

IMPORTANT QUESTIONS CLASS – 11 BIOLOGY

CHAPTER -14 BREATHING AND EXCHANGE OF GASES

Question 1.

What is chloride shift? Write its significance during respiration.

Answer:

The chloride ions (Cl^-) inside RBC combine with potassium ion (K^+) to form potassium chloride (KCL), whereas hydrogen carbonate ions (HCO_3^-) in the plasma combine with Na^+ to form sodium hydrogen carbonate (NaHCO_3) Nearly 70% of carbon dioxide is transported from tissues to the lungs in this form.

In response to chloride ions (Cl^-) diffuse from plasma into erythrocytes to maintain the ionic balance. This is called the chloride shift.

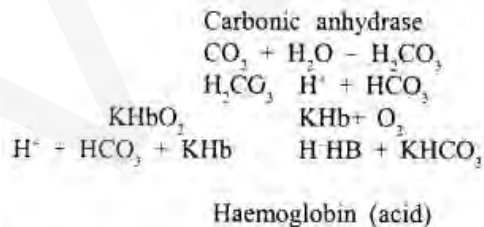
Significance: It maintains electrochemical neutrality during respiration.

Question 2.

What is the role of the carbonic anhydrase enzyme in the transport of gases during respiration?

Answer:

Carbon dioxide produced by the tissues diffuses passively into the bloodstream and passes into the red blood corpuscles where it reacts with water to form carbonic acid (H_2CO_3). This reaction is catalysed by the enzyme, carbonic anhydrase found in the erythrocytes and takes less than one second to complete the process. Immediately after its formation, carbonic acid dissociates into hydrogen (H^+) and bicarbonate (HCO_3^-) ions. The majority of bicarbonate ions (HCO_3^-) formed within the erythrocytes diffuse out into the plasma along a concentration gradient. These combine with haemoglobin to form the haemoglobin acid (H.Hb).



Question 3.

What is partial pressure? How does it help in gaseous exchange during respiration?

Answer:

During inspiration and expiration, gases move freely by the process of diffusion.

Diffusion of any molecule takes place from high to low concentration. The process of diffusion is directly proportional to the pressure caused by the gas alone. The pressure exerted by an individual gas is called partial pressure. It is represented as PO_2 , PCO_2 , and PN_2 , for oxygen, carbon dioxide and nitrogen respectively.

The inspired air ultimately reaches the alveoli of the lung, which in turn receives the blood supply of the pulmonary circulation. At this stage the oxygen of the inspired air is taken in by the blood and carbon dioxide is released into the alveoli for expiration.

In this way, the gases exchange takes place due to partial pressure.

Question 4.

How does hemoglobin help in the transport of oxygen from the lung to tissues?

Answer:

Blood is the medium for the transport of oxygen from the respiratory organ to the different tissues and carbon dioxide from tissues to the respiratory organs. 97% of the oxygen is transported from the lungs to the tissues in combination with hemoglobin ($Hb + O_2 \rightarrow HbO_2$), oxyhemoglobin and 3% is transported in dissolved condition by the plasma.

Under high partial pressure oxygen easily binds with hemoglobin in the pulmonary capillaries. When this oxygenated blood reaches the different tissues, the partial pressure of oxygen declines and the bonds holding oxygen to hemoglobin become unstable. As a result, oxygen is released from the capillaries.

Question 5.

Explain breathing disorders in brief.

Answer:

1. Asthma is caused by an allergic reaction. There is difficulty in breathing.
2. Pneumonia is caused by bacterial infection. There are fever, pain and severe cough.
3. Tuberculosis is an infectious bacterial disease of the lungs and in serious cases, blood may come out while coughing.

Question 6.

In what form O_2 is carried in blood? What happens to it when blood reaches the tissue?

Answer:

O_2 is carried in combination with the hemoglobin of RBCs and forms oxyhemoglobin.

In tissues, there is the dissociation of oxyhaemoglobin and release of O_2 . It diffuses into the tissue cells where it is used in oxidation.

Question 7.

Explain gas transport in the blood.

Answer:

It may be explained in two steps.

- (a) Transport of O_2 from lungs to tissues.
- (b) Transport of CO_2 from tissues to lungs.

A. Oxygen Transport

1. O_2 is transported in the blood via haemoglobin.
2. O_2 diffuses into RBC and combines with haemoglobin to form oxyhaemoglobin.
3. Oxyhaemoglobin breaks into haemoglobin and oxygen at the tissues, where there are high PCO_2 and PO_2 .
4. In the lungs, oxyhaemoglobin is formed due to high PO_2 and low PCO_2 .

B. CO_2 Transport: CO_2 is transported in 3 ways with blood.

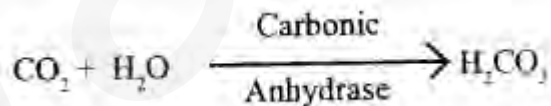
1. 70% of CO_2 in RBC reacts with H_2O to form H_2CO_3

2. The rest 30% CO_2 combining with Hb to form carbon haemoglobin. (HCO_3^- carried by RBC and plasma)

3. Some CO_2 dissolves in plasma on reaching the lungs.



And this CO_2 is expelled out through the lungs.



Question 8.

Name and explain the respiratory organs of the following,

(i) Insect

Answer:

Insect: The integument of insects is thick and highly impermeable to minimise the loss of water through the environment. The exchange of gases cannot take place through the skin covering of these insects. These insects have a highly developed complex system called the tracheal. This mode of respiration is called tracheal respiration.

(ii) Neries

Answer:

Neries: Parapodia is the respiratory organ in neries. In this organism respiratory occurs through the skin covering the parapodia (Locomotory organs), which is again very thin, moist, permeable and highly vascular.

(iii) Prawn

Answer:

Prawn: Gills, in the animals like prawns, certain molluscs, fishes, tadpoles, the process of gaseous exchange occur by special respiratory organs called gills. These are richly supplied with blood and readily absorb oxygen found dissolved in water and release CO_2 back into the water.

(iv) Birds

Answer:

Birds: (lungs). In birds and mammals, the skin is impermeable. These have a high metabolic rate and their oxygen requirement is very high. Birds have spongy lungs to have a more extensive respiratory surface. These lungs always remain in the body to keep the respiratory surface moist, which is necessary for the exchange of respiratory gases.

(v) Fishes

Answer:

Oxygen and carbon dioxide dissolves in water, and most fishes exchange dissolved oxygen and carbon dioxide in water by means of the gills.

(vi) Earthworm.

Answer:

Earthworms do not have lungs. They breathe through their skin. Oxygen and carbon dioxide pass through the earthworm's skin by diffusion

Question 9.

Define the following terms:

(a) Anaerobic respiration,

Answer:

Anaerobic respiration: It is a process that does not involve the use of molecular oxygen. Food is not completely oxidised to CO_2 and water. Less energy is present in anaerobic respiration.

(b) Breathing,

Answer:

Breathing: It is a physical process, which brings in fresh air to the respiratory surface and removes foul impure airs from the outside. It occurs outside the cells and is thus an extracellular process.

(c) Vital capacity,

Answer:

Vital capacity: It is defined as an important measure of pulmonary capacity. It is the maximum amount of air a person can expel from the lungs after first filling the lungs to their maximum extent.

Vital capacity is the sum total of inspiration reserve volume, tidal volume and expiratory reserve volume.

$$(1 + 1 + VC = IRV = TV/ERV)$$

(d) Tidal volume,

Answer:

Tidal volume: It is defined as the volume of air normally inspired or expired in one breath without doing any effort. It is about 500 ml in an adult person. It represents the volume of air, which is renewed in the respiratory system during every breathing.

(e) Respiratory centre.

Answer:

Respiratory centre: A number of groups of neurons located bilaterally in the medulla oblongata control the respiratory. These are called respiratory centres. These centres are named the dorsal respiratory group. Ventral respiratory group and pneumatic centre.

Question 10.

Write the role of the diaphragm and its Costals muscles in the breathing process.

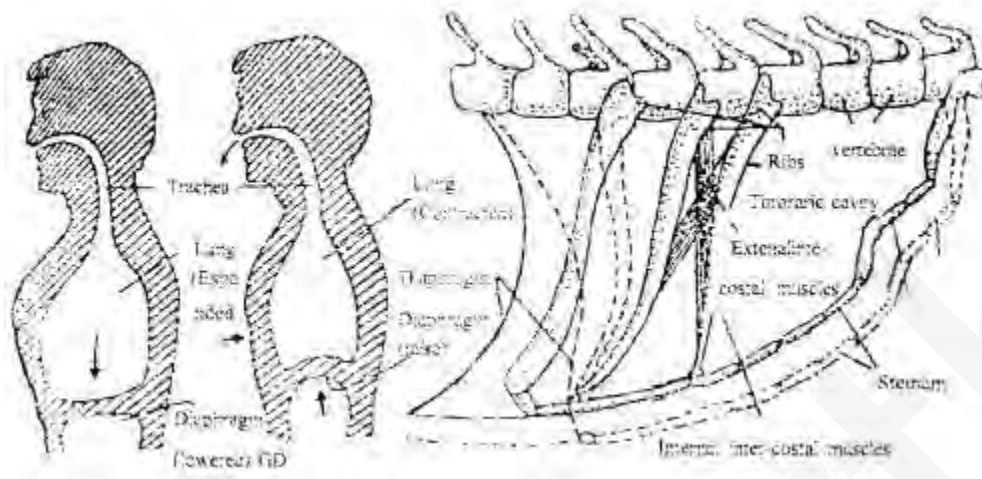
Answer:

During breathing, when the lungs contract their volumes decrease resulting in the increase of air pressure in the lungs. Hence, the air is exhaled from the lungs. These two processes are called inspiration and expiration. During normal breathing, the downward and upward movement of the diaphragm takes place. When the diaphragm, contracts, the lower surface of the lung is pulled downward consequently the volume of the lungs increases.

This causes the inhalation of air or inspiration. When the diaphragm relaxes, lungs are compressed and air exhaled, expiration takes place. The demand for extra oxygen is fulfilled by the expansion of the rib cage, during exercise when the rate of breathing increases.

During expiration, high pressure is generated in the lungs and air moves out. The upward movement of the rib cage is caused mainly by the external intercostals muscles present between the ribs along with the assistance of few other adjacent muscles.

Similarly, the downward movement of the rib cage is facilitated by the internal intercostals, external oblique and internal oblique muscles, position of the diaphragm, ribs and sternum during breathing as shown in the diagram



Position of diaphragm, ribs and sternum during breathing