BREATHING AND EXCHANGE OF GASES

EXCHANGE OF GASES

- Alveoli are the primary sites of exchange of gases. Exchange of gases also occur between blood and tissues.

  Exchange of gases in the lungs is done between alveolar air and deoxygenated blood, ·
- Gaseous exchange is a passive activity. It is done by simple diffusion.
- Diffusion pressure for every gas (in blood or in air) is called partial pressure. At the time of diffusion, gases move from high partial pressure to low partial pressure.

Table of partial pressure (in mm Hg) of oxygen and carbon dioxide :-

Respiratory Gas	Atmospheric Air	Alveoli	Deoxygenated Blood	Oxygenated Blood	Tissues	Inside the cell	Expired Air
O_2	159	104	40	95	40	20	120
CO_2	0.3	40	45	40	45	50	27

The partial pressure of O_2 in alveolar air $[P_{O_2}]$ is 104 mm Hg, its value in arterial blood is 40 mm Hg. So oxygen goes from alveolar air to arterial air

- In alveolar air, partial pressure of CO_2 $[P_{CO_2}]$ is 40 mm Hg and its value in deoxygenated blood is 45-46 mm Hg. So CO_2 moves from arterial blood to alveoli. In this way, according to partial pressure exchange of gases takes place in the lungs.

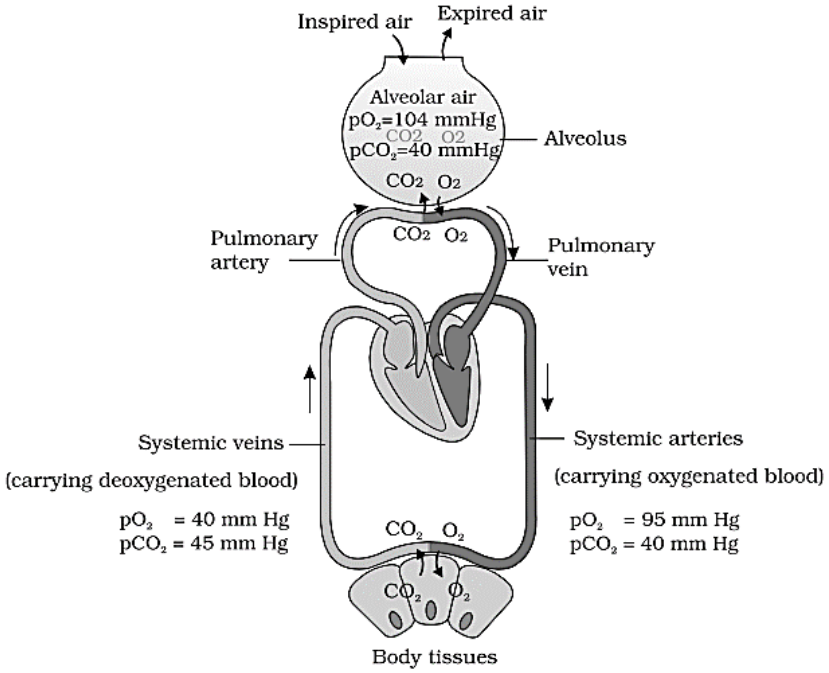

Fig. Diagrammatic representation of exchange of gases at the alveolus and the body tissues with blood and transport of oxygen and carbon dioxide

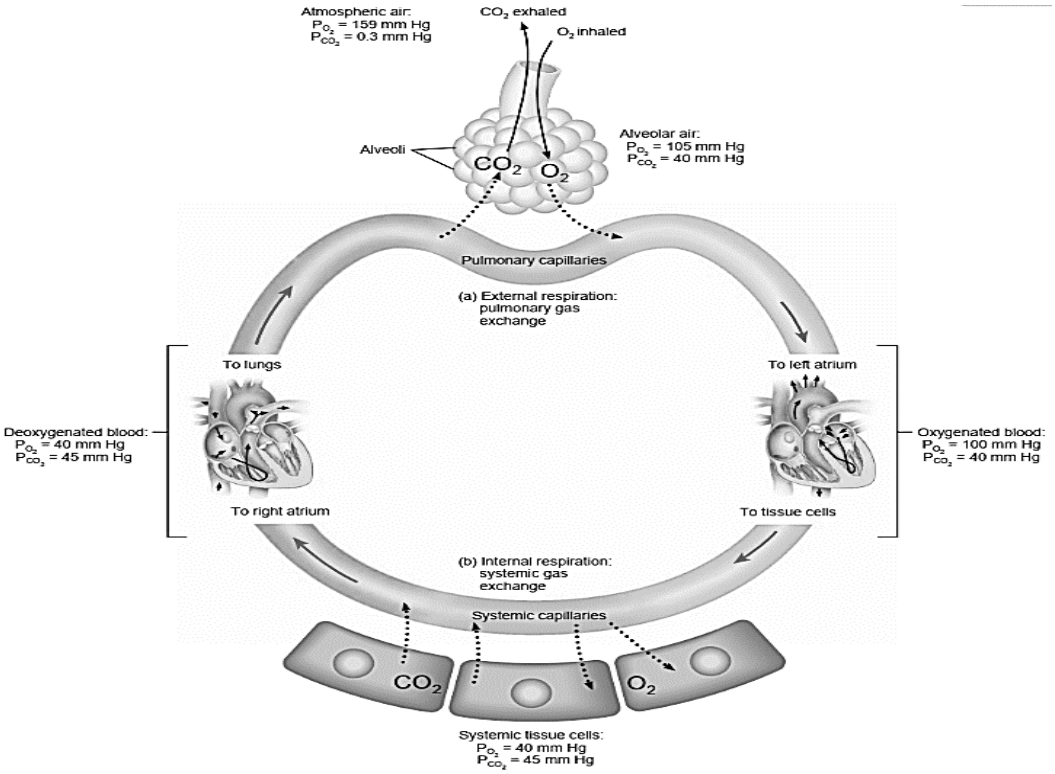

Fig. Changes in partial pressures (in mm Hg) during external and internal respiration

Diffusing capacity depends on solubility of gases, thickess of the respiratory membrane and partial pressure difference.

- As the solubility of CO_2 is 20-25 times higher than that of O_2, the amount of CO_2 that can diffuse through the diffusion membrane per unit difference in partial pressure is much higher compared to that of O_2.

Diffusion membrane is made up of three major layers :-

1. Thin squamous epithelium of Alveoli.
2. Endothelium of Blood capillaries.
3. Basement substances in between them.

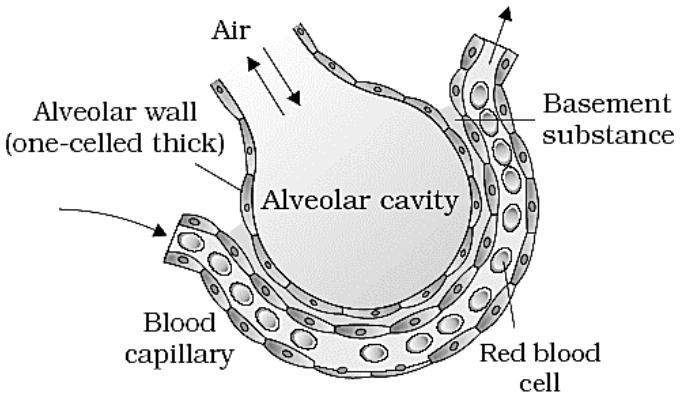

Fig.- A diagram of a section of an alveolus with a pulmonary capillary.

Factors that affect the rate of diffusion

1. **Solubility of gases:** Solubility of partial pressure of Gas. A gas having high solubility, diffused at faster rate than the gas having low solubility. For example, solubility of CO_2 is 20-25 times higher than that of O_2, the amount of CO_2 that diffuses across diffusion membrane is much higher than that of O_2. [Henery's law]
2. **Partial pressure:** As we know that gases are diffused according to their partial pressure. For example O_2 is diffused from atmospheric air having partial pressure 159 mm Hg to the alveoli where pO_2 is less i.e., 104 mm Hg. [Dalton's law] $p = pN_2 + pO_2 +$ p other gases.

3. **Thickness of membrane:** More the thickness of membrane, less will be the rate of diffusion. More the membrane thin, more will be the rate of diffusion. For efficient diffusion to occur, membrane should be very thin.
4. Molecular weight of gases - Molecular weight of CO_2 is 1.6 x more than O_2.