Answer on Question #47929 – Physics - Mechanics | Kinematics | Dynamics

A listener moves toward a stationary source emitting a frequency of 260 Hz at a speed of 52 m/s. What is the frequency heard by the listener?

Solution:

$v_s = 0 - velocity\ of\ the\ source\ (velocity\ of\ the\ car);$
$v_d = 52\frac{m}{s} - velocity\ of\ the\ receiver\ (your\ velocity);$
$v = 343\frac{m}{s} - speed\ of\ sound;$
$f_0 = 260\ Hz - frequency\ of\ the\ horn;$
$f - frequency\ that\ you\ hear;$

This is Doppler effect problem.

As the listener approaches, the sound waves will have shorter wavelengths and higher frequencies, and as it goes by, the sound waves will have longer wavelengths and lower frequencies.

In classical physics, where the speeds of source and the receiver relative to the medium are lower than the velocity of waves in the medium, the relationship between observed frequency f and emitted frequency f_0 is given by

$$f = \left(\frac{v - v_d}{v - v_s}\right) f_0 = 260Hz\left(\frac{343\frac{m}{s} - 52\frac{m}{s}}{343\frac{m}{s} - 0}\right) = 220.6\ Hz$$

Answer: $220.6\ Hz$