# DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

**Solutions**

SUBJECT : PHYSICS
DPP NO. : 8

## Topic :-WAVES

1 **(d)**

Compare the given equation with

$y = a\sin(\omega t + kx) \Rightarrow \omega = 2\pi n = 100 \Rightarrow n = \frac{50}{\pi}Hz$

$k = \frac{2\pi}{\lambda} = 1 \Rightarrow \lambda = 2\pi$ and $v = \omega/k = 100\ m/s$

Since $'+'$ is given between $t$ terms and $x$ term, so wave is travelling in negatie $x$-direction

3 **(d)**

Frequency $f = \frac{1}{2L}\sqrt{\frac{T}{M}} = \frac{1}{2L}\sqrt{\frac{T}{\pi r^2(1)\rho}}$

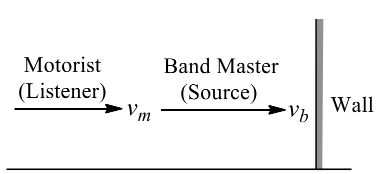
$= \frac{1}{2rL}\sqrt{\frac{T}{\pi\rho}} \Rightarrow \frac{f_1}{f_2} = \left(\frac{r_2}{r_1}\right)\left(\frac{L_2}{L_1}\right) \Rightarrow \frac{1}{2} = \left(\frac{r_2}{r_1}\right)\left(\frac{4}{1}\right)$

$\Rightarrow \frac{r_2}{r_1} = \frac{1}{8} \Rightarrow \frac{r_1}{r_2} = \frac{8}{1}$

4 **(c)**

The motorist receives two sound waves, direct one from the band and that reflected from the wall, figure. For direct sound waves, apparent frequency

$f' = \frac{(v + v_m)f}{v + v_b}$




For reflected sound waves.

Frequency of sound wave reflected from the wall

$$f'' = \frac{v \times f}{v - v_b}$$

Frequency of reflected waves as received by the moving motorist,

$$f' = \frac{(v + v_m)f''}{v} = \frac{(v + v_m)f}{v - v_b}$$

$\therefore$ Beat frequency $= f'' - f'$

$$= \frac{(v + v_m)f}{v - v_b} - \frac{(v + v_m)f}{v + v_b} = \frac{2v_b(v + v_m)f}{v^2 - v_b^2}$$

5 **(c)**

For closed pipe in general $n = \frac{v}{4l}(2N - 1) \Rightarrow n \propto \frac{1}{l}$

i.e. if length of air column decreases frequency increases

6 **(b)**

For infrasonics, frequency $n < 20\ \text{cms}^{-1}$

$$\lambda = \frac{u}{n} > \frac{330}{20} = 15\text{m} = 10^1\text{m}$$

7 **(a)**

Assin$(90 \pm \theta = \cos\theta)$, therefore, phase difference between the two waves is $90°\ or\ \frac{\pi}{2}$.

8 **(b)**

$$n' = n\left(\frac{v}{v - v_S}\right) = 600\left(\frac{330}{300}\right) = 660\ cps$$

9 **(c)**

Octave stands for an interval 2: 1. Therefore octaves will have a frequency ratio $= 2^3 = 8$.

10 **(c)**

$$\frac{I_{\max}}{I_{\min}} = \left(\frac{\frac{a_1}{a_2} + 1}{\frac{a_1}{a_2} - 1}\right)^2 = \left(\frac{\frac{4}{3} + 1}{\frac{4}{3} - 1}\right)^2 = \frac{49}{1}$$

11 **(b)**

$$n' = n\left(\frac{v - v_O}{v + v_S}\right) = n\left(\frac{340 - 10}{340 + 10}\right) = 1950$$

$\Rightarrow n = 2068\ Hz$

12 **(d)**

Comparing the given equation with standard equation

$y = a \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) \Rightarrow T = 0.04sec \Rightarrow v = \frac{1}{T} = 25Hz$

Also $(A)_{\max} = \omega^2 a = \left(\frac{2\pi}{T}\right)^2 \times a = \left(\frac{2\pi}{0.04}\right) \times 3$

$= 7.4 \times 10^4 cm/sec^2$

13 **(c)**

In our case both source and observer are moving, so perceived frequency

$v' = \frac{v(c - v_o)}{(c - v_s)}$

Where $v_o$ is the velocity of observer, $v_s$ is the velocity of source and c is velocity of sound.

Given,

$v_o = -2v, v_s = -v$

$\therefore v' = \frac{v(c + 2v)}{(c + v)}$

14 **(d)**

Given,

$y = 5 \sin\left(30\pi t - \frac{\pi}{7}x + 30°\right) \dots \text{(i)}$

Now,

$y = a \sin\left(\frac{2\pi t}{T} - \frac{2\pi x}{\lambda} + \phi\right) \dots \text{(ii)}$

On comparing Eqs. (i) and (ii)

$\frac{2\pi x}{\lambda} = \frac{\pi x}{7}$

$\Longrightarrow \quad \lambda = 14m$

We know that relation between phase difference and path difference

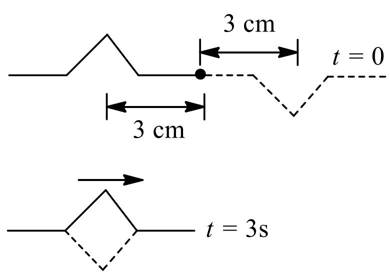
$\Delta\phi = \frac{2\pi}{\lambda} \times \Delta x = \frac{2\pi}{14} \times 3.5$

$\Longrightarrow \Delta\phi = \frac{\pi}{2}$

15 **(a)**

When O is a fixed end, the formation of reflected pulse is equivalent to overlapping of two inverted pulses travelling in opposite direction as shown in figure.

Here at $t = 3$ s, net displacement of all particles of the string will be zero ie the string will be straight as shown in figure.



Choice (a) is correct.

16 **(b)**

If $d$ is the distance between man and reflecting surface of sound then for hearing echo

$$2d = v \times t \Rightarrow d = \frac{330 \times 1.5}{2} = 247.5\ m$$

17 **(a)**

Fundamental frequency of cylindrical open tube

$$\mathrm{n} = \frac{\mathrm{v}}{2\mathrm{L}} = 390\ \mathrm{Hz}$$

When it is immersed in water it become a closed tube of length

$\frac{3}{4}^{\text{th}}$ of the initial length.

Therefore, its fundamental frequency is

$$\mathrm{n}' = \frac{\mathrm{v}}{4\left(\frac{3}{4}\mathrm{L}\right)} = \frac{\mathrm{v}}{3\mathrm{L}} = \frac{2}{3}\left(\frac{\mathrm{v}}{2\mathrm{L}}\right)$$

$$= \frac{2}{3} \times 390\mathrm{Hz} = 260\mathrm{Hz}$$

18 **(a)**

Time required for a point to move from maximum displacement to zero displacement is

$$t = \frac{T}{4} = \frac{1}{4n}$$

$$\Rightarrow n = \frac{1}{4t} = \frac{1}{4 \times 0.170} = 1.47\ Hz$$

19 **(b)**

From Doppler's effect, perceived frequency is

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

$$v_s = 72kmh^{-1} = \frac{72 \times 1000}{60 \times 60} = 20ms^{-1}$$

$$v_o = 0, v = 332\ ms^{-1}, v' = 260\ Hz$$

$$260 = v\left(\frac{332}{332 - 20}\right)$$

$$\Longrightarrow v = \frac{260 \times 312}{332} = 244\ Hz$$

20 **(b)**

From the relation, $v_m = \sqrt{\frac{\gamma p}{\rho}}$

Where, p=pressure of the gas

P=density of the gas

Since, density of moist air is less than that of dry air

i.e., $\rho_m < \rho_d$

Therefore, $v_m > v_d$

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