Answer on Question #41140, Physics, Mechanics | Kinematics | Dynamics

Question:

An observer moves towards a stationary source of sound with a velocity one tenth the velocity of sound. The apparent increase in frequency is

Answer:

The Doppler effect (or Doppler shift is the change in frequency of a wave for an observer moving relative to its source. In classical physics the relationship between observed frequency f and emitted frequency f_0 is given by:

$$f = \frac{c + v_r}{c + v_s} f_0$$

where c is the velocity of waves in the medium;

v_r is the velocity of the receiver relative to the medium; positive if the receiver is moving towards the source (and negative in the other direction);

v_s is the velocity of the source relative to the medium; positive if the source is moving away from the receiver (and negative in the other direction).

In this case $v_r = 0.1\ c$, $v_s = 0$ therefore

$$f = \frac{c + 0.1c}{c} f_0 = 1.1\ f_0$$

Increase in frequency equals:

$$\Delta f = f - f_0 = 0.1\ f_0$$

Answer: $0.1\ f_0$