

Board – CBSE

Class – 11

Topic – Waves

### 1 marks questions

1. If two sound waves has a phase difference of  $60^\circ$ , then find out the path difference between the two waves?
2. Why longitudinal waves are called pressure waves?
3. A hospital uses an ultrasonic scanner to locate tumors in a tissue. What is the wavelength of sound in the tissue in which the speed of sound is  $1.7 \text{ km s}^{-1}$ ? The operating frequency of the scanner is 4.2 MHz.

### 2 marks questions

4. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz. source? Will this source be in resonance with the pipe if both the ends are open?
5. If the splash is heard 4.23 seconds after a stone is dropped into a well. 78.4 meters deep, find velocity of sound in air?
6. The length of a sonometer wire between two fixed ends is 110 cm. Where the two bridges should be placed so as to divide the wire into three segments whose fundamental frequencies are in the ratio of 1:2:3?
7. 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?

### 3 marks questions

8. Explain briefly the analytical method of formation of beats?
9. Show that the frequency of nth harmonic mode in a vibrating string which is closed at both the end is 'n' times the frequency of the first harmonic mode?
10. Differentiate between the types of vibration in closed and open organ pipes?
11. A steel rod 100 cm long is clamed at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53 kHz. What is the speed of sound in steel?

### 4 marks questions

12. Earthquakes generate sound waves inside the earth. Unlike a gas, the earth can experience both transverse (S) and longitudinal (P) sound waves. Typically the speed of S wave is about  $4.0 \text{ km s}^{-1}$ , and that of P wave is  $8.0 \text{ kms}^{-1}$ . A seismograph records P and S waves from an earthquake. The first P wave arrives 4 min before the first S wave. Assuming the waves travel in straight line, at what distance does the earthquake occur?

13. A train, standing in a station-yard, blows a whistle of frequency 400 Hz in still air. The wind starts blowing in the direction from the yard to the station with at a speed of  $10 \text{ ms}^{-1}$ . What are the frequency, wavelength, and speed of sound for an observer standing to the station's platform? Is the situation exactly identical to the case when the air is still and the observer runs towards the yard at a speed of  $10 \text{ ms}^{-1}$ ? The speed of sound in still air can be taken as  $340 \text{ ms}^{-1}$ .

### 5 marks questions

14. A travelling harmonic wave on a string is described by

$$y(x, t) = 7.5 \sin\left(0.0050x + 12t + \frac{\pi}{4}\right)$$

- a) What are the displacement and velocity of oscillation of a point at  $x = 1 \text{ cm}$ , and  $t = 1 \text{ s}$ ? Is this velocity equal to the velocity of wave propagation?
- b) Locate the points of the string which have the same transverse displacements and velocity as the  $x = 1 \text{ cm}$  point at  $t = 2 \text{ s}$ ,  $5 \text{ s}$  and  $11 \text{ s}$ .
15. The transverse displacement of a string (clamped at its both ends) is given by

$$y(x, t) = 0.06 \sin \frac{2}{3} x \cos (120\pi t)$$

Where  $x$  and  $y$  are in m and  $t$  in s. the length of the string is 1.5 m and its mass is  $3.0 \times 10^{-2} \text{ kg}$ .

- a) Does the function represent a travelling wave or a stationary wave?
- b) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength, frequency, and speed of each wave?
- c) Determine the tension in the string.