

varies inversely as the square root of the density.

(ii) Effect of pressure:-

Let the volume of a certain mass ( $m$ ) of a gas be  $V$  and its density be  $\rho$

$$\therefore V = \frac{m}{\rho}$$

From Boyle's Law, we know

$$PV = \text{constant}$$

$$\text{or } P \frac{m}{\rho} = \text{constant}$$

Since with the change of pressure and temp, the mass of gas remains the same.

$$\therefore \frac{P}{\rho} = \text{constant}$$

$$\therefore \sqrt{\frac{P}{\rho}} = \text{constant}$$

Hence, it is concluded that there is no effect of pressure on the velocity of sound.

(iii) Effect of temperature:- Let at  $0^\circ\text{C}$  and  $t^\circ\text{C}$ , the densities of a gas be  $\rho_0$  and  $\rho_t$  and velocities  $v_0$  &  $v_t$  respectively, so can write

$$v_0 = \sqrt{\frac{vP}{\rho_0}} \quad \text{and } v_t = \sqrt{\frac{vP}{\rho_t}}$$

$$\text{or } \frac{v_t}{v_0} = \sqrt{\frac{\rho_0}{\rho_t}}$$

$$\therefore \rho_t = \rho_0 \left(1 + \frac{t}{273}\right)$$

$$\therefore \frac{v_t}{v_0} = \sqrt{1 + \frac{t}{273}} = \sqrt{\frac{273+t}{273}} = \sqrt{\frac{T}{T_0}}$$

where  $T$  &  $T_0$  are the absolute temp at  $t^\circ\text{C}$  &  $t_0^\circ\text{C}$  respectively.

$$\Rightarrow v \propto \sqrt{T}$$

Thus velocity of sound in a gaseous medium is directly proportional to the square root of the absolute temp.

(iv) Effect of moisture :- Let  $v_d$  &  $v_m$  be the velocities &  $\rho_d$  &  $\rho_m$  be the densities of dry & moist air at pressure  $p$  & temp  $t^\circ\text{C}$  respectively. Then we may write

$$v_d = \sqrt{\frac{\gamma p}{\rho_d}}$$

$$v_m = \sqrt{\frac{\gamma p}{\rho_m}}$$

$$\frac{v_d}{v_m} = \sqrt{\frac{\rho_m}{\rho_d}}$$

$$v_d = v_m \sqrt{\frac{\rho_m}{\rho_d}}$$

As the density of moist air is less than that of dry air, the velocity in dry air is less than that in moist air.

(v) Effect of wind :- If  $v$  be the velocity of sound and  $w$  be that of wind, then if they move in the same direction the velocity of sound is  $v+w$ , while it will be  $(v-w)$  in opposite direction.

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