الزئبق

1- Find the speed of sound in mercury, which has a bulk modulus of approximately $2.80 \times 10^{10}\ N/m^2$ and a density of $13\,600\ kg/m^3$.

3- A vacuum cleaner produces sound with a measured sound level of 70.0 dB. (a) What is the intensity of this sound in W/m^2? (b) What is the pressure amplitude of the sound?

① Givens :- $B = 2.8 \times 10^{10}\ N/m^2$, $\rho = 13600\ kg/m^3$

$V = ?$

$$V = \sqrt{\frac{B}{\rho}} = \sqrt{\frac{2.8 \times 10^{10}}{13600}} = \boxed{1935\ m/s}$$

---

③ $\beta = 70\ dB$

a) $I = ?$ $\longrightarrow$ $\beta = 10\ Log\left(\frac{I}{I_o}\right)$ — $I_o = 1 \times 10^{-12}$

$70 = 10\ Log\left(\frac{I}{10^{-12}}\right)$ $\longrightarrow$ shift (Log)

$10^7 = \frac{I}{10^{-12}}$ $\longrightarrow$ $I = 10^7 \times 10^{-12} = \boxed{10^{-5}\ w/m^2}$

b) $\Delta P_{max} = ?$ — pressure amplitude

$$I = \frac{(\Delta P_{max})^2}{2\rho V}$$

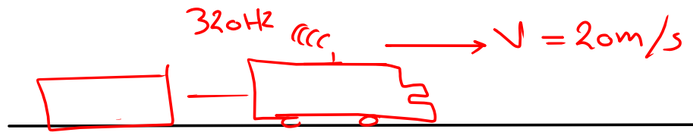
V — speed of wave (Air) $= 343\ m/s$

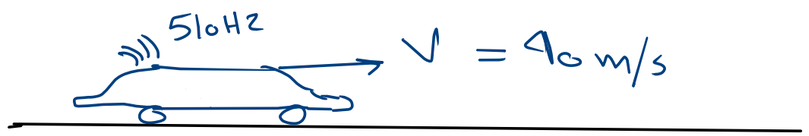
ρ — density $= 1.2\ kg/m^3$

$$(\Delta P_{max})^2 = 2\rho V I$$

$$\Delta P_{max} = \sqrt{2\rho V I} = \sqrt{2(1.2)(343)(10^{-5})} = \boxed{9.1 \times 10^{-2}\ Pa}$$

2- A train is moving parallel to a highway with a constant speed of 20.0 m/s. A car is traveling in the same direction as the train with a speed of 40.0 m/s. The car horn sounds at a frequency of 510 Hz, and the train whistle sounds at a frequency of 320 Hz. (a) When the car is behind the train, what frequency does an occupant of the car observe for the train whistle? (b) After the car passes and is in front of the train, what frequency does a train passenger observe for the car horn?





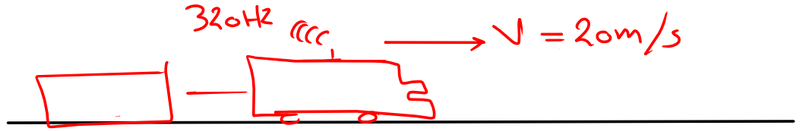
$V_{sound\ Air} = 343 m/s$

a) Car is observer $\quad F' = \left(\frac{V + V_o}{V - V_s}\right) F$

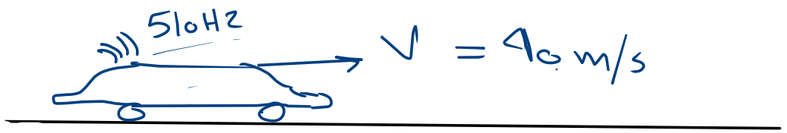
$V_o = +40 m/s \qquad V_s = -20 m/s$

$F' = \left(\frac{343 + (+40)}{343 - (-20)}\right)(320) = \boxed{337.6\ Hz}$

b)



Train is observer



$\because V_o < V_s \quad , V_o = -20\ m/s$

$V_s = -40 m/s$

$F' = \left(\frac{343 + (-20)}{343 - (-40)}\right)(510) = \boxed{430.1\ Hz}$

☆☆☆

- when observer and source at the same direction and $V_s > V_o$ This means That observer slowing down $\rightarrow V_o = -ve$