Phys102 (Sec # 41) Quiz # 2 (Ch.17)

Name: (Key) ID #

1- An ambulance emits sound of frequency 300 Hz and is moving with a speed of 45.0 m/s away from a moving car. If the car is moving towards the ambulance with a speed of 15.0 m/s, what frequency does a person in the car hear? [The speed of sound in air is 343 m/s].

$v_D \rightarrow$ $v_S \rightarrow$

$$f' = f\,\frac{v + v_D}{v + v_S}$$

$$= (300)\left(\frac{343 + 15}{343 + 45}\right) = 300\left(\frac{358}{388}\right) = 276.8 \text{ Hz}$$

2- The frequency of the fundamental mode of a sound wave in a 30-cm long tube closed at one end is 200 Hz. When the tube length is shortened to 10 cm, what is the new fundamental frequency?

$$f_1 = \frac{v}{4L_1}$$

$$200 = \frac{v}{4(0.3)}$$

$$\Rightarrow v = 240 \text{ m/s}$$

Then

$$f_1' = \frac{v}{4L_2}$$

$$f_1' = \frac{240}{4(0.1)} = 600 \text{ Hz}$$

3- A sound source located at the origin emits sound with an average power of 0.04 W. Two detectors are located on the positive x-axis. Detector A is at x = 3.0 m and detector B is at 5.0 m. What is the difference in sound level between A and B?

$$\beta_A = 10 \log\left(\frac{\frac{P_s}{4\pi(3)^2}}{10^{-12}}\right) \qquad \beta_B = 10 \log\left(\frac{\frac{P_s}{4\pi(5)^2}}{10^{-12}}\right) \qquad \beta_A > \beta_B$$

$$\text{The diff.} = \beta_A - \beta_B = 10\left[\log\left(\frac{\frac{P_s}{4\pi(9)}}{10^{-12}}\right) - \log\left(\frac{\frac{P_s}{4\pi(25)}}{10^{-12}}\right)\right] \qquad \text{use } \log A - \log B = \log$$

$$\text{to get } \beta_A - \beta_B = 10 \log\frac{25}{9} = 4.4 \text{ dB}$$