Chapter - 17 Breathing and Exchange of Gases

Question-1

What are the two factors that contribute towards the dissociation of oxyhaemoglobin in the arterial blood to release molecular oxygen in an active tissue?

Solution:

The two factors that contributes towards the dissociation of oxyhaemoglobin in the arterial blood to release molecular oxygen in an active tissue are,

(i) The lower concentration of PO_2 and

(ii) Higher concentration of PCO_2.

Question-2

What do you understand by forceful expiration?

Solution:

Vital capacity is the volume of air breathed out by a maximum forceful expiration.

Question-3

What is the role of carbonic anhydrase in RBCs?

Solution:

About 70% of CO_2 reacts with water to form carbonic acid in RBCs in the presence of the enzyme, carbonic anhydrase.

Question-4

Blood vessel in the liver has blood with PO_2 of 95 mm Hg that is much higher than the PO_2 of the tissue in the liver. Does O_2 diffuses in the blood from the tissue or diffuse from blood into the tissue.

Solution:

O_2 will diffuse from the blood into the tissue.

Question-5

In mammals, the lungs replace the skin very effectively as a respiratory organ. Explain giving three reasons.

Solution:

(i) Lungs provide a very large surface area for the exchange of gases. The total alveolar surface area is nearly 100 m^2 whereas the total surface area of the skin is around 1.6m^2 only.

(ii) Alveoli are lined by thin highly permeable membranous wall. These are surrounded by many blood capillaries. They are, therefore more richly connected with blood capillaries than the skin.

(iii) Endothelium of blood capillaries and membranous walls of the alveoli are highly permeable to respiratory gases.
Therefore, the lungs replace the skin very effectively as a respiratory organ.

Question-6

What is tidal volume?

Solution:

The volume of air breathed in and out during effortless respiration.

Question-7

Why does it become difficult to breathe at high altitudes?

Solution:

At high altitudes, the concentration of oxygen becomes less. At a height of about 15,000 feet or more, the pressure also decreases along with a decrease in the oxygen content. Persons reaching such heights are unable to get the amount of oxygen required for proper functioning of their body. Due to this, sufficient oxygen does not diffuse into the blood, as a result of which the person suffers from nausea, headache and delusion. As a result he finds it difficult to breathe.

Question-8

The maximum number of molecules of oxygen which one molecule haemoglobin can carry?

Solution:

Four.

Question-9

What is pneumonia?

Solution:

Pneumonia is the disease of lungs characterized by accumulation of mucous in lungs.

Question-10

Explain how CO_2 produced during oxidation of carbohydrate in the muscles of our heart is released into the atmosphere.

Solution:

CO_2 in the plasma is absorbed by RBC as a physical solution. It is transported as carbonic acid, bicarbonates and carbonic haemoglobin. It is then carried to the heart and from there it is taken to the pulmonary artery and then to the lungs. Dissociation takes place in the alveoli and the CO_2 is finally, exhaled through the nostrils.

Question-11

Give two symptoms of bad cold.

Solution:

(i) Inflammation of mucous membrane in *Rhinitis*.

(ii) Enlargement of tonsils.

Question-12

What is the dissociation curve? Explain.

Solution:

The relationship between O_2 tension and its absorption by haemoglobin produces a graph called the oxygen dissociation curve. At about 100mm Hg, O_2 tension in Hb is 98% saturated. As it falls, the saturation of Hb decreases slowly. When O_2 tension is about 40mm Hg, oxyhaemoglobin dissociates and O_2 is available to the tissues.

Question-13

What is formed when CO_2 combines with globin of reduced haemoglobin?

Solution:

Carbaminohaemoglobin is formed when CO_2 combines with globin of reduced haemoglobin.

Question-14

How does exchange of respiratory gases take place in the alveoli of lungs?

Solution:

During intake of air, the partial pressure of oxygen (PO_2) and partial pressure of carbon dioxide (PCO_2) are 158mm Hg and 0.3mm Hg respectively. There is already a small amount of alveolar air in the lungs. This air contains less amount of oxygen and more amount of CO_2 than the inspired air. As this alveolar air mixes with the inspired air, the O_2 content and PO_2 of the alveolar air increase to about 13.1% and 100mm Hg. Whereas, CO_2 content and PCO_2 are about 5.3% and 40mm Hg.

The pulmonary artery brings the deoxygenated blood from the heart to the lungs. The blood consists of lower PO_2 than the alveolar PO_2. In the lungs, O_2 diffuses into the blood from the alveolar air and now PO_2 is about 95mm Hg. Now the O_2 content is 19.8%. This oxygenated blood is taken away by the pulmonary vein. The mixed venous blood present in the alveolar capillaries contains PCO_2 of 40mm Hg. So the CO_2 diffuses from the alveolar capillaries to the alveolar air and PCO_2 falls to 40mm Hg. In the alveoli of the lungs, O_2 is taken up by the pulmonary vein and CO_2 is given out from the blood of the pulmonary artery.

Question-15

How much is the "vital capacity" of human? Do people living on mountains have the same, less or more vital capacity as those living in the plains?

Solution:

About 3.5 – 4.5 litres. Vital capacity is higher in people living on mountains than living in the plains.

Question-16

Why is haemoglobin called conjugated protein? What happens to the molecule at high and low partial pressure of oxygen?

Solution:

Haemoglobin is called conjugated protein because it consists of a basic protein globulin and a non-protein called haem. The haemoglobin, when exposed to high partial pressure of oxygen, combines with it to form oxyhaemoglobin, which carries four molecules of oxygen loosely bound to the four Fe^{2+} ions. When this oxyhaemoglobin reaches the tissues where there is low oxygen pressure, oxyhaemoglobin dissociates into oxygen and deoxyhaemoglobin.

Question-17

Write an equation to represent an aerobic respiration.

Solution:

$C_6H_{12}O_6$ + enzymes ###ERROR###à $2C_2H_5OH + 2CO_2$ + 54 Kcals energy

Question-18

Give at least four points of difference between aerobic and anaerobic respiration.

Solution:

The four points of difference between aerobic respiration and anaerobic respiration are as follows:

Aerobic respiration	Anaerobic respiration
(i) It takes place in the presence of oxygen.	(i) It takes place in the absence of oxygen.
(ii) It takes place in two steps - the first step is glycolysis, which is carried out in the cytoplasm and the second step is the Kreb's cycle, which takes place in the mitochondria.	(ii) The complete process takes place outside the mitochondria, in the cytoplasm.
(iii) Complete oxidation of glucose takes place.	(iii) Incomplete oxidation of glucose takes place.
(iv) During this process, 38 ATP molecules per gram mole of glucose are formed.	(iv) During this process, 2 ATP molecules per gram mole of glucose are formed.

Question-19

Which organelle in the cell is associated with the production of energy?

Solution:

Mitochondrion is the organelle in the cell which is associated with the production of energy.

Question-20

Write the difference between carbamino-haemoglobin and oxyhaemoglobin.

Solution:

Carbamino-haemoglobin	Oxyhaemoglobin
Carbon dioxide when enters the erythrocytes combines with globin, part of deoxy haemoglobin as a result of which carbamino- haemoglobin is formed.	Oxygen diffuses into erythrocytes and combines with the Fe^{2+} ions of haemoglobin and forms oxyhaemoglobin

Question-21

Why is it not healthy to breath in a closed room for a very long time?

Solution:

In a closed room there is no provision of fresh air coming into the room. The oxygen already present in the air of that room shall be gradually consumed. If more number of people are sitting in a room the percentage of oxygen will go on decreasing and the percentage of carbon dioxide would go on increasing by continuous use of oxygen during respiration. Thus it is not a healthy sign to breath in a closed room for a very long time.

Question-22

What happens to the leg muscle of an athlete who runs a marathon race?

Solution:

While running a marathon race, the internal muscle respires anaerobically as they do not get the required increased supply of oxygen at that time. This results in the deposition of lactic acid in them. As a result of the lactic acid deposition, the leg muscles feel cramps. Lactic acid, thus produced will be oxidised later by other tissues.

Question-23

The venous blood in the lungs has a PCO_2 of 46mm Hg. Should the alveolar PCO_2 exceed or be less than 46mm Hg to result in diffusion of CO_2 from the blood into the alveolus?

Solution:

Less (40 mm Hg).

Question-24

Why is haemoglobin called conjugated protein?

Solution:

Haemoglobin is called conjugated protein because it consists of a basic protein globin and a non-protein haem.

Question-25

Write any three differences between larynx and pharynx.

Solution:

Larynx	Pharynx
It produces sound.	It does not produce sound.
It has a cartilaginous framework.	It has no cartilaginous framework.
It is a passage for air only.	It is a passage for both food and air.

Question-26

Define external respiration.

Solution:

External respiration is the biophysical process where uptake of oxygen and elimination of carbon dioxide takes place.

Question-27

Differences between aquatic and terrestrial respiration.

Solution:

Aquatic respiration	Terrestrial respiration
It occurs mainly through gills and moist body wall.	It occurs mainly through the lungs.
The oxygen is absorbed from the water.	The inhalation of oxygen occurs from the atmosphere.
Respiratory pigments and process of respiratory exchange between the internal medium and tissue are not well developed.	The respiratory pigments and the process of respiratory exchange between the internal medium and tissues are well developed.

Question-28

What is the role of carbonic anhydrase in RBC's?

Solution:

About 70% of CO reacts with water to form carbonic acid in RBCs in the presence of enzyme carbonic anhydrase.

Question-29

Why do you breathe faster while running?

Solution:

The metabolism of food increases due to the supply of more energy to the body, while running. Due to this process more carbon dioxide is added into the blood and its concentration in the blood is increased above normal, which stimulates the respiratory center in the brain. The respiratory center sends the stimulus to the muscles of ribs and diaphragm through the nerves for faster and deeper respiration. Thus we breathe faster during running or hard physical work.

Question-30

Name the artery, which supplies blood to the alveolar capillaries.

Solution:

Pulmonary artery.

Question-31

What is pulmonary respiration?

Solution:

Respiration by lungs is termed as pulmonary respiration.

Question-32

Which part of the brain controls the respiratory process in the vertebrates.

Solution:

Respiratory center which is situated in the floor of medulla oblongata is the part of brain that controls the respiratory process in the vertebrates.

Question-33

What is epiglottis?

Solution:

Epiglottis is the structure situated in the pharyngeal region, the function of which is to close the open larynx during food swallowing so that food particles do not enter the respiratory tract.

Question-34

When haemoglobin content is less what disease occurs?

Solution:

Anaemia.

Question-35

By what process does yeast derive energy from food?

Solution:

Yeast derives energy by the anaerobic fermentation of glucose into ethanol.

Question-36

What is normal rate of breathing in man?

Solution:

15 to 20 times per minute.

Question-37

What is the percentage of O_2 in the inspired and expired air?

Solution:

Inspired air – 21 % of oxygen and expired air - 16 % of oxygen.

Question-38

Name the structure, which prevent the collapsing of trachea.

Solution:

Cartilaginous rings.

Question-39

Name the process of respiration, which takes place in the absence of oxygen.

Solution:

Anaerobic respiration.

Question-40

Is the energy released during respiration liberated immediately or is it stored somewhere and utilized as and when required?

Solution:

The energy released during respiration is stored in small chemical compounds known as ATP.