DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 5

Topic :-WAVES

1 **(a)**

Loudness, $L = 10 \log_{10} \frac{I}{I_0}$

$60 = 10 \log_{10} \frac{I_1}{I_0}$

$\Rightarrow \frac{I_1}{I_0} = 10^6 \quad ...(i)$

$similarly, \quad 30 = 10\ lig_{10} \frac{I_2}{I_0}$

$\frac{I_2}{I_0} = 10^3 \quad ...(ii)$

Dividing Eq. (i) by Eq. (ii), we get

$\frac{I_1}{I_2} = 1000$

2 **(a)**

Path difference for a given phase difference δ is given by

$\Delta x = \frac{\lambda}{2\pi}\delta$

Given that $\delta = 60° = \frac{\pi}{3}$

$\Delta x = \frac{\lambda}{2\pi} \times \frac{\pi}{3} \therefore \Delta x = \frac{\lambda}{6}$

3 **(a)**

Velocity of propagation

$x = \frac{\text{Coefficient of t}}{\text{coefficient of x}} = \frac{2\pi\ /0.01}{2\pi/0.3} = 30ms^{-1}$

4 **(b)**

If $\rho_H = 1$, then $\rho_{mix} = \frac{4\times1+1\times16}{(4+1)} = 4$

$$\frac{v_{mix}}{v_H} = \sqrt{\frac{\rho_H}{\rho_{mix}}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

$$v_{mix} = \frac{v_H}{2} = \frac{1224}{2} = 612\text{ms}^{-1}$$

6 **(b)**

$$\text{Frequency} = \frac{\text{velocity}}{\text{Wavelength}}$$

$$\therefore f_1 = \frac{v}{\lambda_1} = \frac{330}{5} = 66Hz$$

And $f_2 = \frac{v}{\lambda_2} = \frac{330}{5.5} = 60Hz$

Number of beats per second

$= f_1 - f_2 = 66 - 60 = 6$

7 **(d)**

Given,

Progressive wave y=a sin (kx-ωt)

When reflected by right wall

Progressive wave y'= a sin [k(-x)-wt)]

Or y' = a sin [-(kx+ωt)]

Or y' = a sin (kx+ωt)

9 **(b)**

For hearing beats, difference of frequencies should be less than 10 Hz

10 **(b)**

In close organ pipe

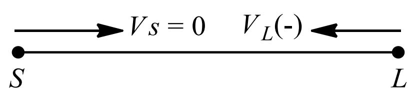
$$v = \frac{v}{4l}$$

So,

$$l = \frac{v}{4v}$$

11 **(a)**

Here, $v_s = 0$ and v_L is negative where $v_s$is velocity of source and $v_L$is velocity of listener (aeroplane)



If apparent frequency is v' and v is actual frequency, then

$$v' = \frac{v - (-v_L)}{v} v = \frac{v + v_L}{v} L$$

$i.e.$, v'>v

So, apparent frequency will increase, it means apparent wavelength will decrease.

12 **(b)**

As is clear from figure of question

$$l=\frac{\lambda_p}{4}, \lambda=4l, n_p=\frac{v}{\lambda_p}=\frac{v}{4l}$$

$$l=\frac{\lambda_q}{2}, \lambda_q=2l, n_q=\frac{v}{\lambda_q}=\frac{v}{2l}$$

$$l=\lambda_r, \lambda_r=l, n_r=\frac{v}{\lambda_r}=\frac{v}{l}$$

$$l=\frac{3\lambda_s}{4}, \lambda_s=\frac{4l}{3}, n_s=\frac{v}{\lambda_s}=\frac{3v}{4l}$$

$$\therefore n_p:n_q:n_r:n_s=\frac{v}{4l}:\frac{v}{2l}:\frac{v}{l}:\frac{3v}{4l}=1:2:3:4$$

13 **(b)**

At t=0 and t=2s, the shape of y-x graphs are same.

14 **(d)**

$$Y=10\sin\left[\frac{2\pi}{45}t+a\right]$$

If t=0, y=5 cm

5=10(sin a)

$$\sin a=\frac{1}{2}$$

$$a=\frac{\pi}{6}$$

If t=7.5 g

Then total phase =

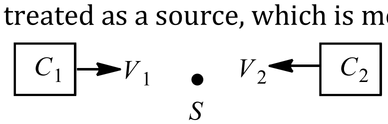
$$\frac{2\pi}{45}\times\frac{15}{2}+\frac{\pi}{6}=\frac{\pi}{3}+\frac{\pi}{6}=\frac{\pi}{2}$$

15 **(a)**

$$n=\frac{v}{\lambda}\propto v \Rightarrow \frac{n_{MW}}{n_{US}}\approx\frac{3\times10^8}{3\times10^2}\approx10^6:1$$

16 **(a)**

Firstly, car will be treated as an observer which is approaching the source. Then, it will be treated as a source, which is moving in the direction of sound.



Hence,

$$f_1=f_o\left(\frac{v+v_1}{v-v_1}\right)$$

$$f_2=f_o\left(\frac{v+v_2}{v-v_2}\right)$$

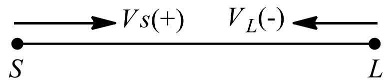
$$\therefore \; f_1 - f_2 = \left(\frac{1.2}{100}\right) f_o$$
$$= f_o \left[\frac{v+v}{v+v_1} - \frac{v+v_2}{v-v_2}\right]$$
Or
$$\left(\frac{1.2}{100}\right) f_o = \frac{2v(v_1 - v_2)}{(v-v_1)(v-v_2)}, f_o$$
$as\ v_1 and\ v_2$ Are very very less than v.
We can write, $(v - v_1) or\ (v - v_2) \approx v$.
$$\therefore \left(\frac{1.2}{100}\right) f_o = \frac{2(v_1 - v_2)}{v} f_o$$
$$Or\ \ (v_1 - v_2) = \frac{v \times 1.2}{200}$$
$$= \frac{300 \times 1.2}{200} = 1.98 ms^{-1}$$
=7.128km$\boldsymbol{h}^{-1}$
∴ the nearest integer is 7.

17 **(a)**
$y = y_1 + \ y_2 = a\sin(\omega t - kx) = a\sin(\omega t - kx)$
$y = 2a\sin\omega t\cos kx$
Clearly it is equation of standing wave for position of nodes y=0.
$$i.e., x = (2n+1)\frac{\lambda}{4}$$
$$\Rightarrow \left(n + \frac{1}{2}\right)\lambda = 0,1,2,3$$

18 **(b)**
In case of interference of two waves resultant intensity
$I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$
If ϕ varies randomly with time, so $(\cos\phi)_{av} = 0$
$\Rightarrow I = I_1 + I_2$
For n identical waves, $I = I_0 + I_0 + \ \ldots. = nI_0$
Here $I = 10I_0$

19 **(a)**
According to Doppler's effect, whenever there is a relative motion between a source of sound and listener, the apparent frequency of sound heard by the listener is different from the actual frequency of sound emitted by the source. Let S be source of sound and L the listener of sound. Let v be the actual frequency of sound emitted by the source and λbe the actual wavelength of the sound emitted.
If v is velocity of sound in still air, then
$$\lambda = \frac{v}{V}$$
If velocity of listener is $v_L$and velocity of source is v_s, then apparent frequency of sound waves heard by the listener is
$$v' = \frac{v - v_L}{v - s_s} \times V$$

Here, both source and listener are approaching each other.



Then v_s is positive and v_L is negative.

$$\therefore v' = \frac{v - (-v_L)}{v - v_s} v = \left(\frac{v + v_L}{v - v_s}\right) v$$

$i.e., \quad v' > v$

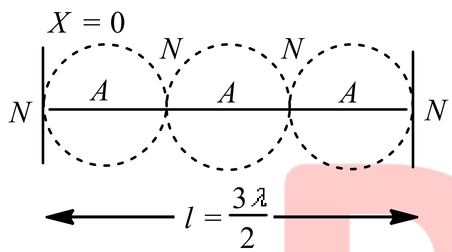
Also,

$\lambda' < \lambda$

So, listener listens more frequency and observes less wavelength.

20 **(c)**

Third mode of vibration or second overtone has three loops.



It consist of 4 nodes and 3 antinodes.

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