

The equation of a wave on a string of linear mass density 0.04 kg m^{-1} is given by

$$y = 0.02\,(\text{m}) \sin\left[2\pi\left(\frac{t}{0.04(\text{s})} - \frac{x}{0.50(\text{m})}\right)\right]$$

The tension in the string is
(a) 6.25 N (b) 4.0 N
(c) 12.5 N (d) 0.5 N *(2010)*

Question 15

The speed of sound in oxygen (O_2) at a certain temperature is 460 m s^{-1}. The speed of sound in helium (He) at the same temperature will be (assume both gases to be ideal)
(a) 330 m s^{-1} (b) 460 m s^{-1}
(c) 500 m s^{-1} (d) 650 m s^{-1} *(2008)*

Question 16

A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of
(a) 100 (b) 1000 (c) 10000 (d) 10
(2007)

Question 17

Numerical Value Type

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

Question 18

The percentage increase in the speed of transverse waves produced in a stretched string if the tension is increased by 4%, will be _____%.
(25th Feb 2nd Shift 2021)

Question 19

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 $A_1 = 12$ mm and $A_2 = 5$ mm, $x_0 = 3.5$ cm and wave number $k = 6.28$ cm^{-1}. The amplitude of resulting wave will be _____ mm.
(26th Aug 2nd Shift 2021)

Question 20

A wire of density 9×10^{-3} kg cm^{-3} is stretched between two clamps 1 m apart. The resulting strain in the wire is 4.9×10^{-4}. The lowest frequency of the transverse vibrations in the wire is (Young's modulus of wire $Y = 9 \times 10^{10}$ N m^{-2}), (to the nearest integer), _____.
(2nd Sep 2nd Shift 2020)