Phys102 (Sec # 42) Quiz # 2 (Ch.17)

Name: (Key) ID #

1- A sinusoidal sound wave is described by the displacement $S(x,t)=2*10^{-8}$ cos(1.25x-1850t), where x is in meters and t is seconds. What is the pressure amplitude of this wave if it is traveling in a material with a bulk modulus of $2.1*10^9$ N/m$^2$?

$\Delta P_m = (v \rho \omega) S_m$

$\Delta P_m = (1480)(958.7)(1850) * 2\times10^{-8}$

$= \boxed{52.5 \text{ W}}$

$S_m = 2\times10^{-8}$ m

$\omega = 1850 \frac{\text{rad}}{\text{s}}$

$v = \frac{\omega}{k} = \frac{1850}{1.25} = 1480 \frac{\text{m}}{\text{s}}$

to find $\rho$:

use $v = \sqrt{\frac{B}{\rho}}$

$\rho = \frac{B}{v^2} = \frac{2.1\times10^9}{(1480)^2} = 958.7 \frac{\text{kg}}{\text{m}^3}$

2- Two sound waves, from two different sources with the same frequency, 540 Hz, travel in the same direction at 344 m/s. The sources are in phase. What is the phase difference of the waves at a point that is 4.4 m from one source and 4 m from the other source?

$\Delta L = 0.4$ m

$f = 540$ Hz

$v = 344 \frac{\text{m}}{\text{s}}$

$\phi = ?$

$\frac{\phi}{2\pi} = \frac{\Delta L}{\lambda} \Rightarrow \phi = 2\pi \frac{\Delta L}{\lambda}$

$\phi = 2\pi \frac{\Delta L}{v/f} = 2\pi \frac{0.4}{(344/540)}$

$\boxed{\phi = 3.9 \text{ rad}}$

3- An ambulance siren emits a sound of frequency 1.6 kHz. A person running with an unknown speed hears a frequency of 1.7 kHz as the ambulance approaches him from the back with a speed of 10 m/s. How fast is the person running? (Speed of sound is 340 m/s).

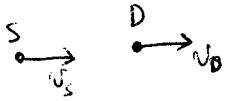
$f = 1.6\times10^3$ Hz

$f' = 1.7\times10^3$ Hz

$v_s = 10 \frac{\text{m}}{\text{s}}$

$v_D = ?$

$v = 340 \frac{\text{m}}{\text{s}}$




$f' = f \frac{v - v_D}{v - v_s}$

$1.7\times10^3 = 1.6\times10^3 \frac{340 - v_D}{340 - 10}$

$\Rightarrow v_D = -\left(\frac{1.7*(330)}{1.6} - 340\right) = \boxed{-10.6 \frac{\text{m}}{\text{s}}}$