

Topic :-Breathing and Exchange of Gases

- 1 (a)
CO₂ transport in blood : Transport of CO₂ by blood is must easier/simple than that of O₂ due to high solubility of CO₂ in water.
Most of the CO₂, *i.e.*, 70% of CO₂ is transported as bicarbonate (HCO₃⁻) in blood. 23% as carbaminohaemoglobin (HbCO₂) and 7% of CO₂ is dissolved in the plasma.
CO₂ produced by the tissues, diffuses passively into the blood plasma and reacts with water forming carbonic acid. The reaction occurs very rapidly inside RBCs because of the presence of enzyme carbonic anhydrase.
Chloride shift : To maintain electro-chemical neutrality of plasma many chloride ions diffuse from plasma into RBCs and bicarbonates pass out. The chloride content of RBCs increases when oxygenated blood becomes deoxygenated. This is termed as **chloride shift or Hamburger shift**.
Haldane's effect : Oxygenated blood behaves as strong acid. More and more oxyhaemoglobin is formed in lungs, which releases H⁺, *i.e.*, increasing the acidity of blood. This H⁺ combines with bicarbonate forming carbonic acid and soon dissociates.
- 2 (a)
Air entering the lungs is warm and filtered.
Nasal Cavity It is the first part of the respiratory system. It opens to the exterior through nostrils. The small hairs present in the cavity helps to filter the particles of dust and other foreign matter. The air in the nasal cavity gets warmed (because nasal cavity has very good blood supply) and moistened before it enters to the lungs
- 3 (d)
The relationship between the ρO_2 and the percent saturation of haemoglobin when represented on a graph is called as oxygen haemoglobin dissociation curve. It is sigmoid in shape. Rise in ρCO_2 , H⁺ ions (fall in pH), temperature and diphosphoglyceric acid shifts the HbO₂ dissociation curve to the right. (As more O₂ dissociate from the oxyhaemoglobin)
- 4 (b)
Hiccups occurs due to spasmodic contraction of diaphragm (possible due to the irritation of phrenic nerve which controls the diaphragm)
- 5 (d)
Carbohaemoglobin dissociates in the alveoli, where there is high O₂ partial pressure and

low ρCO_2 . Due to the pressure gradient, CO_2 dissociates from the haemoglobin and O_2 combines to form oxyhaemoglobin

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(b)

O_2 binds with RBC

Haemoglobin is a red coloured iron containing pigment, present in the RBCs. O_2 binds with haemoglobin in reversible manner to form oxyhaemoglobin

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(a)

Partial pressure of respiratory gases in-mm Hg

Respiratory gases	Inspired air on atmospheric air	Alveolar air	Deoxygenated blood	Oxygenated blood	Expired air	Tissue cells
ρO_2	158	100	40	95	116	40
ρCO_2	0.3	40	45	40	32	45

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(b)

$$\begin{aligned} \text{Vital Capacity (VC)} &= \text{IRV} + \text{TV} + \text{ERV} \\ &= 3000 + 500 + 1100 = 4600 \text{ mL} \end{aligned}$$

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(a)

When a graph is plotted between percent saturation of haemoglobin and oxygen tension, a curve is obtained which is termed as O_2 – Hb dissociation curve. Oxygen-haemoglobin dissociation curve is sigmoid or S-shaped.

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(b)

Carbonic anhydrase is an enzyme that accelerates the reaction between carbon dioxide and water to form carbonic acid in the RBCs. Zinc acts as cofactor of carbonic anhydrase.

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(b)

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(c)

There are as many as 750 million of alveoli in both the lungs of adult man, which provide about 100 sq metre surface area for respiration.

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(d)

Diffusion membrane is made up of three layers

(i) Thin squamous epithelium of alveoli. (ii) Endothelium of alveolar capillaries. (iii)

Basement substance in between the squamous epithelium of alveoli and endothelium of alveolar capillaries

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(b)

Alveoli are the primary site of exchange of gases. Exchange of gases also occur between the blood and tissue. O_2 and CO_2 are exchanged in these sites by simple diffusion, mainly based on pressure concentration gradient

- 15 (c)
Larynx is present on tip of trachea and is made up of cartilages. It is a short tubular chamber and opens into the laryngopharynx by a slit-like aperture called glottis. It is more prominent in male than female due to male hormones. Inside the larynx, vocal cords are present. Sound is produced by true vocal cords.
- 16 (d)
About 7% of carbon dioxide is transported as dissolved in plasma, 23% as carbaminohaemoglobin and 70% as bicarbonates. Most of the carbon dioxide that dissolved in blood plasma reacts with water to form carbonic acid. All carbonic acid of RBCs dissociates into hydrogen and bicarbonate ions, that bicarbonate ions diffuse from RBCs to blood plasma.
- 17 (b)
Each lung is enclosed in two membranes called pleurae (sing. Pleura).
- 18 (c)
Amount of CO_2 in expired air is 4.4%. The air we breathe in contains about 0.04% CO_2 . The air we breathe out contains about 4% CO_2 . In other words, exhaled air contains about 100 times the concentration of CO_2 that inhaled air does.
- 19 (a)
Dissociation curve of **haemoglobin** shows oxygen tension and % saturation of haemoglobin with oxygen. Normally dissociation curve is **sigmoid** or S-shaped.
- 20 (d)
Dolphins are aquatic mammals which breath by lungs.