DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 6

Topic :-WAVES

1 **(a)**

$y(x,t) = e^{-(ax^2+bt^2+2\sqrt{ab}tx)}$

$= e^{-(\sqrt{a}x+\sqrt{b}t)^2}$

It is a function of type

∴ y(x,t) represents wave travelling along –x direction.

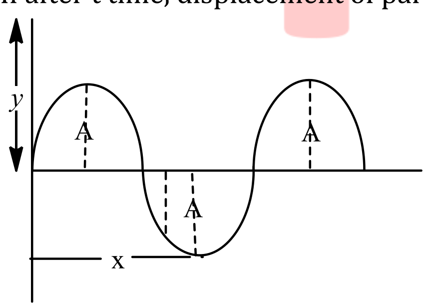
$Speed\ of\ wave\ = \frac{\omega}{k} = \frac{\sqrt{b}}{\sqrt{a}} = \sqrt{\frac{b}{a}}$

2 **(c)**

Total energy is conserved

3 **(c)**

If after t time, displacement of particle is y, then the rquation of progressive wave



Y=A cos (ax+bt)

4 **(a)**

$y = 5\ \sin\frac{\pi}{2}(100t - x)$

$y = 5\ \sin\left(\frac{100\pi}{2}t - \frac{\pi}{2}x\right)$

$y = 5\ \sin\left(50\pi t - \frac{\pi}{2}x\right)$

The general equation

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

$\therefore \omega = 50\pi$

$T = \frac{2\pi}{\omega} = \frac{2\pi}{50\pi} = \frac{1}{25}$

Or $T = 0.04$ s

5 **(a)**

$n \propto \frac{1}{l} \Rightarrow n_1 l_1 = n_2 l_2 \Rightarrow (n+4)49 = (n-4)50 \Rightarrow n = 396$

6 **(d)**

Beats are the periodic and repeating function heard in the intensity of sound when two sound waves of very similar frequency interface with one another.

8 **(a)**

No of beats, $x = \Delta n = \frac{30}{3} = 10\ Hz$

$\Rightarrow$ Also $\Delta n = v\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right] = v\left[\frac{1}{5} - \frac{1}{6}\right] = 10 \Rightarrow v = 300\ m/s$

9 **(c)**

Relation of path difference and phase difference is given by

$\Delta\Phi = \frac{2\pi}{\gamma} \times \Delta x$

Where Δx is path difference.

But path difference between two crests Δx=λ

Hence, $\Delta\Phi = \frac{2\pi}{\lambda} \times \lambda = 2\pi$

10 **(c)**

Here, $v = 330\ \text{ms}^{-1}$

Phase difference of $1.6\pi = 40$ cm

Phase difference of $2\pi = \frac{40}{1.6\pi} \times 2\pi$ cm $= 50$ cm

ie, $\lambda = 50$ cm $= 0.5$ cm

$n = \frac{v}{\lambda} = \frac{330}{0.5} = 660$ Hz

11 **(d)**

Speed of sound $v \propto \sqrt{T}$ and it is independent of pressure

12 **(b)**

Position of first node=16cm

$\frac{\lambda}{2} + e = 16cm$

Where e =end correction

Position of second node=46cm

$$\frac{\lambda}{2}+\frac{\lambda}{2}+e=46cm$$

Dividing Eq. (ii) by Eq.(i)

$$\frac{\lambda}{2}=30\ cm$$

$$\lambda=60\ cm=\frac{60}{100}m$$

∴ speed of sound v=vλ

$$=500\times\frac{60}{100}=300ms^{-1}$$

13 **(b)**

Using $n=\frac{1}{2l}\sqrt{\frac{T}{m}}$

Number of beats $=\frac{1}{2}\sqrt{\frac{T}{m}}\left[\frac{1}{l_2}-\frac{1}{l_1}\right]$

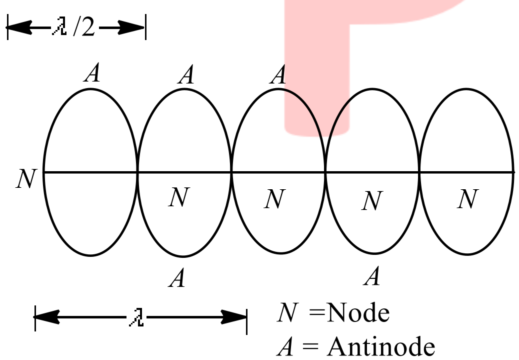
$$=\frac{1}{2}\sqrt{\frac{20}{1\times10^{-3}}}\left[\frac{1}{49.1\times10^{-2}}-\frac{1}{51.6\times10^{-2}}\right]=7$$

14 **(d)**

By using $n'=n\frac{v}{v-v_S}\Rightarrow\frac{n'}{n}=\left(\frac{V}{V-S}\right)$

17 **(d)**

The nodes and antinodes are formed in a standing wave pattern as a result of the interface of two waves. Distance between two nodes is half wavelength (λ)



Standerd equation of standing wave is

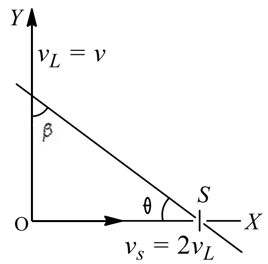
$$y=2_a\sin\frac{2\pi x}{\gamma}\cos\frac{2\pi vt}{\gamma}$$

Where a is amplitude, the wavwlength

18 **(b)**

Let speed of observer be $v_L=v$ along Y-axis and speed of source the $v_s=2v_L=2v$ along X-axis

$\therefore PS=2(OL)$



$\cos\alpha = \frac{2}{\sqrt{5}}$ *and* $\cos\beta = \frac{2}{\sqrt{5}}$

Now , apparent frequency n' is given by

$$n' = \frac{(v - v_L\cos\beta)n}{(v + v_L\cos\alpha)}$$

Where v is velocity of sound.

$$n' = \frac{(v - v\sqrt{5})n}{(v + 4v\sqrt{5})}$$

Clearly, n' is constant, but $n' < n$. This is shown in curve (b).

19 **(c)**

Frequency of sonometer wire is given by

$$v = \frac{1}{2l}\sqrt{\frac{T}{m}} = \frac{1}{2l}\sqrt{\frac{T}{\pi r^2 p}}$$

$$v_1 = \frac{1}{2l_1}\sqrt{\frac{T_1}{\pi r_1^2 \rho_1}}$$

$$v_2 = \frac{1}{2l_2}\sqrt{\frac{T_2}{\pi r_2^2 \rho_2}}$$

$$\therefore \frac{v_1}{v_2} = \frac{l_2}{l_1}\sqrt{\frac{T_1}{T_2} \times \frac{r_2^2}{r_1^2} \times \frac{\rho_2}{\rho_1}}$$

$$\frac{v_1}{v_2} = \frac{35}{36}\sqrt{\frac{8}{1} \times \frac{1}{16} \times \frac{2}{1}}$$

$\because \mathrm{v}_1 < \mathrm{v}_2$ and $\mathrm{v}_2 = 360\mathrm{Hz}$

Therefore,

$$v = 360 \times \frac{35}{36}$$

v_1=350 Hz

So, number of beats produced $= v_1 - v_2$

=360-350=10

20 **(b)**

$$v = \frac{\text{Co} - \text{efficient of } t}{\text{Co} - \text{efficient } of\ x} = \frac{1/2}{1/4} = 2m/s$$

Hence $d = vt = 2 \times 8 = 16m$

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