

Answer on Question #50240, Physics, Mechanics | Kinematics | Dynamics

Question:

the frequency change by 10% as a sound source approach a stationary observer with constant velocity V . what would be % change in the frequency as the source reduce the observer with same speed...

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: $v_r = 0$, $v_s = \pm v$

$$f_1 = \frac{c}{c + v} f_0 = 0.9 f_0 \Rightarrow v = \frac{0.1}{0.9} c = \frac{c}{9}$$

$$f_2 = \frac{c}{c - v} f_0 = \frac{9}{8} f_0 = \left(1 + \frac{1}{8}\right) f_0$$

$$\frac{1}{8} 100\% = 12.5\%$$

Answer: 12.5 %