國立東華大學

Department of Physics
National Dong Hwa University, 1, Sec. 2,
Da Hsueh Rd., Shou-Feng, Hualien, 97401, Taiwan

General Physics I, Quiz 5
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Quiz-5 Solution

1. Solution : ***(Similar to problem no.29, chap.17, text book 8th edition)***

(a) We know the sound level $\beta = 10 \log (I/ 10^{-12})$

So the intensity, $I = 10^{(\beta/10)} (10^{-12})$ W/ m^2

For 100 dB, $I_{(100dB)} = 10^{(100/10)} \times 10^{-12}$ W/m^2 = 10^{-2} W/m^2

Now average power of sound, $P = 4\pi r^2 I$

We can compare for different distances using constant source power by

$$r_1^2 I_{(100\ dB)} = r_2^2 I_2$$

$$I_2 = (r_1^2 I_1)/ r_2^2 = [(3000)^2 x\ 10^{-2}] / (2000)^2$$

$$I_2 = 0.023 \text{ W/m}^2 = 2.3x10^{-2} \text{W/m}^2$$

Given that

$\beta = 100$ dB

$r_1 = 3000$ m

$r_2 = 2000$ m

(b) When the sound level = zero ,

The intensity $I_{(0dB)} = 10^{(0/10)} \times 10^{-12}$ W/m^2 = 10^{-12} W/m^2

Using the relation $r_1^2 I_{(100\ dB)} = r_2 I_2$

One can get, $r_2 = [r_1^2 I_{(100\ dB)}]/ I_{0dB} = 9000/10^{-12} = 9x10^{15}$ m

2. Solution: ***(Similar to problem no.(37+45), chap.17, text book 8th edition)***

(a) The net velocity of sound will be $(V- V_0)$

So the wave length is

$\lambda = (V_0-V_w) / f = (332-32)/ 1000 = 0.3$ m

(b) Using Doppler effect

Observe frequency before passing

$f_1' = (V_0+V) f / V_0$

$= [(332+ 532)/ 332]$ x1000000

= 2602.5 kHz =˜ 2063 kHz

Observed frequency after passing,

$f_2' = (V_0-V) f / V_0$

$= [(332-532)/332]$ x1000

= - 603 kHz

Since frequency is just a quantity so taking positive sign,

$f_2' = 603$ kHz

Here

$V_w = 32$ m/s

V= 1915 km/hr

$= 1915x10^3/3600$

= 532 m/s

$V_0 = 332$ m/s

$f = 1000$k Hz