DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 3

Topic :-WAVES

1 **(b)**

Here $\rho_1 = \rho_2; \frac{r_1}{r_2} = \frac{1}{2}, T_1 = T_2$

$$n_1 = \frac{1}{2lr_1}\sqrt{\frac{T_1}{\pi\rho_1}}; n_2 = \frac{1}{2lr_2}\sqrt{\frac{T_2}{\pi\rho_2}}$$

$$\frac{n_1}{n_2} = \frac{r_2}{r_1} = 2$$

2 **(a)**

Velocity of wave (v)=360 m/s

Frequency, n= 600Hz

Phase difference, $\Delta\Phi = 60o$

If the minimum distance between two points is Δx, then

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

$$\Delta \mathrm{x} = \frac{\mathrm{v}}{2\pi \mathrm{n}} \times \Delta\Phi$$

Or

$$\Delta \mathrm{x} = \frac{360}{2\pi \times 600} \times 60$$

$$\Delta \mathrm{x} = \frac{360}{2\pi \times 600} \times \frac{\pi}{3}$$

$$\Delta \mathrm{x} = \frac{1}{10}\mathrm{m}$$

$$\Delta \mathrm{x} = 10 \text{ cm}$$

3 **(c)**

Intensity ∝ $(\text{amplitude})^2$

As $A_{\max} = 2a_o (a_o = \text{amplitude of one source})$ so $I_{\max} = 4I_o$

4 **(b)**

EM waves do not require medium for their propagation

5 **(b)**

Velocity of sound increases if the temperature increases. So with $v = n\lambda$, if v increases n

will increase

At 27°C, $v_1 = n\lambda$, at 31°C, $v_2 = (n+x)\lambda$

Now using $v \propto \sqrt{T}$ $\left[\because v = \sqrt{\frac{\gamma RT}{M}}\right]$

$$\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = \frac{n+x}{n}$$

$$\Rightarrow \frac{300+x}{300} = \sqrt{\frac{(273+31)}{(273+27)}} = \sqrt{\frac{304}{300}} = \sqrt{\frac{300+4}{300}}$$

$$\Rightarrow 1 + \frac{x}{300} = \left(1 + \frac{4}{300}\right)^{1/2} = \left(1 + \frac{1}{2} \times \frac{4}{300}\right) \Rightarrow x = 2$$

$[\because (1+x)^n = 1 + nx]$

6 **(c)**

We know that intensity $I \propto a^2$, where a is amplitude of the wave. The maximum amplitude is the sum of two amplitudes i.e., $(a + a = 2a)$

Hence, maximum intensity $\propto 4\,a^2$

Therefore the required ratio $i.e.$, ratio of maximum intensity (loudness) and intensity (loudness)of one wave is given by n,

$$n = \frac{4a^2}{a^2} = 4$$

7 **(b)**

As given,

$$y = 10^{-6} \sin\left(100t + 20x + \frac{\pi}{4}\right) \quad \dots \text{(i)}$$

Comparing it with

$$y = a\sin(\omega t + kx + \phi) \quad \dots \text{(ii)}$$

We find,

$\omega = 100\, rads^{-1}, k = 20/m$

$$\therefore \quad v = \frac{\omega}{k} = \frac{100}{20} = 5ms^{-1}$$

8 **(d)**

As source is moving towards observer,

$$\therefore v' = \frac{uv}{u - v_1} = \frac{333 \times 450}{333 - 30} = 499.5 = 500$$

9 **(b)**

When the piston is moved through a distance of 8.75cm, the path difference produced is $2 \times 8.75cm = 17.5cm$.

This must be equal to $\frac{\lambda}{2}$ for maximum to change to minimum.

$$\therefore \frac{\lambda}{2} = 17.5\ cm \Rightarrow \lambda = 35cm = 0.35m$$

So, $v = n\lambda \Rightarrow n = \frac{v}{\lambda} = \frac{350}{0.35} = 1000Hz$

10 **(b)**

$n_1 l_1 = n_2 l_2 \Rightarrow 250 \times 0.6 = n_2 \times 0.4 \Rightarrow n_2 = 375Hz$

11 **(b)**

$$v = \sqrt{\frac{T}{m}} = \sqrt{\frac{T}{\pi r^2 \rho}}$$

$$v \propto \frac{\sqrt{T}}{r} \Rightarrow \frac{v_A}{v_B} = \sqrt{\frac{T_A}{T_B}}.\frac{r_B}{r_A} = \sqrt{\frac{1}{2}}.\frac{1}{2} = \frac{1}{2\sqrt{2}}$$

12 **(b)**

Phase difference $= \frac{2\pi}{\lambda} \times$ path difference

$$\Rightarrow \frac{\pi}{2} = \frac{2\pi}{\pi} \times 0.8 \Rightarrow \lambda = 4 \times 0.8 = 3.2m$$

Velocity $v = n\lambda = 120 \times 3.2 = 384\ m/s$

13 **(a)**

Since there is no relative motion between the source and listener, so apparent frequency equals original frequency

14 **(c)**

Since there is no relative motion between the listener and source, hence actual frequency will be heard by listener

16 **(a)**

$l_1 + x = \frac{\lambda}{4} = 22.7;$

$l_2 + x = \frac{3\lambda}{4} = 70.2; \ l_3 + x = \frac{5\lambda}{4}$

$$x = \frac{l_2 - 3l_1}{2} = \frac{70.2 - 68.1}{2} = \frac{2.1}{2} = 1.05 \text{ cm}$$

$$\frac{l_3 + x}{l_1 + x} = 5$$

$$l_3 = 5l_1 + 4x = 5 \times 22.7 + 4 \times 1.05 = 117.7 \text{ cm}$$

17 **(b)**

$$\therefore \frac{v}{v_c} = \frac{c/2\lambda}{v/4\lambda} = \frac{2}{1}$$

18 **(c)**

Comparing with $y = a\cos(\omega t + kx - \phi)$,

We get $k = \frac{2\pi}{\lambda} = 0.02\pi \Rightarrow \lambda = 100\ cm$

Also, it is given that phase difference between particles $\Delta\phi = \frac{\pi}{2}$. Hence path difference between them

$$\Delta = \frac{\lambda}{2\pi} \times \Delta\phi = \frac{\lambda}{2\pi} \times \frac{\pi}{2} = \frac{\lambda}{4} = \frac{100}{4} = 25\ cm$$

19 **(d)**

Beat frequency of heart $= 1.25\ Hz$

$\therefore$ Number of beats in 1 minute $= 1.25 \times 60 = 75$

20 **(a)**

$n_A = ?, n_B =$ Known frequency $= 320\ Hz$

$x = 4\ bps$, which remains same after filing.

Unknown fork A if filed so $n_A \uparrow$

Hence $n_A \uparrow - n_B = x \ \rightarrow$ Wrong

$n_B - n_A \uparrow = x \ \rightarrow$ Correct

$\Rightarrow\ n_A = n_B - x = 320 - 4 = 316\ Hz.$

This is the frequency before filing.

But in question after filing is asked which must be greater than 316 Hz, such that it produces 4 *beats per sec*. Hence it is 324 Hz

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