DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 10

Topic :-WAVES

1 **(c)**

For an organ pipe open at one end,

Frequency of 1st overtone $n_1 = \frac{3v}{4l_1}$

For the organ pipe open at both ends,

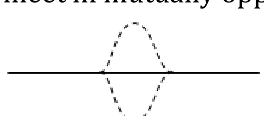
Frequency of 3rd harmonic,$n_2 = \frac{3v}{2l_2}$

As $n_1 = n_2$

$$\therefore \frac{3v}{4l_1} = \frac{3v}{2l_2} \; or \, \frac{l_1}{l_2} = \frac{2}{4} = \frac{1}{2}$$

2 **(c)**

After two seconds each wave travel a distance of $2.5 \times 2 = 5 \; cm \; i.e.$ the two pulses will meet in mutually opposite phase and hence the amplitude of resultant will be zero.



3 **(b)**

$$\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} \Rightarrow \frac{I_1}{I_2} = \frac{25}{100} = \frac{1}{4}$$

4 **(a)**

Frequency

$$v = \frac{1}{2l}\sqrt{\left(\frac{T}{m}\right)}$$

$$\therefore v+\frac{3}{2}=\frac{1}{2l}\sqrt{\left(\frac{101\,T}{100\,m}\right)}$$

$$=1.005\times\frac{1}{2l}\sqrt{\left(\frac{T}{m}\right)}$$

$\Longrightarrow$ v+1.5=1.005v

$\Longrightarrow$ v=300 Hz

5 **(c)**

Reverberation time, $T=\frac{0.61V}{aS}$

$$\Rightarrow\frac{T_1}{T_2}=\left(\frac{V_1}{V_2}\right)\left(\frac{S_2}{S_1}\right)=\left(\frac{V}{8V}\right)\left(\frac{4S}{S}\right)=\frac{1}{2}$$

$\Rightarrow T_2=2T_1=2\times1=2$ sec. $[\because T_1=1$ sec$]$

6 **(b)**

As $\frac{v}{4l_1}=\frac{3v}{2l_2}$

$$\therefore\ \frac{l_1}{l_2}=\frac{2}{12}=\frac{1}{6}$$

7 **(d)**

It is known that Doppler's effect depends on velocity not on distance. When the source is approaching the stationary observer, the apparent frequency heard by the observer is

$$n'=\frac{v\times n}{v-v_s}=\text{constant}$$

But $n'>n$.

When the source has crossed the observer, apparent frequency heard by the observer is

$$n''=\frac{v\times n}{v+v_s}=\text{another constant}$$

But $n''<n$.option (d) is correct.

8 **(b)**

Sound geard directly

$$v_1=v_o\left(\frac{v}{v-v_s}\right)$$

$$\therefore 970=1000\left(\frac{330}{330+v_s}\right)$$

Or $v_s=10.2ms^{-1}$

The frequency of reflected sound is given by

$$v_2 = v_o\left(\frac{v}{v - v_s}\right) = 1000\left(\frac{330}{330 - 10.2}\right)$$

$$= \frac{1000 \times 330}{319.8} \approx 1032Hz$$

9 **(c)**

A pulse of a wave train when travels along a stretched string and reaches the fixed end of the string, then it will be reflected back to the same medium and the reflected ray suffers a phase change of π with the incident wave but wave velocity after reflection does not change.

10 **(a)**

Given, y(x,t)=0.005 cos (ax-βt)

$$\frac{2\pi}{\lambda} = a \quad and\, \frac{2\pi}{T} = \beta$$

So,

$$a = \frac{2\pi}{0.08} = 25\pi \quad and\ \beta = \frac{2\pi}{2} = \pi$$

11 **(a)**

Length of air column in resonance is odd integer multiple of

$$\frac{\lambda}{4}$$

And prongs of tuning fork are kept in a vertical plane.

12 **(b)**

As $p\sqrt{T}$ = constant $\therefore\ \frac{T_2}{T_1} = \frac{p_1^2}{p_2^2} = \frac{4^2}{6^2}$

$$T_2 = \frac{16}{36}T_1 = \frac{16}{36} \times 65 = 29$$

$\therefore$ Weight to be removed $= 65 - 29 = 36$ g

13 **(c)**

The amplitude of a plane progressive wave=a, that of a cylindrical progressive wave is $a/\sqrt{r}$.

14 **(a)**

The average power per unit area that is incident perpendicular to the direction of propagation is called the intensity, i.e.,

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

Or

$$I \propto \frac{I}{r^2}$$

Or

$$\frac{I_2}{I_2} = \left(\frac{r_2}{r_1}\right)^2$$

Here, $r_1 = 2m, r_2 = 3m$

$\therefore \frac{I_1}{I_2} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$

15 **(a)**

Wavelength of closed organ pipe is

$\lambda = \frac{4L}{(2n-1)}$

Putting n=1,2,3,….. we find that

$\lambda_1 = 4L, \frac{4L}{3}, \frac{4L}{5}, ...$

So frequency of vibration corresponding to modes n=1,2,3…is

$v_1 = \frac{v}{\lambda_1} = \frac{v}{4L} = v_1$

$v_2 = \frac{v}{\lambda_2} = \frac{v}{4L/3} = \frac{3v}{4L} = 3v_1$

$v_2 = \frac{v}{\lambda_3} = \frac{v}{4L/5} = \frac{5v}{4L} = 5v_1$

$\therefore \quad v_1 L v_2 : v_3 \ldots . = 1:3:5: ....$

So, only odd harmonics are present.

16 **(c)**

The standard equation of wave is

Y=a sin (ωt-kx)

Where a is amplitude, ω the angular velocity and x the displacement at instant t.

Given equation is

Y=0.1sin (100πt-kx)

Comparing Eq. (i) with Eq. (ii), we get

$\therefore$ Wave number $= \frac{\omega}{v} = \frac{100\pi}{100} = \pi m^{-1}$

17 **(a)**

The velocity of wave

$v = \frac{\omega(\text{Co} - \text{efficient of } t)}{k(\text{Co} - \text{efficient of } x)} = \frac{10}{1} = 10\ m/s$

18 **(a)**

Speed of wave on a string

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

Or

$v \propto \sqrt{T}$

Or

$$\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}}$$

Or

$$T - \frac{2}{T_1} = \frac{v_2^2}{v_1^2}$$

Or

$$\frac{T_2 - T_1}{T_1} = \frac{v_2^2 - v_1^2}{v_1^2}$$

Initially, $T_1 = 120\ N$,

$v_1 = 150 ms^{-1}$

$$v_2 = v_1 + \frac{20}{100} v_1$$

$$= v_1 + \frac{v_1}{5} = \frac{6v_1}{5}$$

$$= \frac{6}{5} \times 150 = 180 ms^{-1}$$

So, from eq. (i), we get

$$\frac{T_2 - T_1}{T_1} = \frac{(180)^2 - (150)^2}{(150)^2}$$

$$= \frac{30 \times 330}{150 \times 150} = 0.44$$

Hence, % increases in tension

$$= \left(\frac{T_2 - T_1}{T_1}\right) \times 100 = 0.44 \times 100 = 44\%$$

20 **(c)**

$$n \propto \sqrt{T} \Rightarrow \frac{\Delta n}{n} = \frac{\Delta T}{2T}$$

If tension increases by 2%, then frequency must increases by 1%.

If initial frequency $n_1 = n$ then final frequency $n_2 - n_1 = 5$

$$\Rightarrow \frac{101}{100} n - n = 5 \Rightarrow n = 500 Hz$$

Short trick : If you can remember then apply following formula to solve such type of problems.

Initial frequency of each wire (n)

$$= \frac{(\text{Number of beats heard per sec}) \times 200}{(\text{per centage change in tension of the wire})}$$

Here $n = \frac{5 \times 200}{2} = 500 Hz$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	C	B	A	C	B	D	B	C	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	B	C	A	A	C	A	A	C	C