

QUES 01:-

A rocket is moving at a speed of 200 ms^{-1} towards a stationary target. While moving, it emits a wave of frequency 1000 Hz . Some of the sound reaching the target gets reflected back to the rocket as an echo. Calculate

1. the frequency of sound as detected by the person at the position of target and
2. frequency of echo as detected by the rocket.

Sol. Here, the speed of source is given by, $V_s = 200 \text{ ms}^{-1}$, actual frequency is $\nu = 1000 \text{ Hz}$

Target is at rest i.e. the speed of the observer is given by, $V_o = 0$

As source is moving towards the target or observer, therefore, apparent frequency

$$\begin{aligned}\nu &= \nu_0 \left(1 - \frac{V_s}{V}\right)^{-1} = 1000 \times \left(1 - \frac{200}{330}\right)^{-1} \\ &= 1000 \times \left(\frac{130}{330}\right)^{-1} = 1000 \times \frac{330}{130} \approx 2538 \text{ Hz}\end{aligned}$$

In the second case, target is the source of echo, which is at rest (i.e. $V_s = 0$). Rocket's detector is the listener.

$$\therefore \nu' = \nu \left(\frac{V+V_o}{V}\right) = 2538 \times \left(\frac{330+200}{330}\right) \approx 4076 \text{ Hz}$$