Class XI

Oscillations and waves worksheet 6

1.	If the displacement of two waves at a point is given by $y_1 = a\sin wt$ *and* $y_2 = a\sin\left(wt + \frac{\pi}{2}\right)$ Calculate the resultant amplitude?	1
Ans.	$a_1 = a_2 = a, \phi = \frac{\pi}{2}$ $A = \sqrt{a_1^2 + a_2^2 + 2a_1a_2\cos\phi} \quad = \sqrt{a^2 + a^2 + 2a^2\cos\left(\frac{\pi}{2}\right)} \quad = \sqrt{a^2 + a^2 + 2a^2(0)}$ $A = \sqrt{2}a$	
2.	Why do the stages of large auditoriums have curved backs?	1
Ans.	The stages of large auditorium have curved backs because when speaker stands at or near the focus of curved surface his voice is rendered parallel after reflection from the concave or parabolic seer face. Hence the voice can be heard at larger distances.	
3.	Show that Doppler effect in sound is asymmetric?	1
Ans.		
4.	A simple harmonic wave has the equation y = 0.30 Sin (314 t – 1.57x) t = sec, x = meters, y = cm. Find the frequency and wavelength of this wave. Another wave has the equation y_1 = 0.1 Sin (314 t – 1.57x + 1.57) Deduce the phase difference and ratio of intensities of the above two waves?	2
Ans.	$y = 0.30\sin(314t - 1.57x)t \quad \longrightarrow (1)$ *Equation of plane progressive wave is* $y = a\sin(\omega t - kx)$ $\therefore\ a = 0.3cm = 3\times10^{-3}m$ $\omega = 314$ $k = 1.57$ $\nu = \frac{\omega}{2\pi} = \frac{314}{2\times3.14} = 50Hz$ $v = \frac{\omega}{k} = \frac{314}{1.57} = 200ms^{-1}$ $\lambda = \frac{v}{\nu} = \frac{200}{50} = 4m$ $y = 0.1\sin(314t - 1.57x + 1.57)t \quad \longrightarrow (2)$ $\phi = 1.57\,rad = 1.57\left(\frac{180}{\pi}\right) = 90^0$ $Ratio\ of\ amplitudes = \frac{0.3}{0.1} = 3$ $Ratio\ of\ \text{int}ensities = \frac{0.3^2}{0.1^2} = 9$	

5.	The component waves producing a stationary wave have amplitude, Frequency and velocity of 8 cm, 30Hz and 180 cm/s respected. Write the equation of the stationary wave?	2
Ans.	$a = 8cm,\ \nu = 30Hz, v = 180cms^{-1}$ $T = \frac{1}{\nu} = \frac{1}{30}\sec$ $\lambda = vT = 180 \times \frac{1}{30} = 6cm$ *Equation of stationary wave is* $y = 2a\cos\frac{2\pi x}{\lambda}.\sin\frac{2\pi}{T}t$ $y = 2 \times 8\cos\frac{2\pi x}{6}.\sin 2\pi(30)t$ $y = 16\cos\frac{\pi x}{3}.\sin 60\pi t$	
6.	Differentiate between the types of vibration in closed and open organ pipes?	3
Ans.		