Answer on Question #47927 – Physics - Mechanics | Kinematics | Dynamics

A car honks its horn as it approaches you. The car is traveling at 16. m/s and the horn has a frequency of 900. Hz. What frequency do you hear?

A) 860 Hz
B) 900 Hz
C) 944 Hz
D) 990 Hz

Solution:

$v_s = 16\frac{m}{s} - velocity\ of\ the\ source\ (velocity\ of\ the\ car);$
$v_d = 0 - velocity\ of\ the\ receiver\ (your\ velocity);$
$v = 343\frac{m}{s} - speed\ of\ sound;$
$f_0 = 900\ Hz - frequency\ of\ the\ horn;$
$f - frequency\ that\ you\ hear;$

This is Doppler effect problem.

As the car 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

$$f = \left(\frac{v - v_d}{v - v_s}\right) f_0 = 900Hz\left(\frac{343\frac{m}{s} - 0}{343\frac{m}{s} - 16\frac{m}{s}}\right) = 944\ Hz$$

Answer: C) 944 Hz