Phys102 (Sec # 40) Quiz # 2 (Ch.17)

Name: Key ID #

1- A source emits sound with a frequency of 1000 Hz. The source and an observer are moving toward each other, each with a speed of 100 m/s. If the speed of sound is 340 m/s, the observer hears sound with a frequency of:

$f = 1000$ Hz
$v_s = 100$ m/s
$v_D = 100$ m/s
$v = 340$ m/s
$f' = ?$

S → ← D

$$f' = f\,\frac{v + v_D}{v - v_s} = 1000\,\frac{340 + 100}{340 - 100}$$

$$= 1000\,\frac{440}{240}$$

$$= 1833 \text{ Hz}$$

2- A tuning fork with a frequency of 510 Hz is placed at the open end of an air column that is closed at the other end. What is the shortest length of the air column that will resonate with the tuning fork? The speed of sound in air is 345 m/s.

Shortest length ⇒ $n = 1$

$$L = \frac{\lambda}{4} = \frac{v/f}{4} = \frac{345/510}{4} = 0.17 \text{ m}$$

$$= 17 \text{ cm}$$

3- The sound level at a distance of 5 m from a point source is 117 dB. Calculate the power output of the source.

$$\beta = 10 \log \frac{\frac{P_s}{4\pi r^2}}{10^{-12}}$$

$$117 = 10 \log \frac{\left(\frac{P_s}{4\pi (5)^2}\right)}{10^{-12}}$$ Solve for P_s.

$$\frac{\left(\frac{P_s}{4\pi (5^2)}\right)}{10^{-12}} = 10^{11.7} = 5 \times 10^{11}$$

$$P_s = 5 \times 10^{11} \times 10^{-12} \times 4\pi (5^2) = 157.5 \text{ W}$$