PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

STATIONARY WAVES

Example

1. The two individual wave functions are

$y_1 = (5 \text{ cm})\sin(4x - t)$ and $y_2 = (5 \text{ cm})\sin(4x + t)$

ltbrrgt where, x and y are in centimetres. Find out

the

maximum displacement of the motion at $x = 2.0$ cm.

A. 9.89 cm

B. 8 cm

C. 8.39 cm

D. 7.69 cm

Answer: a

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2. The displacement of the wave given by equation

$y(x, t) = a \sin(kx - \omega t + \phi)$, where$\phi = 0$ at point

x and

t = 0 is same as that at point

A. $x + 2n\pi$

B. $x + \frac{2n\pi}{k}$

C. $kx + 2n\pi$

D. Both (a) and (b)

Answer: b

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3. A guitar string is 100 cm long and has a fundamental

frequency of 125 Hz. Where should it be pressed to produce a fundamental frequency of 200 Hz.

A. 60.3 cm

B. 62.5 cm

C. 65.3 cm

D. 69.8 cm

Answer: b

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4. Two identical wires of length l and $2l$ vibrate with fundamental frequencies 100 Hz and 150 Hz respectively. What is the ration of their tensions?

A. 9

B. 11

C. 8

D. 6

Answer: a

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5. A pipe 30.0 cm long is opened at both ends. Which Harmonic mode of the pipe will be at 1.1 kHz frequency also find fundamental frequency, if one end of the pipe is colsed. Take the speed of sound in air as 330 ms^{-1}

A. 2nd harmonic and 275 Hz

B. 1st harmonic and 260 Hz

C. 3rd harmonic and 260 Hz

D. Fundamental harmonic and 240 Hz

Answer: a

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6. 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. 100 Hz

B. 150 Hz

C. 200 Hz

D. 250 Hz

Answer: c

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7. In a resonance tube experiment, a tuning fork resonates with an air column of length 12 cm and again resonates when it is 38cm long. The end correction will be

A. 0.25 cm

B. 0.5 cm

C. 0.75 cm

D. 1 cm

Answer: d

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8. Which characteristic of musical sound determines the shrillness or graveness of the sound?

A. Quality

B. Loudness

C. Pitch

D. None of these

Answer: c

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9. A tuning fork produces 5 beats s^{-1} with a sonometer

wire of length 78 cm. If the length of the wire

iscreased byy 2 cm, then there is a resonance between

the tuning fork and the wire. The frequency of the fork is

A. 195 Hz

B. 190 Hz

C. 200 Hz

D. 180 Hz

Answer: a

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Exercise 1

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

A. $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$

B. $v = v_1 + v_2 + v_3$

C. $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

D. $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

Answer: c

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2. Two pulses having equal and opposite displacements

moving in oppositee directions overlap at $t = t_1$ sec. The resultant displacement of the wave at $t = t_1$ sec is

A. twice the displacement of each pulse

B. half the displacement of each pulse

C. zero

D. Either (a) or (c)

Answer: c

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3. A uniform wire of linear density 0.004 per kg-m, when stretched between two rigid supports, with a tension 3.6×10^2 N, resonates with a frequency of 420 hz. The next harmonic frequency with which the wire resonates is 490 Hz. The length of the wire in metre is

A. 1.41

B. 2.14

C. 2.41

D. 3.14

Answer: b

4. A string is hanging from a rigid support. A transverse

pulse is excited at its free end. The speed at which

the

pulse travels a distance x is proportional to

A. x

B. $\frac{1}{x}$

C. $\frac{1}{\sqrt{x}}$

D. $\sqrt{x}$

Answer: d

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5. A metal wire of linear mass density of $9.8g/m$ is stretched with a tension of $10kg - wt$ between two

rigid support $1meter$ 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

A. 50 Hz

B. 100 Hz

C. 200 Hz

D. 25 Hz

Answer: a

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6. A uniform string of length 1.5 m has two successive harmonics of frequencies 70 Hz and 84 Hz. The speed of the wave in the string (in ms^{-1}) is

A. 84

B. 42

C. 21

D. 10.5

Answer: b

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7. A uniform rope of mass 0.1 kg and length 2.5 m hangs from ceiling. The speed of transverse wave in the rope at upper end at a point 0.5 m distance from lower end will be

A. $5 \ \ \mathrm{ms}^{-1} \ \text{and} \ \ 2.24\mathrm{ms}^{-1}$

B. $10 \ \ \mathrm{ms}^{-1} \ \text{and} \ \ 3.23\mathrm{ms}^{-1}$

C. $7.5 \ \ \mathrm{ms}^{-1} \ \text{and} \ \ 1.2\mathrm{ms}^{-1}$

D. None of these

Answer: a

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8. A string of mass 2.50kg is under a tension os 200N. The length of the stretched string is 20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?

A. 1 s

B. 0.5 s

C. 2 s

D. Data insufficient

Answer: b

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9. The equation of a stationary wave along a stretched

string is given by $y = 4\sin\frac{2\pi x}{3}\cos 4O\pi t$

where, x and y are in cms and t is in sec.

The separation between two adjacent nodes is

A. 3 cm

B. 1.5 cm

C. 6 cm

D. 4 cm

Answer: b

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10. The wave generated from up and down jerk given to the string or by up and down motion of the piston at the end of the pipe is

A. transverse or longitudinal

B. progressive

C. standing

D. Both (a) and (b)

Answer: d

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11. A wave frequency $100Hz$ travels along a string towards its fixed end . When this wave travels back after reflection , a node is formed at a distance of $10cm$from the fixed end . The speed of the wave (incident and reflected) is

A. $5\ \mathrm{ms}^{-1}$

B. $10\ \mathrm{ms}^{-1}$

C. $20\ \mathrm{ms}^{-1}$

D. $40\ \mathrm{ms}^{-1}$

Answer: c

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12. The equation of a stationary wave on a string clamped at both ends and vibrating in its third harmonic is given by $y = 0.5\sin(0.314\mathrm{x})\cos(600\pi t)$ where x and y are in cm and t is in sec. What is the length of the string?

A. 10 cm

B. 20 cm

C. 30 cm

D. 40 cm

Answer: c

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13. For a stationary wave, $t = 8\sin\left(\frac{\pi x}{20}\right)\cos(50\pi t)$. What is the distance between two successive antinode ?

A. 15 cm

B. 20 cm

C. 25 cm

D. 30 cm

Answer: b

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14. Two instruments having stretched strings are being played in unison . When the tension in one of the instruments is increases by 1% , 3 beats are produced in $2s$. The initial frequency of vibration of each wire is

A. 300 Hz

B. 500 Hz

C. 1000 Hz

D. 400 Hz

Answer: a

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15. A string vibrates with a frequency of 200Hz. Its length is doubled and its tension is altered till it begins to vibrate with a frequency of 300Hz. What is the ratio of new tension to the original tension ?

A. $9:01$

B. $1:09$

C. $3:01$

D. $1:03$

Answer: a

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16. The speed of a wave on a string is 150 ms^{-1} when the

tension is 120 N. The percentage increase in the

tension in orderr to raise the wave speed by $20\ \%$ is

A. $44\ \%$

B. $40\ \%$

C. $20\ \%$

D. $10\ \%$

Answer: a

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17. A string has tension T. For tripling the frequency.

The

tension is string will become

A. 3T

B. $\frac{T}{9}$

C. $\frac{T}{\sqrt{3}}$

D. 9T

Answer: d

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18. A string of length $0.4m$ and mass $10^{-2}kg$ is tightly clamped at its ends. The tension in the string is $1.6N$. Identical wave pulse are produced at one end at equal intervals of time, Δt. The minimum value of Δt which allows constructive interference of successive pulse is

A. 0.05 s

B. 0.40 s

C. 0.20 s

D. 0.10 s

Answer: d

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19. A wave of length $2m$ is superimposed on its reflected wave to form a stationary wave. A node is located at $x = 3m$, the next node will be located at x equals to

A. 3 m

B. 2 m

C. 5 m

D. 4 m

Answer: d

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20. Equation of a plane progressive wave is given by $y = 0.6 \sin 2\pi\left(t - \frac{x}{2}\right)$. On reflection from a denser medium, its amplitude becomes $2/3$ of the amplitude of the incident wave. The equation of the reflected wave is

A. $y = 0.6 \sin 2\pi\left(t + \frac{x}{2}\right)$.

B. $y = -0.6 \sin 2\pi\left(t + \frac{x}{2}\right)$.

C. $y = 0.4 \sin 2\pi\left(t + \frac{x}{2}\right)$.

D. $y = -0.4 \sin 2\pi\left(t - \frac{x}{2}\right)$.

Answer: b

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21. Two uniform strings A and B made of steel are made to vibrate under the same tension. If the first overtone of A is equal to the second overtone of B

and if the radius of A is twice that of B, the ratio of the lengths of the strings is

A. $2:01$

B. $3:04$

C. $3:02$

D. $1:03$

Answer: d

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22. A string of mass 0.2 kg/m and length l= 0.6 m is fixed at both ends and streteched such that it has a

tension of 80 N. the string vibrates in 3 segments with maximum amplitude of 0.5 cm. the maximum transevers velcotiy amplitude is

A. $9.43ms^{-1}$

B. $3.14ms^{-1}$

C. $1.57ms^{-1}$

D. $6.28ms^{-1}$

Answer: c

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23. A stretched string of length l, fixed at both ends can sustain stationary waves of wavelength λ given by

A. $\lambda = \frac{n^2}{2l}$

B. $\lambda = \frac{l^2}{2n}$

C. $\lambda = \frac{2l}{n}$

D. $\lambda = 2\ln$

Answer: c

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24. Two strings of the same material and the same area

of cross-section are used in an wxperiment. One is loaded with 12 kg and the other with 3 kg The fundamental fequency of the first string is equal to the first overtone of the second string. If the length of

the second string is 100 cm, then the length of the first string is

A. 300 cm

B. 200 cm

C. 100 cm

D. 50 cm

Answer: c

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25. A segment of wire vibrates with fundamental frequency of 40 Hz under a tension of 9 kg-wt. Then, tension at which the fundamental frequency of the same wire becomes 900 Hz is

A. 36 kg-wt

B. 27 kg-wt

C. 18 kg-wt

D. 72 kg-wt

Answer: a

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

A. 6 cm

B. 4 cm

C. 3 cm

D. 1.5 cm

Answer: c

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

A. 1092° C

B. 819 K

C. 819°

D. 546°

Answer: c

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28. A stretched wire of lenth 110 cm is divided into three segments whose frequencies are in ratio $1:2:3$. Their length must be

A. 20 cm, 30 cm, 60 cm,

B. 60 cm, 30 cm, 20 cm

C. 60 cm, 20 cm, 30 cm,

D. 30 cm, 60 cm, 20 cm

Answer: b

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29. The tension in a wire is decreased by $19\ \%$ The percentage decrease in frequency will be

A. $19\ \%$

B. $10\ \%$

C. $0.9\ \%$

D. None of these

Answer: b

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30. Two vibrating strings of the same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the string vibrate in their fundamental nodes, the one of length L with freuqency v_1 and the other with frequency v_2. the ratio v_1 / v_2 is given by

A. 2

B. 4

C. 3

D. 1

Answer: d

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31. A string in a musical instrument is 50 cm long and its fundamental frequency is 800 Hz. If a frequency of 1000 Hz is to be produced, then required length of string is

A. 62.5 cm

B. 50 cm

C. 40 cm

D. 37.5 cm

Answer: c

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32. A wave representing by the equation $y = a\cos(kx - \omega t)$ is suerposed with another wave to form a stationary wave such that point $x = 0$ is a node. The equation for the other wave is

A. $y = a\cos(kx - \omega t)$

B. $y = a\sin(kx - \omega t)$

C. $y = -a\sin(kx - \omega t)$

D. $y = -a\cos(kx - \omega t)$

Answer: d

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33. Two stratched strings of same material are vibrating

under some tension in fundamental mode. The ratio of their froquencies is $1:2$ and ratio of the length of the vibrating segments is $1:4$ Then, the ratio of the radii of the strings is

A. $2:1$

B. $4:1$

C. $3:2$

D. $8:1$

Answer: d

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34. A uniform wire of length L, diameter D and density ρ is stretched under a tension T. The correct relation between its fundamental frequency f, the length L and the diameter D is

A. $f \propto \frac{1}{LD}$

B. $f \propto \frac{1}{L\sqrt{D}}$

C. $f \propto \frac{1}{D^2}$

D. $f \propto \frac{1}{LD^2}$

Answer: a

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35. To increase the frequency by $20\ \%$, the tension in the

string vibrating on a sonometer has to be increased by

A. $44\ \%$

B. $33\ \%$

C. $22\ \%$

D. $11\ \%$

Answer: a

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36. the frequency of a sonometer wire is 10 Hz. When the weight producing th tensions are completely immersed in water the frequency becomes 80 Hz and on immersing the weight in a certain liquid the

frequency becomes 60 Hz. The specific gravity of the liquid is

A. 1.42

B. 1.77

C. 0.36

D. 1.82

Answer: b

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37. When the length of the vibrating segment of a sonometer wire is increased by 1% the percentage

change in its frequency is

A. $\frac{100}{101}$

B. $\frac{99}{100}$

C. 1

D. 2

Answer: c

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38. Two forks A and B when sounded together produce

four beats s^{-1}. The fork A is in unison with 30 cm

length of a sonometer wire and B is in unison with 25

cm length of the same wire at the same tension. The frequencies of the forks are

A. 24 Hz, 28 Hz

B. 20 Hz, 24 Hz

C. 16 Hz, 20 Hz

D. 26 Hz, 30 Hz

Answer: b

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39. A pipe of 60 cm long and open at both the ends produces harmonics. Which harmonic mode of pipe resonates a 2.2 kHz source? Given, speed of sound in ari $= 300ms^{-1}$.

A. Fifth harmonic

B. Eighth harmonic

C. Third harmonic

D. Second harmonic

Answer: b

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40. If we study the vibration of a pipe open at both ends, then the following statements is not true

A. Open ends will be antinode

B. Odd harmonic of the fundamental frequency will be generated

C. All harmonics of the fundamental frequency will be generated

D. Pressure change will be maximum at both ends

Answer: d

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41. Two organ pipes, each closed at one end, give 5 beats s^{-1} when emitting their fundamental notes. If their lengths are in the ratio $50:51$, their fundamental frequencies are

A. 250, 255

B. 255, 250

C. 260, 265

D. 265, 270

Answer: b

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42. The frequency of the first overtons of a closed pipe of

length l_1 is equal to that of the first overtone of an open pipe of length l_2 The ratio of their lengths $(l_1 : l_2$ is

A. $2:3$

B. $4:5$

C. $3:5$

D. $3:4$

Answer: d

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43. Air is blown at the mouth of an open tube of length 25

cm and diameter 2 cm. If the velocity of sound in air is

$330ms^{-1}$, then the emitted frequencies (in Hz) are

A. $660, 1320, 2640$

B. 660, 1000, 3300

C. 302, 664, 1320

D. 330, 990, 1690

Answer: a

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44. A pipe opened at both ends prpduces a note of frequency f_1. When the pipe is kept with $\frac{3}{4}th$ of its length in water, it produces a note of frequency f_2. The ratio $\frac{f_1}{f_2}$ is

A. $\frac{3}{4}$

B. $\frac{4}{3}$

C. $\frac{1}{2}$

D. 2

Answer: c

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45. A closed organ pipe of length 1.2 m vibrates in its first overtone mode. The pressure variation is maximum at

A. 0.4 m from the open end

B. 0.4 m from the closed end

C. Both (a) and (b)

D. 0.8 m from the open end

Answer: a

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46. An organ pipe P closed at one end vibrates in its first

narmonic. Another organ pipe Q open at both ends vibrates in its third harmonic. When both are in

resonance with a tuning fork, the ratio of the length

of

P to that of Q is

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{6}$

D. $\frac{1}{8}$

Answer: c

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47. Two closed organ pipe A and B have the same length. A is wider than B. They resonate in the fundamental mode at frequencies V_A and V_B respectively , then

A. $n_A = n_B$

B. $n_A > n_B$

C. $n_A < n_B$

D. Either (b) or (c) depending on the ratio of their diameters

Answer: c

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48. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of the waves giving resonance in the fundamental, first and second overtone modes respecively in a open organ pipe, then the ratio of the wavelengths $\lambda_1 : \lambda_2 : \lambda_3$, is :

A. $1:3:5$

B. $1:2:3$

C. $5:3:1$

D. $1:\frac{1}{3}:\frac{1}{5}$

Answer: d

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

A. 4

B. 13

C. 6

D. 9

Answer: c

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50. Two closed organ pipes of length 100 cm and 101 cm 16 beats is 20 sec. When each pipe is sounded in its fundamental mode calculate the velocity of sound

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A. $303ms^{-1}$

B. $332ms^{-1}$

C. $323.2ms^{-1}$

D. $300ms^{-1}$

Answer: c

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51. 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. 200 Hz

B. 480 Hz

C. 240 Hz

D. 300 Hz

Answer: a

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52. An open organ pipe has fundamental frequency 100 Hz. What frequency will be produced if its one end is closed ?

A. 100, 200, 300....

B. 50, 150, 250....

C. 50, 100, 200, 300....

D. 50, 100, 150, 200....

Answer: b

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53. A pipe closed at one end open at the other end, resonates with sound waves of frequency 135 Hz and also 165 Hz, but not with any wave of frequency intermediate between these two. Then, the frequency

of the fundamental note is

A. 30 Hz

B. 15 Hz

C. 60 Hz

D. 7.5 Hz

Answer: b

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54. A glass tube is open at both the ends. A tuning fork of

frequency f resonates with the air column inside the tude. Now, the tube is placed bertically inside water so that half the length of the tube is filled with

water.

Now, the air column inside the tube is in unison with another fork of frequency f . Then

A. $f' = f$

B. $f' = 4f$

C. $f' = 2f$

D. $f' = \frac{f}{2}$

Answer: a

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55. A cylinderical 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 air column is now

A. $f/2$

B. $3f/4$

C. f

D. $2f$

Answer: c

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56. The end correction of a resonance colume is 1.0 cm.

If the shortest length resonating with the tuning fork is

15.0 cm the next resonating length will be

A. 31 cm

B. 45 cm

C. 46 cm

D. 47 cm

Answer: d

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57. The vibrating of four air columns are represented in

the figure. The ratio of frequencies $n_p : n_q : n_r : n_s$ is

A. $12 : 6 : 3 : 5$

B. $1 : 2 : 4 : 3$

C. $4 : 2 : 3 : 1$

D. $6 : 2 : 3 : 4$

Answer: b

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58. Air is blown at the mouth of a tube of length 25 cm

and diameter equal to 2 cm open at both ends. If velocity of sound in air is $330ms^{-1}$, the sound emitted

will have all the frequencies in the group

A. 330, 990, 1690 Hz

B. 302, 664, 1320 Hz

C. 660, 1320, 1980 Hz

D. 660, 100, 3300 Hz

Answer: c

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59. A closed organ pipe of length 20 cm is sounded with

tuning fork in resonance. What is the frequency of

tuning fork? $\left(v = 332ms^{-1}\right)$

A. 300 Hz

B. 350 Hz

C. 375 Hz

D. 415 Hz

Answer: d

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60. An orgen pipe open at one end is vibrating in first

overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio

of length of two pipes is

A. $3:8$

B. $8:3$

C. $1:2$

D. $4:1$

Answer: c

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61. In a resonance column first and second resonance are obtained at depths 22.7 cm and 70.2 cm. The third resonance will be obtained at a depth of

A. 117.7 cm

B. 92.9 cm

C. 115.5 cm

D. 113.5 cm

Answer: a

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62. In one metre long open pipe what is the harmonic of resonance obtained with a tuning fork of frequency 480 Hz

A. First

B. Second

C. Third

D. Fourth

Answer: c

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63. A cylinderical 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 air column is now

A. $3f_0/4$

B. f_0

C. $f_0/2$

D. $2f_0$

Answer: b

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Exercise 2

1. A sonometer wire of length $1.5m$ is made of steel. The tension in it produces an elastic strain of 1%. What is the fundamental frequency of steel if density and elasticity of steel are $7.7 \times 10^3 kg/m^3$ and $2.2 \times 10^{11} N/m^2$ respectively ?

A. 188.5 Hz

B. 178.2 Hz

C. 200.5 Hz

D. 770 Hz

Answer: b

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

A. 80 cm

B. 100 ccm

C. 120 cm

D. 140 cm

Answer: c

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3. Fundamental frequency of a sonometer wire is n. If the length and diameter of the wire are doubled keeping the tension same, then the new fundamental

frequency is

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

B. $\frac{n}{2\sqrt{2}}$

C. $\sqrt{2}n$

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

Answer: b

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4. A cylindrical tube open at both the ends has a fundamental frequency of 390 Hz in air. If $\frac{1}{4}$ th of the

tube is immesed vertically in water the fundamental frequency of air column is

A. 260 Hz

B. 130 Hz

C. 390 Hz

D. 520 Hz

Answer: d

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5. A glass tube of length 1.0 m is completely filled with

water. A vibrating tuning fork of frequency 500 Hz is kept over the mouth of the tube and the water is drained out slowly at the bottom of the tube. If the velocity of sound in air is 330 ms^{-1}, then the total number of resonances that occur will be

A. 2

B. 3

C. 1

D. 5

Answer: b

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6. in an experiment it was found that string vibrates in n loops when a mass M is placed on the pan. What mass should be placed on the pan to make it vibrate in 2n loops with same frequency ? (neglect the mass of pan)

A. $M/4$

B. 4 M

C. 2 M

D. $M/2$

Answer: b

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7. Standing waves are produced by the superposition of two waves $y_1 = 0.05\sin(3\pi t - 2x)$ and $y_2 = 0.05\sin(3\pi t + 2x)$ Where x and y are in metres and t is in second. What is the amplitude of the particle at $x = 0.5$ m ? (Given, $\cos 57.3^\circ = 0.54$)

A. 2.7 cm

B. 5.4 cm

C. 8.1 cm

D. 10. 8 cm

Answer: a

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8. The transverse displacement $y(x, t)$ of a wave on a string is given by $y(x, t) = e^{-\left(ax^2+bt^2+2\sqrt{(ab)}xt\right)}$. This represents a :

A. wave moving in -x direction with speed $\sqrt{b/a}$

B. standing wave of frequency $\sqrt{b}$

C. standing wave of frequency $\sqrt{\frac{1}{\sqrt{b}}}$

D. wave moving in +x direction with speed $\sqrt{a/b}$

Answer: b

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9. A pipe is open at both ends and 40 cm of its length is

in resonance with an external frequency 1.1 kHz. If the speed of sound is $330ms^{-1}$, which harmonic is in

resonance?

A. First

B. Second

C. Third

D. none

Answer: d

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10. While measuring the speed of sound by performing a resonance column experiment, a student gets the first resonance condition at a column length of $18cm$ during winter. Repeating the same experiment during summer, she measures the

column length to be xcm for the second resonance.

Then

A. $18 > x$

B. $x > 54$

C. $54 > x > 36$

D. $36 > x > 18$

Answer: d

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11. 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. $0.61v$

C. $1.50v$

D. $0.75v$

Answer: a

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12. A Uniform rope having mass m hags vertically from a rigid support. A transverse wave pulse is

produced at the lower end. The speed v of wave pulse varies with height h from the lower end as

A. 

B. 

C. 

D. 

Answer: a

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13. The frequency of the third overtone of a closed pipe

of length L_c is the same as the frequency of the sixth

overtone of an open pipe of the length L_o. Then

A. $\frac{L_o}{L_c} = 4$

B. $\frac{L_o}{L_c} = \frac{2}{1}$

C. $\frac{L_o}{L_c} = \frac{1}{4}$

D. $\frac{L_o}{L_c} = \frac{1}{2}$

Answer: b

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14. A stretched string is vibrating in the second overtone,

then the number of nodes and anti-nodes between the ends of the string are respectivley

A. 3 and 4

B. 4 and 3

C. 2 and 3

D. 3 and 2

Answer: c

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15. A wire under tension vibrates with a fundamental frequency of 600 Hz. If the length of the wire is doubled, the radius is halved and the wire is made to vibrate under one-ninth the tension. Then, the fundamental frequency will became

A. 400 Hz

B. 600 Hz

C. 300 Hz

D. 200 Hz

Answer: d

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16. An open organ pipe is closed suddenly with the result

that the second overtone of the closed pipe is found to be higher in frequency by 100 than the first overtone of the original pipe. Then, the fundamental frequency of the open pipe is

A. $200s^{-1}$

B. $100s^{-1}$

C. $300s^{-1}$

D. $250s^{-1}$

Answer: a

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17. The lengths of two organ pipes open at both ends are L and $L+d$. If they are sounde together, then the beat frequency will be

A. $\frac{2Vd}{L(L+x)}$

B. $\frac{2Vd}{L(L+d)}$

C. $\frac{2L(L+d)}{Vd}$

D. $\frac{Vd}{2L(L+d)}$

Answer: d

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18. The equation of a standing wave is $y = 0.2 \sin \frac{2\pi}{0.3} x \cdot \cos \frac{2\pi t}{0.01}$ where x and y are in metres and t is in seconds. The velocity of propagation of the wave is

A. 30 ms^{-1}

B. 40 ms^{-1}

C. 300 ms^{-1}

D. 400 ms^{-1}

Answer: a

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19. Tube A has both ends open while tube B has one end closed. Otherwise they are identical. Their fundamental frequencies are in the ratio

A. $4:1$

B. $2:1$

C. $1:4$

D. $1:2$

Answer: b

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20. 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. 338 ms^{-1}

B. 328 ms^{-1}

C. 330 ms^{-1}

D. 320 ms^{-1}

Answer: a

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21. A string fixed at both ends oscillates in 5 segments,

length 10 m and velocity of wave is 20 ms^{-1}. What is the frequency?

A. 5 Hz

B. 15 Hz

C. 10 Hz

D. 2 Hz

Answer: a

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22. A hollow pipe of length $0.8m$ is closed at one end. At its open end a $0.5m$ 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 $50N$ and the speed of sound is $320ms^{-1}$, the mass of the string is

A. 5 g

B. 10 g

C. 20 g

D. 40 g

Answer: b

Watch Video Solution

23. A hollow cylinder with both sides open generates a

frequency v in air. When the cylinder is vertically

immersed in water by half its length, the frequency

will be

A. v

B. 2 v

C. $v/2$

D. $v/4$

Answer: a

Watch Video Solution

24. A pipe open at both produces a note of fundamental frequency v_1 When the pipe is kept with $\frac{3}{4}$ th of its length in water, it produces a note of fundamental frequency v_2 The ratio of $\frac{v_1}{v_2}$ is

A. $\frac{4}{3}$

B. $\frac{3}{4}$

C. 2

D. $1/2$

Answer: d

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25. Match the columns for each of the properties of sound in List I primarily depends on one of the quantites in List II.

A. $1-A, 2-B, 3-C$

B. $3-A, 2-B, 1-C$

C. $2-A, 3-B, 1-C$

D. $2-A, 1-B, 3-C$

Answer: b

View Text Solution

26. For a certain organ pipe, three successive resonant

frequencies are observed at 300 Hz. 420 Hz and

540 Hz. The speed of sound in air is 340 ms^{-1}, The pipe is a

A. closed pipe of length $\frac{11}{12}$ m

B. open pipe of length $\frac{11}{12}$ m

C. closed pipe of length $\frac{17}{12}$ m

D. open pipe of lenth $\frac{17}{12}$ m

Answer: c

Watch Video Solution

27. A travelling wave represented by

$y = A\sin(\omega t - kx)$

is superimposed on another wave represented by $y = A\sin(\omega t + kx)$. The resultant is

A. A standing wave having node at $x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$, $n = 0, 1, 2$

B. A wave travelling along + x-direction

C. A wave travelling along - x-direction

D. A standing wave having nodes at $x = \frac{n\lambda}{2}, n = 0, 1, 2$

Answer: a

Watch Video Solution

Mht Cet Corner

1. Two strings A and B made of same material are stretched by same tension. The radius of string A is double of the radius of B. A transverse wave travels on A with speed v_A and on B with speed v_B. The ratio $\frac{v_A}{v_B}$ is

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 2

D. 4

Answer: c

Watch Video Solution

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

A. $\frac{1}{3}$ cm

B. $\frac{2}{3}$ cm

C. $\frac{3}{2}$ cm

D. 0.2 cm

Answer: b

Watch Video Solution

3. Wire having tension 225 N produces six beats per second when it is tuned with a fork. When tension changes to 256 N, it is tuned with the same fork, the number of beats remain unchanged. The frequency of the fork will be

A. 186 Hz

B. 225 Hz

C. 256 Hz

D. 280 Hz

Answer: a

Watch Video Solution

4. When open pipe is closed from one end, then third overtone of closed pipe is higher in frequency by 150 Hz than second overtone of open pipe. The fundamental frequency of open end pipe will be

A. 75 Hz

B. 150 Hz

C. 225 Hz

D. 300 Hz

Answer: d

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5. In a sonometer experiment the bridges are separted by a fixed distance the wire which is slightly elastic emits a tone of frequency n when held by tension T If the tension is increased to 4T the tone emitted by the wire will be of frequency

A. n

B. 2n

C. slightly greater than 2n

D. slightly less than 2n

Answer: b

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6. The length and diameter of a metal wire is doubled the fundamental frequency of vibration will change from n to (tension being kept constant and material of both the wires is same)

A. $\frac{n}{4}$

B. $\frac{n}{8}$

C. $\frac{n}{12}$

D. $\frac{n}{16}$

Answer: a

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7. In a pipe opened at both ends n_1 and n_2 be the frequencies corresponding to vibrating lengths L_1 and L_2 respectively .The end correction is

A. $\frac{n_1 l_1 - n_2 l_2}{2(n_1 - n_2)}$

B. $\frac{n_2 l_2 - n_1 l_1}{2(n_2 - n_1)}$

C. $\frac{n_2 l_2 - n_1 l_1}{2(n_1 - n_2)}$

D. $\frac{n_2 l_2 - n_1 l_1}{(n_1 - n_2)}$

Answer: d

Watch Video Solution

8. An open and closed organ pipe have the same length the ratio pth mode of frequency of vibration of air in two pipe is

A. $p(2p+1)$

B. $\frac{2p}{2p-1}$

C. p

D. 1

Answer: b

Watch Video Solution

9. If we study the vibration of a pipe open at both ends, then the following statements is not true

A. Open ends will be antinode

B. Odd harmonic of the fundamental frequency will be generated

C. All harmonics of the fundamental frequency will be

generated

D. Pressure change will be maximum at both ends

Answer: d

Watch Video Solution

10. For the stationary wave $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, the distance between a node and the next antinode is

A. 7.5

B. 15

C. 22.5

D. 30

Answer: a

Watch Video Solution

11. If the temperature increases, then what happens to the frequency of the sound produced by the organ pipe ?

A. increases

B. decreases

C. unchanged

D. not definite

Answer: a

Watch Video Solution

12. In a resonance tube the first resonance with a tuning fork occurs at 16 cm and second at 49 cm . If the velocity of sound is 330 m/s , the frequency of tuning fork is

A. 500

B. 300

C. 330

D. 165

Answer: a

Watch Video Solution

13. In the fundamental mode , time taken by the wave to reach the closed end of the air filled pipe is 0.01 s . The fundamental frequency is

A. 25

B. 12.5

C. 20

D. 15

Answer: a

Watch Video Solution

14. n_1 is the frequency of the pipe closed at one and n_2 is the frequency of the pipe open at both ends. If both are joined end to end, find the fundamental frequency of closed pipe so formed

A. $\frac{n_1 n_2}{n_2 + 2n_1}$

B. $\frac{n_1 n_2}{2n_2 + n_1}$

C. $\frac{n_1 + 2n_2}{n_2 n_1}$

D. $\frac{2n_1 + n_2}{n_2 n_1}$

Answer: a

Watch Video Solution

15. Two Cu wires of radii R_1 and R_2 are such that $(R_1 > R_2)$. Then which of the following is true ?

A. Transcerse wave travels faster in thicker wire

B. Transverse wave travels faster in thinner wire

C. Travels with the same speed in both the wires

D. Does not travel

Answer: b

Watch Video Solution

16. In a resonance pipe the first and second resonance are obtained at depths 22.7 cm and 70.2 respectively. What will be the end correction?

A. 1.05 cm

B. 115.5 cm

C. 92.5 cm

D. 113.5 cm

Answer: a

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17. Fundamental frequency of pipe is 100 Hz and other two frequencies are 300 Hz and 500 Hz then

A. pipe is open at both the ends

B. pipe is closed at both the ends

C. one end is open and another end is closed

D. None of the above

Answer: c

Watch Video Solution

18. If a source emitting waves of frequency f moves towards an observer with a velocity $\frac{v}{4}$ and the observer moves away from the source with a velocity $\frac{v}{6}$, the apparent frequency as heard by the observer will be (v=velocity of sound)

A. $\frac{14}{15}f$

B. $\frac{14}{9}f$

C. $\frac{10}{9}f$

D. $\frac{2}{3}f$

Answer: c

Watch Video Solution

19. A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance 1.21Å between them. The wavelength of the standing wave is

A. $1.21Å$

B. $1.42Å$

C. $6.05Å$

D. $3.63 Å$

Answer: a

Watch Video Solution

20. A note has a frequency 128 Hz. The frequency of a note two octaves higher than it is

A. 256 Hz

B. 64 Hz

C. 32 Hz

D. 512 Hz

Answer: d

Watch Video Solution

21. At a certain instant a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is

A. sinusoidal shape with amplitude $\frac{A}{3}$

B. sinusoidal shape with amplitude $\frac{A}{2}$

C. sinusoidal shape with amplitude A

D. straight line

Answer: a

Watch Video Solution

22. If the length of an open organ pipe is 33.3 cm, then

the frequency of fifth overtone is $\left(v_{sound} = 333ms^{-1}\right)$

A. 3000 Hz

B. 1500 Hz

C. 2500 Hz

D. 1250 Hz

Answer: a

Watch Video Solution

23. The harmonics which are present in a pipe open at one end are

A. odd harmonics

B. even harmonics

C. even as well as odd harmonics

D. None of the above

Answer: a

Watch Video Solution

24. In Melde,s experiment, the string vibrates in 6 loops

when a 30 g weight is placed in the pan of weight 10 g.

To make the string to vibrates in 8 loops the 10 g. mass that has to be removed form the pan is

A. 20 g

B. 40 g

C. 22.5 g

D. 17.5 g

Answer: d

View Text Solution

25. The frequency of tuning fork is 256 Hz. It will not resonate with a fork of frequency

A. 768 Hz

B. 738 Hz

C. 512 Hz

D. 256 Hz

Answer: b

Watch Video Solution

26. Ten tuning forks are arranged in increasing order of frequency is such a way that any two nearest tuning forks produce $4be * /\sec.$ The highest freqeuncy is twice of the lowest. Possible highest and the lowest frequencies are

A. 144

B. 36, 72

C. 18, 36

D. 9, 18

Answer: b

Watch Video Solution

27. A tuning fork makes 256 vibrations per second in air. When the speed of sound is $330 m/s$, the wavelength of the note emitted is :

A. 1.29 m

B. 2.1 m

C. 0.5 m

D. 0.9 m

Answer: a

Watch Video Solution

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

A. $3:8$

B. $3:4$

C. $3:2$

D. $3:1$

Answer: a

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