

RABBIT --- RESPIRATORY SYSTEM

VSAQ s:

1. What are conchae?

- ✱ Conchae or turbinals are three thin, twisted bony plates present in respiratory part of each nasal chamber.

2. Which muscles help in breathing movements in rabbit?

- ✱ i) Muscles of diaphragm (phrenic muscles) ii) External intercostals muscles
- iii) Internal intercostal muscles iv) Abdominal muscles

3. What is rima glottidis ?

- ✱ Rima glottidis is the space between the two vocal cords in larynx.

4. Name different lobes of right and left lungs in rabbit.?

- ✱ i) Right lung has 4 lobes like Anterior azygous lobe Right anterior lobe,
Right posterior lobe, Posterior azygous lobe.
- ✱ ii) Left lung has 2 lobes like Left anterior lobe Left posterior lobes.

5. Describe the histology of respiratory membrane?

- ✱ Respiratory membrane is thin membrane made up of two layers of simple squamous epithelium (one belongs to alveolus and the other belongs to endothelium of blood capillaries), and their basement membranes.
- ✱ Through this membrane exchange of gases takes place.

6. Name the muscles that contract during normal inspiration?

- ✱ Muscles of diaphragm and external intercostals muscles.

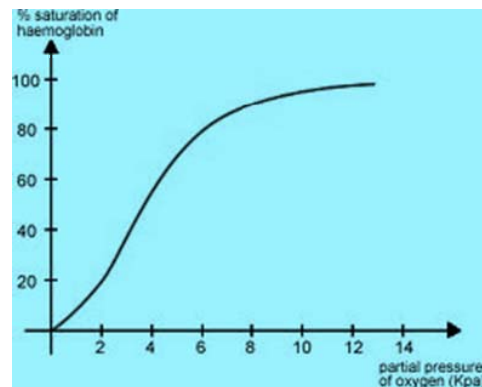
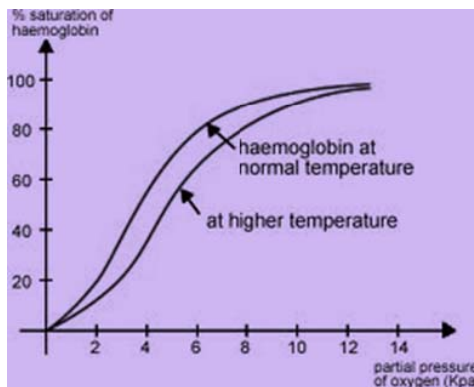
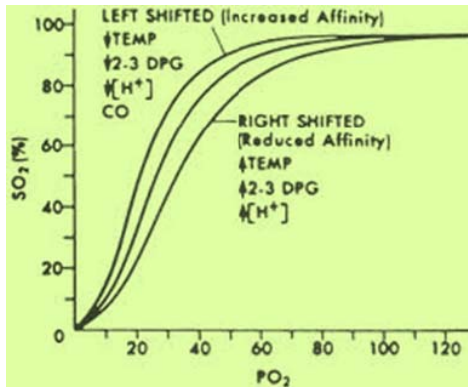
7. Why is normal expiration is passive while forceful expiration is an active process?

- ✱ Normal expiration is a passive process as it involves relaxation of muscles or does not involve contraction of muscles.
- ✱ Forceful expiration is an active process; as it involves contraction of internal inter costal muscles and abdominal muscles.

8. What is Bohr Effect?

- ✱ Effect of CO_2 and H^+ ions on the oxygen-affinity of Haemoglobin is Bohr effect.

9. Draw diagram of Oxygen dissociation curve.

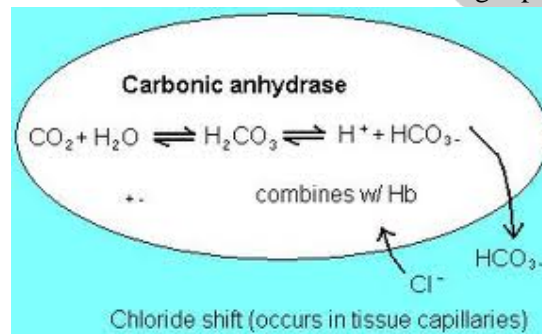


10. Name the three forms of transportation of Carbon dioxide?

- I) Dissolved state -- 7 %
- II) Carbaminocompounds --- 23 %
- III) Bicarbonates --- 70 %.

11. What is meant by chloride shift?

- As the bicarbonate ions diffuse into blood plasma, Cl⁻ ions diffuse from plasma into RBC to maintain electrical balance. It is also known as Hamberger phenomenon.



12. What is Oxygenation?

- Binding oxygen with haemoglobin to form oxyhaemoglobin is oxygenation.

13. Differentiate external respiration, internal respiration and cellular respiration?

- External respiration : exchange of gases between the air in alveoli and blood in pulmonary capillaries.
- Internal respiration : Exchange of gases between the blood in systemic capillaries and tissue cells.

- ✿ Cellular respiration: Oxidation of food which takes place within the cell. It produces ATP.

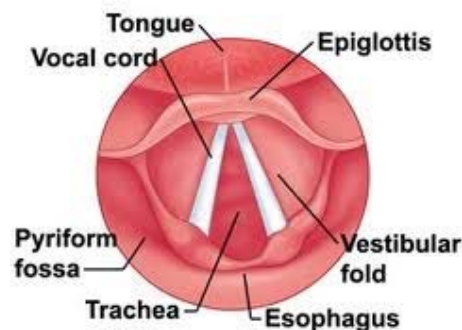
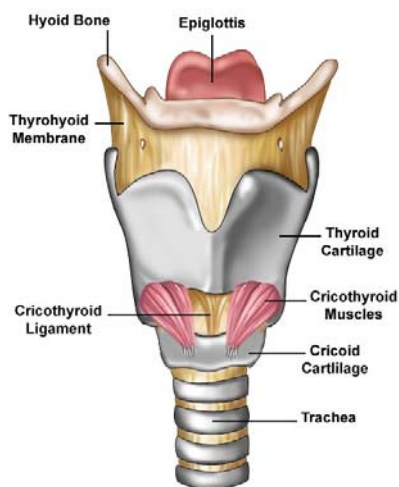
14. What is epiglottis?

Epiglottis is a lid made up of elastic cartilage which guards the glottis and prevents the entry of food and water into larynx. It arises from thyroid cartilage.

SAQ s:

1. Describe the structure of Larynx in rabbit.

- ✿ Larynx is the voice box. It is short tube like structure.
- ✿ Laryngopharynx opens into larynx through glottis.
- ✿ Larynx is supported by different types of cartilages. They are
 - a) **Thyroid cartilage:** Largest. It forms ventral and lateral walls of larynx. It gives epiglottis.
 - b) **Cricoid cartilage:** present behind thyroid. It is a ring like cartilage.
 - c) **Arytenoid cartilages:** one pair of arytenoids is present on dorsal side of larynx.
 - d) **Cartilages of santorini:** Present at the tips of arytenoids.
- ✿ Two fibro elastic strands known as vocal cords are extend between thyroid and arytenoids. Their vibrations produce sound.
- ✿ Rima glottidis is the space between two vocal cords.
- ✿ Larynx opens into trachea.

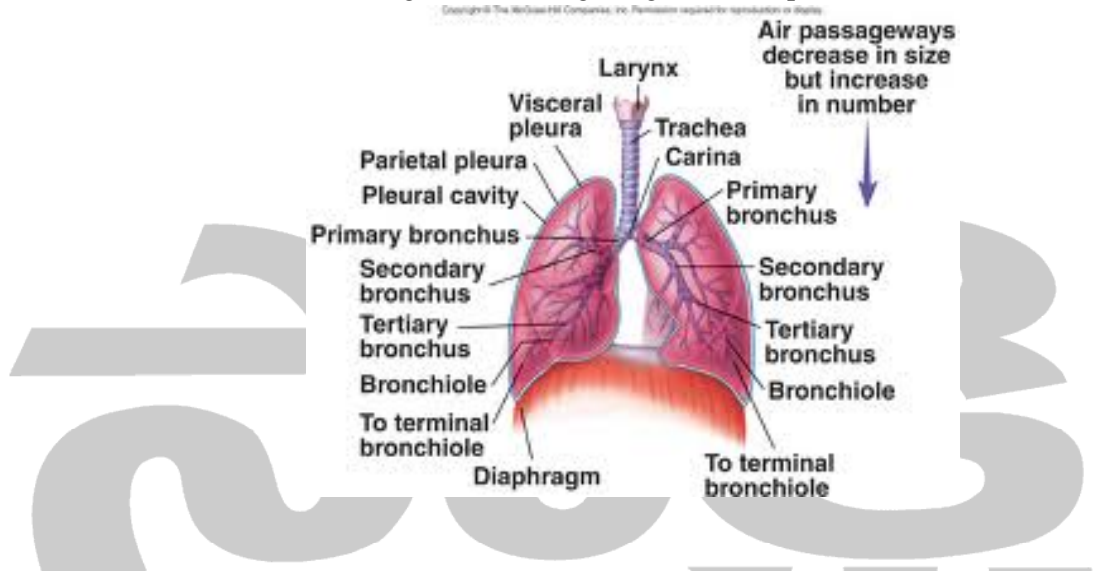


2. Describe the structure of lungs in rabbit?

- ➔ One pair of pinkish, spongy lungs is present in thoracic cavity.
- ➔ Each lung is enclosed in a double layered peritoneum known as pleural membrane.

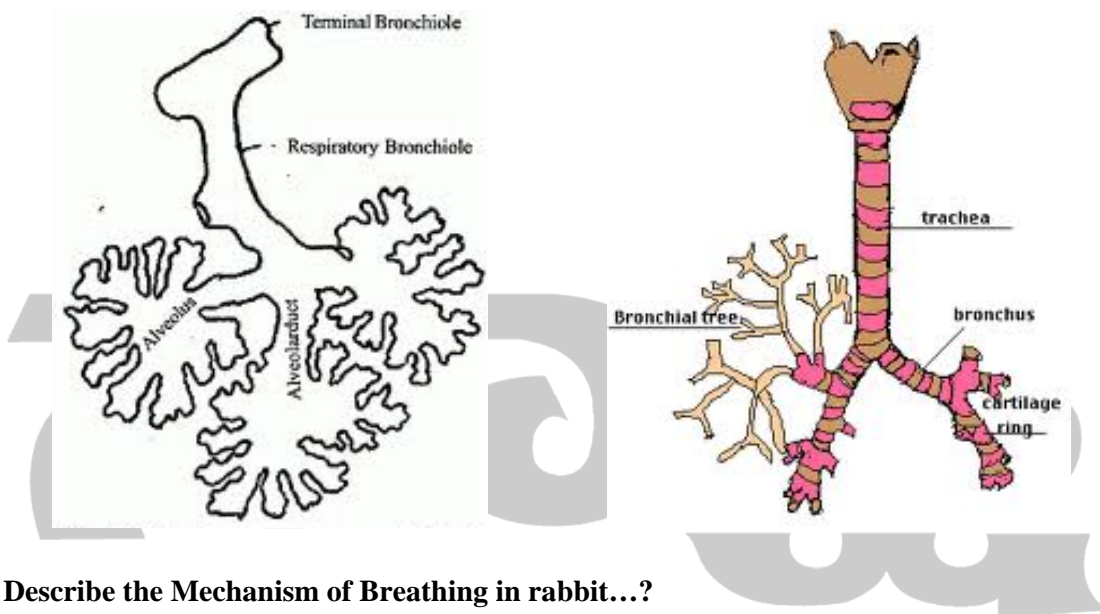
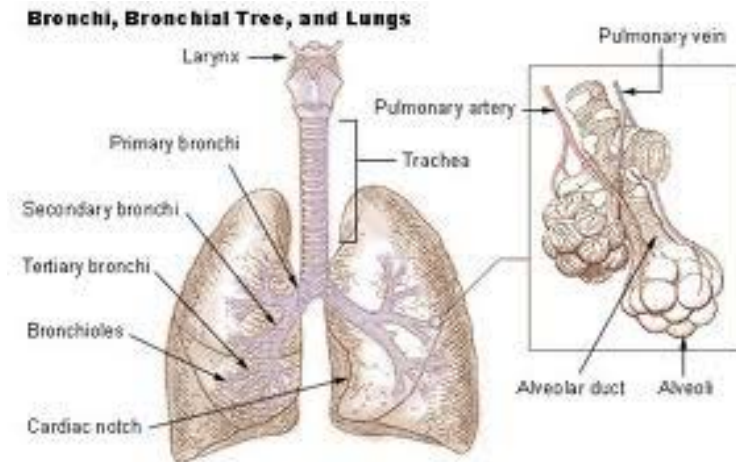
With outer parietal pleura and inner visceral pleura. Pleural cavity between them is filled with pleural fluid. It acts as a lubricant.

- Right lung has four lobes like
 - a) Anterior azygous
 - b) Right anterior
 - c) Right posterior
 - d) Posterior azygous
- Left lung has two lobes like
 - a) Left anterior
 - b) Left posterior lobe.
- Alveolar ducts end in alveolar sacs in each lung.
- Each alveolar sac is formed of small round or oval chambers known as Alveoli.
- Each alveolus is lined by simple squamous epithelium present basement membrane.
- Pulmonary capillaries are present on outer surface of alveoli.
- Respiratory membrane is formed by two layers of simple squamous epithelium and their basements membranes. Through this exchange of gases takes place.



3. Describe the structure of Bronchial tree in rabbit?

- Trachea or wind pipe passes through neck on ventral side of oesophagus.
- Trachea bifurcates into two Primary bronchi in thorax. Each primary bronchus enters the lung and divides into secondary bronchi which further divide into Tertiary bronchi.
- Tertiary bronchi are divided into many branches known as Bronchioles in the order of Primary bronchioles, Secondary bronchioles, Tertiary bronchioles, Terminal bronchioles and respiratory bronchioles.
- Each respiratory bronchiole terminates in a cluster of Alveolar ducts.
- This extensive branching from trachea resembles an inverted tree and known as Bronchial tree.



4. Describe the Mechanism of Breathing in rabbit...?

- Breathing is the action of taking air into lungs and sending it out of lungs.
- Thoracic cavity in rabbit is bound dorsally by vertebral column, ventrally by sternum, posteriorly by a dome shaped muscular diaphragm and laterally by 12 pairs of ribs.

A) INSPIRATION ;

- It involves the contraction of muscles. So it is an active process.
- Contraction of muscles of diaphragm makes the diaphragm flat which increases the volume of thoracic cavity anteroposteriorly.
- Contraction of External intercostals muscles moves the rib cage forward and downward. It results the increase in the volume of thoracic cavity dorsoventrally and laterally.
- When thoracic cavity expands, air pressure in lungs decreases.
- Atmospheric air is drawn into alveoli of lungs.
- Contraction of diaphragm accounts for 75% of air that enters the lungs.

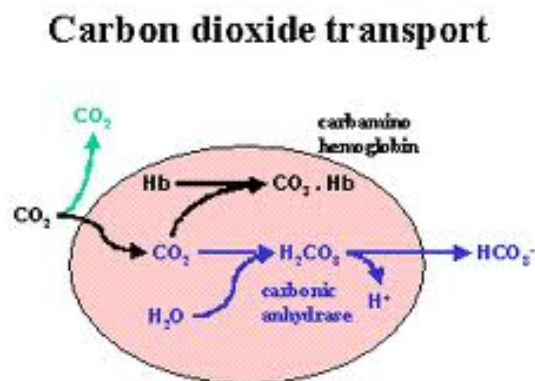
B) EXPIRATION:

- Normal expiration is a passive process as it does not involve contraction of muscles.
- Relaxation of muscles of diaphragm makes the diaphragm dome shaped. It decreases the volume of thoracic cavity anteroposteriorly.
- Relaxation of external intercostal muscles moves the rib cage to its original position which decreases the volume of thoracic cavity dorsoventrally.
- Decrease in thoracic cavity causes elastic recoil of lungs and expulsion of air from alveoli into atmosphere. Forceful expiration is an active process.

5. Explain pulmonary gas exchange and systemic gas exchange.

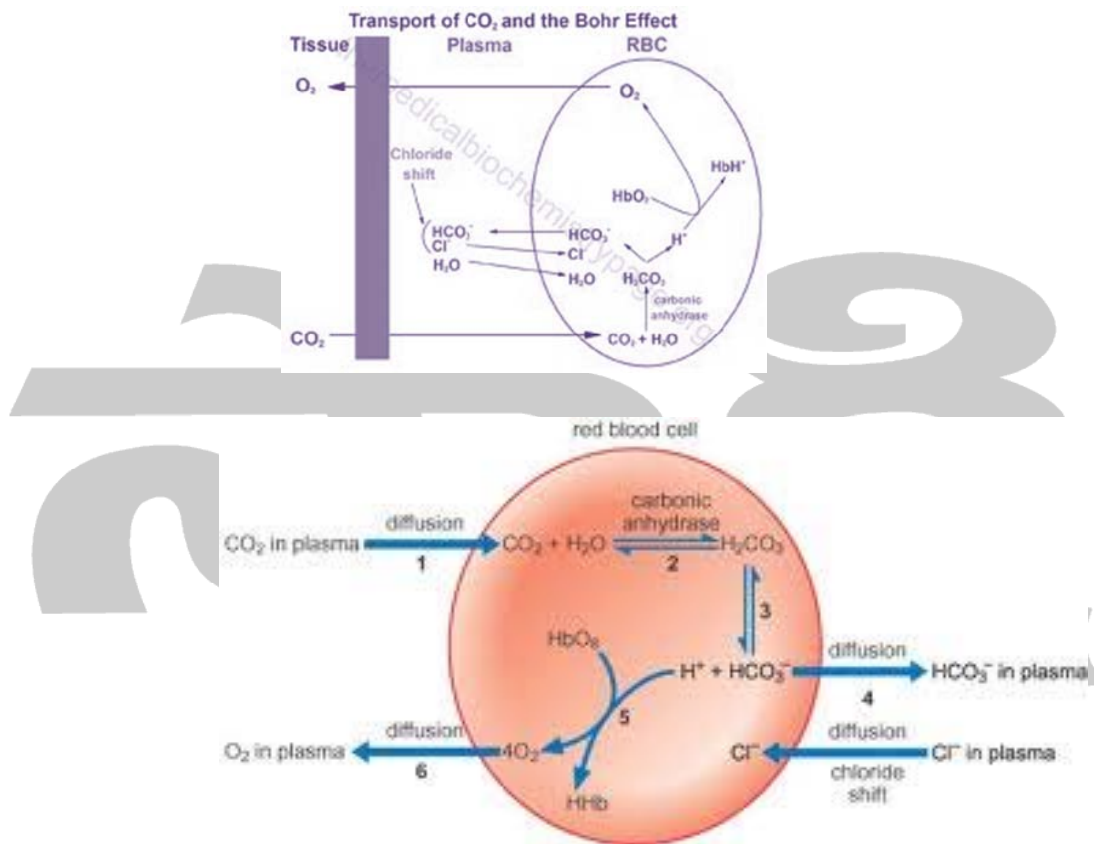
- Partial pressure is the pressure exerted by an individual gas in a mixture of gases.
- The rate of gas exchange depends on 1) partial pressure of gases
2) Solubility of gases 3) Surface area 4) Distance of diffusion
- I) PULMONARY GAS EXCHANGE (external respiration)
Differences in PO_2 and PCO_2 of alveolar air and pulmonary capillaries favour diffusion of O_2 from alveolar air into blood of capillaries and diffusion of CO_2 in the opposite direction
- II) SYSTEMIC GAS EXCHANGE (internal respiration)
Differences in PO_2 and PCO_2 of oxygenated blood in systemic capillaries and those of the tissues favour diffusion of O_2 from systemic capillaries into tissues and diffusion of CO_2 in the opposite direction.

6. Explain how CO_2 is transported as bicarbonate ions.



- About 70% of CO_2 is transported as bicarbonate ions.
- CO_2 reacts with water in RBC of systemic capillaries to form Carbonic acid (H_2CO_3). This reaction occurs about 5000 times faster in RBC than in plasma due to the enzyme Carbonic Anhydrase in RBC.
$$H_2O + CO_2 \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$
- Carbonic acid dissociates into hydrogen ions and bicarbonate ions.
- Due to the action of carbonic anhydrase concentration of bicarbonates increases in RBC. These bicarbonate ions diffuse into blood plasma from RBC.

- To maintain electrical balance, Cl^- ions diffuse from plasma into RBC. This exchange of chloride and bicarbonate ions between RBC and plasma is known as Chloride shift or Hamberger's phenomenon.
- H^+ ions combine with deoxyhaemoglobin to form HHb.
- At lungs, as haemoglobin loads oxygen, its affinity for H^+ ions decreases. So H^+ ions dissociate from haemoglobin and binds with bicarbonate and form H_2CO_3 that dissociates into CO_2 and H_2O . It is catalysed by carbonic anhydrase.
- CO_2 diffuses into alveoli and is exhaled.
- As concentration of HCO_3^- declines in RBC, HCO_3^- ions diffuse from plasma into RBC in exchange for Cl^- (Reverse chloride shift).



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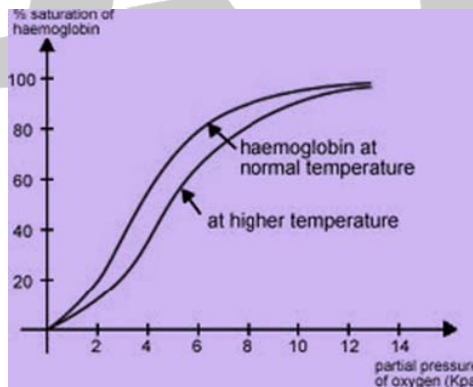
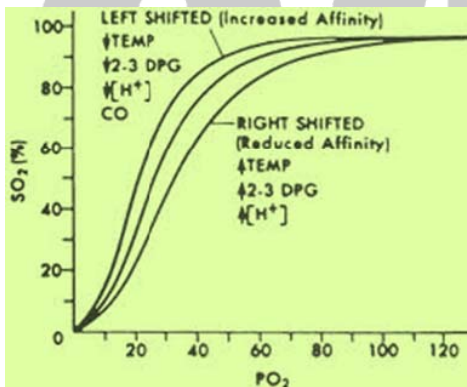
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7. Explain Oxygen – haemoglobin dissociation curve.

- It explains the relationship between percent saturation of haemoglobin and PO_2 .
- PO_2 is plotted on X – axis and percent saturation of haemoglobin on Y—axis.

% saturation of Hb	Number of O_2 Molecules bind with Hb
100%	4
75%	3
50 %	2

- About 97 % of Hb is saturated in systemic arteries, where PO_2 is about 95 mm Hg.
- About 75 % of Hb is saturated in resting cells where PO_2 is about 40 mm Hg.
- Very less % of Hb is saturated in active tissues like skeletal muscles where PO_2 is much below 40 mm Hg. Here dissociation of oxyhaemoglobin occurs.
- Decrease in pH, increase in CO_2 , increase in temperature increase unloading of O_2 from oxyhaemoglobin.
- In these conditions, oxygen-haemoglobin dissociation curve shifts to the right side. Effect of CO_2 and H^+ ions on oxygen-affinity of Hb is known as Bohr Effect



LONG ANSWER QUESTIONS:

1. Explain the transportation of Oxygen and Carbondioxide.

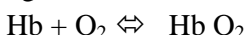
Blood transports O_2 from lungs to tissues and CO_2 from tissues to lungs.

A) **TRANSPORT OF O_2 :** Plasma and RBC transport O_2 .

I) **As Dissolved Oxygen:** O_2 does not easily dissolve in water so only about 3 % of O_2 is transported in dissolved state in blood plasma.

II) **As Oxyhaemoglobin:**

- About 97 % of O₂ binds with haemoglobin and form Oxyhaemoglobin.
- Each haemoglobin molecule can carry 4 O₂ molecules at one time.
- At lungs Oxyhaemoglobin is formed by the binding of O₂ with haemoglobin due to high O₂ tension in lungs.



- At tissues, where O₂ tension is low, oxyhaemoglobin dissociates into Haemoglobin & O₂

III) Oxygen-Haemoglobin Dissociation Curve

- It explains the relationship between percent saturation of haemoglobin and PO₂.
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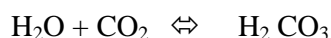
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B) TRANSPORT OF CARBON DIOXIDE;

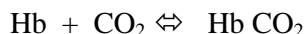
Transport of CO₂ occurs in 3 forms—

→ **As dissolved CO₂** : About 7 % of CO₂ is dissolved in plasma at tissues.

In lungs, it diffuses into alveolar air.



→ **As Carbaminocompounds** : about 23 % of CO₂ is transported as carbamino compounds. CO₂ combines with amino groups of plasma proteins and amino groups of amino acids of haemoglobin and form carbaminohaemoglobin.

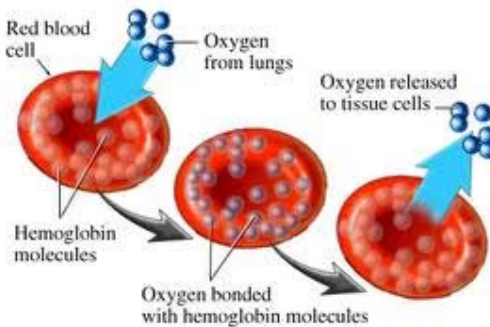
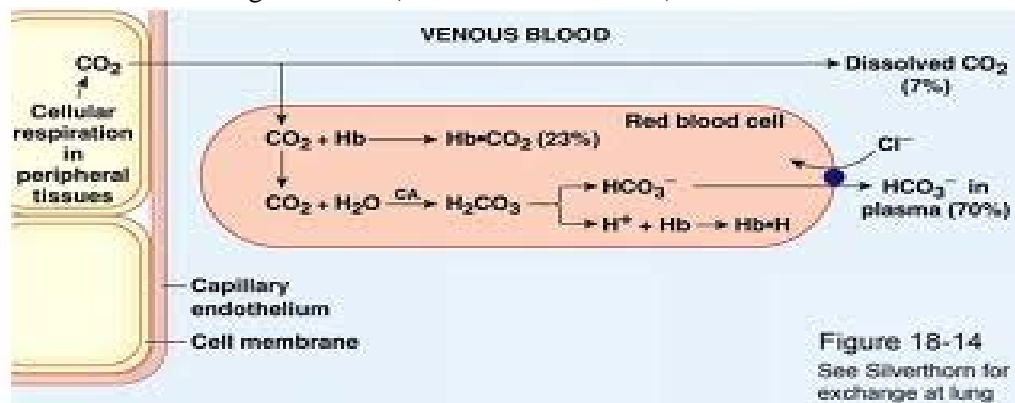


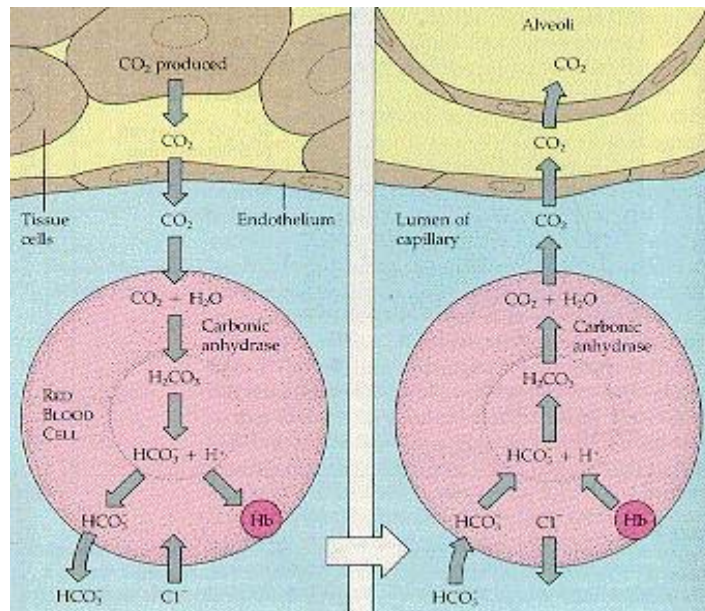
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3. Explain the mechanism of breathing and exchange of gases in rabbit.

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- ➔ Thoracic cavity in rabbit is bound dorsally by vertebral column, ventrally by sternum, posteriorly by a dome shaped muscular diaphragm and laterally by 12 pairs of ribs.

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- ➔ Decrease in thoracic cavity causes elastic recoil of lungs and eexpulsion of air from alveoli into atmosphere. Forceful expiration is an active process as it involves the contraction of internal intercostals muscles and abdominal muscles.

Pulmonary gas exchange and systemic gas exchange.

- ➔ Partial pressure is the pressure exerted by an individual gas in a mixture of gases.
- ➔ The rate of gas exchange depends on 1)partial pressure of gases
2) Solubility of gases 3)Surface area 4)Distance of diffusion

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