CHAPTER 13

SOUND

Example 3:

A submarine emits a sonar pulse, which returns off an underwater cliff in 1.02 s. If the speed of sound in salt water is 1531 m/s, how far away is the cliff?

Sol.

Time (t) taken by the sonar pulse to return = 1.02 s

Speed (v) of sound in salt water = 1531 ms^{-1}

Distance travelled by sonar pulse = Speed of sound x Time taken

= 1531 x 1.02 = 1561.62 m

Distance of the cliff from the submarine =

(Total distance travelled by sonar pulse) / 2

= 1561.62 / 2

= 780.81 m

Example 4:

A person has a hearing range from 20 Hz to 20 kHz. What are the typical wavelengths of sound waves in air corresponding to these two frequencies? Take the speed of sound in air as 344 ms^{-1}.

Sol.

For sound waves,

Speed = Wavelength x Frequency

$V = \lambda . f$

Speed of sound wave in air = 344 m/s

- For f_1 = 20 Hz

$$\lambda_1 = \frac{V}{V_1} = \frac{344}{20}$$

$$= 17.2 \text{ m}$$

- For f_2 = 20,000 Hz

$$\lambda_2 = \frac{V}{V_2} = \frac{344}{20,000} = 0.0172 \text{m}$$

Therefore, for human beings, the hearing wavelength is in the range of 0.0172 m to 17.2 m.