PHYS102.10
Quiz # 2

Name: Key Id#:

Consider a sound wave in air given by $\Delta P = (1.5\ \text{Pa}) \sin [\pi (0.9\ x - 310\ t)]$.

Write the equation of the displacement wave corresponding to this pressure variation wave. Take density of air = 1.2 kg/m^3.

$$S(x,t) = S_m \cos(kx - \omega t)$$

$$S_m = \frac{\Delta P_m}{\rho v \omega}$$

$\rho = 1.2\ \text{kg/m}^3$

$$v = \frac{\omega}{k} = \frac{310\pi}{0.9\pi} = 344.4\ \text{m/s}$$

$\omega = 310\pi\ \text{rad/s}$

$\Delta P_m = 1.5$

$$\Rightarrow S_m = \frac{1.5}{1.2 \times 344.4 \times 310\pi} = 3.7 \times 10^{-6}\ \text{m}$$

$$S(x,t) = (3.7 \times 10^{-6}\ \text{m}) \cos[\pi(0.9x - 310t)]$$

Phys102.11
Quiz#2

Name: Key Id#:

A train approaches a mountain at a speed of 20 m/s. The train's engineer sounds a whistle that emits a frequency of 420 Hz. What will be the frequency of the echo that the engineer hears reflected off the mountain? Take speed of sound in air to be 340 m/s.

a) train is source, mountain is detector

$$f_D = f_s \frac{v}{v - v_s}$$

$$= 420 \frac{340}{340-20} = 446 \text{ Hz}$$

b) train is detector, mountain is source

$$f_D = f_s \frac{v + v_D}{v}$$

$$= 446 \frac{340+20}{340} = \boxed{472 \text{ Hz}}$$

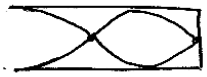
Phys102.12
Quiz#2

Name: Key Id#:

(a) A 75-cm long organ pipe closed at one end is played when the speed of sound in the air is 340 m/s. Find the frequency of the third harmonic.

(b) If the same pipe was open at both ends, what would be the frequency of the third harmonic?

(a) Third harmonic



$f_n = n \frac{v}{4L}$ $n = 1, 3, 5, \ldots$

$f_3 = 3 \times \frac{340}{4 \times 0.75} =$ **340 HZ**

(b) Third harmonic

$f_n = n \frac{v}{2L}$ $= 1, 2, 3, \ldots$

$f_3 = 3 \times \frac{340}{2 \times 0.75} =$ **680 HZ**