DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH | **Solutions** | **SUBJECT : PHYSICS**

DATE : | | **DPP NO. : 4**

Topic :-WAVES

1 **(c)**

Let I_r and I_i represent the intensities of reflected and incident waves respectively, then

$$\frac{\mathrm{I_r}}{\mathrm{I_i}} = \left(\frac{\mu - 1}{\mu + 1}\right)^2$$

Where $\mu = \frac{\mathrm{v_1}}{\mathrm{v_2}}$

Or $\quad \mathrm{v} = \frac{\sqrt{\frac{T}{m_1}}}{\sqrt{\frac{T}{m_2}}} = \sqrt{\frac{m_2}{m_1}} = \sqrt{\frac{25}{9}} = \frac{5}{3}$

$$\therefore \frac{\mathrm{I_r}}{\mathrm{I_i}} = \left[\frac{\left(\frac{5}{3}\right) - 1}{\left(\frac{5}{3}\right) + 1}\right]^2 = \frac{1}{16}$$

2 **(d)**

For two coherent sources, $I_1 = I_2$

$$I_{\max} = (A_1 + A_2)^2 = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$$

This is given as I_0 for maximum and zero for minimum. If there are two noncoherent sources, there will be no maximum and minimum intensities. Instead of all the intensity I_0 at maximum and zero foe minimum, it will be just $I_0/2$

3 **(c)**

$$v_s = r\omega = r \times 2\pi v$$

$$= \frac{70}{100} \times 2 \times \frac{22}{7} \times 5 = 22ms^{-1}$$

Frequency is minimum when source is moving away from listener.

$$v' = \frac{u \times v}{u + u_s} = \frac{352 \times 1000}{352 + 22} = 941 \text{ Hz}$$

4. **(a)**

Since, train (source) is moving towards pedestrian (observer), the perceived frequency will be higher than the original.

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

Here, $v_o = o$(as observer is stationary)

$v_s = 25ms^{-1}$(velocity of source)

$v = 350\ ms^{-1}$ (velocity of sound)

And v=1kHz (original frequency)

Hence,

$$v^{'} = 1000\left(\frac{350+0}{350-25}\right)$$

$$= 1000 \times \frac{350}{325} = 1077\ Hz$$

5 **(c)**

The reflection sound appears to propagate in a direction opposite to that of moving engine. Thus, the source and the observer can be presumed to approach each other with same velocity.

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

$$= v\left(\frac{v+v_s}{v-v_s}\right) \qquad (\because v_o = v_s)$$

$$\Rightarrow v^{'} = 1.2\left(\frac{350+50}{350-50}\right)$$

$$= \frac{1.2 \times 400}{300} = 1.6\ kHz$$

6 **(a)**

Using relation v=vλ

Or

$$\lambda = \frac{v}{v} = \frac{340}{340} - 1m$$

If length of resonance columns are $l_1, l_2$and l_3, then

$l_1 = \frac{\lambda}{4} = \frac{1}{4}m = 25$ cm (for first resonance)

$l_2 = \frac{3\lambda}{4} = 75$cm (for second resonance)

$l_3 = \frac{5\lambda}{4} = 125$ cm for third resonance

This case of third resonance is impossible because total length of the tube is 120 cm

So, minimum height of water =120-75=45cm

8 **(b)**

As is known, frequency of vibration of a stretched string

$n \propto \sqrt{T} \propto \sqrt{mg} \propto \sqrt{g}$

As$n_\omega = \frac{80}{100} n_a = 0.8 n_a$

$\therefore \frac{g'}{g} = \left(\frac{n_\omega}{n_a}\right)^2 = (0.8)^2 = 0.64$

If ρ_ω = relative density of water(=1)

ρ_m =relative density of mass

ρ_r = relative density of liquid, then

$\frac{g'}{g} = \left(1 - \frac{\rho_\omega}{\rho_m}\right) = 0.64$

$\frac{\rho_\omega}{\rho_m} = 1 - 0.64 = .36$ (i)

Similarly, in the liquid

$\frac{g'}{g} = \left(\frac{n_L}{n_a}\right)^2 = (0.6)^2 = 0.36$

$\frac{g'}{g} = \left(1 - \frac{\rho_L}{\rho_m}\right) = 0.36$

$\frac{\rho_L}{\rho_m} = 1 - 0.36 = 0.64$ (ii)

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

$\frac{\rho_L}{\rho_m} = \frac{0.64}{0.34} = 1.77$

Hence specific gravity of liquid=1.77

9 **(a)**

The time taken by the stone to reach the lake

$t_1 = \sqrt{\left(\frac{2h}{g}\right)} = \sqrt{\left(\frac{2 \times 500}{10}\right)} = 10 \text{ sec}$ (Using $h = ut + \frac{1}{2} g t^2$)

Now time taken by sound from lake to the man

$t_2 = \frac{h}{v} = \frac{500}{340} \approx 1.5 \text{ sec}$

$\Rightarrow$ Total time $= t_1 + t_2 = 10 + 1.5 = 11.5$ sec

10 **(c)**

Let n be the actual frequency of sound of horn.

If v_s is velocity of car, then frequency of sound striking the cliff (source moving towards listener)

$$n' = \frac{(v+v_s)n'}{v} = \frac{(v+v_s)}{v} \times \frac{v \times n}{(v-v_s)}$$

Or $\frac{n'}{n} = \frac{v+v_s}{v-v_s} = 2$

$$v + v_s = 2v - 2v_s$$

$$3v_s = v, v_s = \frac{v}{3}$$

11 **(b)**

$$2\left(\frac{v_1}{2\iota_1}\right) = \frac{v_2}{4\iota_2}$$

$$\therefore \frac{\sqrt{T/\mu}}{\iota_1} = \frac{320}{4\iota_2}$$

(μ=mass per unit length of wire)

$$Or\ \frac{\sqrt{50/\mu}}{0.5} = \frac{320}{4 \times 0.8}$$

Solving we get μ=0.02 kg/m=20 g/m

∴ Mass of string=20 g/m ×0.5 m=10 g

12 **(a)**

In transverse waves medium particles vibrate perpendicular to the direction of propagation of wave

13 **(b)**

As v=nλ

$$\therefore \quad \lambda = \frac{v}{n} = \frac{300}{500} = \frac{3}{5} m$$

Now, phase difference

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

$$\therefore \quad 60° = \frac{2\pi}{\lambda} \times \text{path difference}$$

$$\text{or} \quad \frac{60° \times \pi}{180°} = \frac{2\pi \times 5}{3} \times \text{path difference}$$

$$\text{path difference} = \frac{3 \times 60 \times \pi}{2\pi \times 5 \times 180} = 0.1$$

14 **(b)**

Beat frequency=number of beats s^{-1}

$= n_1 - n_2$

And maximum loudness $= (a+a)^2 = 4a^2 = 4I_1 \; or \; 4I_2 = 4I$

15 **(d)**

speed $v = \frac{\omega}{k} = \frac{2\pi \times \lambda}{T \times 2\pi} = \frac{\lambda}{T}$

16 **(b)**

Let L is the original length of the wire and k is force constant of wire.

Final length = initial length + elongation

$L' = L + \frac{F}{k}$

For the condition

$a = L + \frac{4}{k} \qquad ...(i)$

For the second condition

$b = L + \frac{5}{k} \qquad ...(ii)$

By solving Eqs. (i) and (ii), we get

$L = 5a - 4b \; and \; k = \frac{1}{b-a}$

Now, when the longitudinal tension is 9N, length of the string

$= L + \frac{9}{k} = 5a - 4b + 9(b-a)$

=5b-4a

17 **(a)**

Let m be the total mass of the rope of length$l$. Tension in the rope at a height h from lower end= weight of rope of length h is $T = \frac{mg}{l}(h)$

As $v = \sqrt{\frac{T}{(m/l)}}$

$v = \sqrt{\frac{mg(h)}{l(m/l)}} = \sqrt{gh}$

$v^2 = gh$

Which is a parabola. Therefore, h versus v graph is a parabola option (a) is correct.

18 **(c)**

The fundamental frequency of a wire is given by

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

Where $l$is length of wire, T the tension and m the mass per unit length.

$$\mathrm{m}=\frac{\text{mass of wire}}{\text{length of wire}}$$

$$=\frac{\pi \mathrm{r}^2 \mathrm{L}\times \text{density}}{L}=\pi r^2 d$$

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

$$\Rightarrow \quad v=\frac{1}{2rl}\sqrt{\frac{T}{\pi d}}$$

$$\therefore \frac{v_1}{v_2}=\frac{r_2}{r_1}=\frac{2}{1}$$

19 **(d)**

The speed of sound in a gas of density ρ at pressure P is

$$v=\sqrt{\frac{\gamma P}{\rho}}$$

20 **(c)**

$$\mathrm{v}_1=\frac{\mathrm{v}}{\lambda_1}=\frac{\mathrm{v}}{1.00} \text{ and } \mathrm{v}_2=\frac{\mathrm{v}}{\lambda_2}=\frac{\mathrm{v}}{1.01}$$

$$\therefore \Delta\mathrm{v}=\mathrm{v}_1-\mathrm{v}_2=\mathrm{v}\left[\frac{1}{1.00}-\frac{0}{1.01}\right]=10$$

$$\text{or } \mathrm{v}=\frac{10\times 1\times 1.01}{0.01}=1010 \text{ for 3s}$$

$$\therefore \mathrm{v}=336.6\ \mathrm{ms}^{-1}$$

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