

**Class: 11**  
**Subject: Biology**  
**Topic: Breathing and exchange of gases**  
**No. of Questions: 25**

Q1. What are the two factors that contribute towards the dissociation of oxyhaemoglobin in the arterial blood to release molecular oxygen in an active tissue?

Sol. The two factors that contribute 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  $PCO_2$ .

Q2. What do you understand by forceful expiration?

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

Q3. What is the role of carbonic anhydrase in RBCs?

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

Q4. 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  $O_2$  diffuse in the blood from the tissue or diffuse from blood into the tissue.

Sol.  $O_2$  will diffuse from the blood into the tissue.

Q5. In mammals, the lungs replace the skin very effectively as a respiratory organ. Explain giving three reasons.

Sol.

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

Q6. What is tidal volume?

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

Q7. Why does it become difficult to breathe at high altitudes?

Sol. 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.

Q8. The maximum number of molecules of oxygen which one molecule haemoglobin can carry?

Sol. Four.

Q9. What is pneumonia?

Sol. Pneumonia is the disease of lungs characterized by accumulation of mucus in lungs.

Q10. Explain how  $\text{CO}_2$  produced during oxidation of carbohydrate in the muscles of our heart is released into atmosphere.

Sol.  $\text{CO}_2$  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  $\text{CO}_2$  is finally, exhaled through the nostrils.

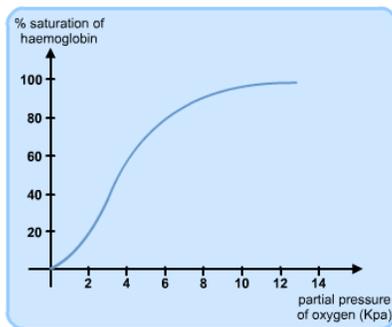
Q11. Give two symptoms of bad cold.

Sol.

- (i) Inflammation of mucous membrane in Rhinitis.
- (ii) Enlargement of tonsils.

Q12. What is the dissociation curve? Explain.

Sol.



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

Q13. What is formed when  $CO_2$  combines with globin of reduced hemoglobin?

Sol. Carbaminohaemoglobin is formed when  $CO_2$  combines with globin of reduced hemoglobin.

Q14. How does exchange of respiratory gases take place in the alveoli of lungs?

Sol. 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 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.

Q15. 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?

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

Q16. Why is haemoglobin called conjugated protein? What happens to the molecule at high and low partial pressure of oxygen?

Sol. 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.

Q17. Give at least four points of difference between aerobic and anaerobic respiration.

Sol. 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.   | 1. 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. | 2. The complete processes takes place outside the mitochondria, in the cytoplasm. |

|   |  |
|---|--|
| (iii) Complete oxidation of glucose takes place.                                | 3. Incomplete oxidation of glucose takes place.                              |
| (iv) During this process, 38 ATP molecules per gram mole of glucose are formed. | 4. During this process, 2 ATP molecules per gram mole of glucose are formed. |

Q18. Which organelle in the cell is associated with the production of energy?

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

Q19. Write the difference between carbamino-haemoglobin and oxyhaemoglobin.

Sol.

| 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 $\text{Fe}^{2+}$ ions of haemoglobin and forms oxyhaemoglobin |

Q20. Why is it not healthy to breath in a closed room for a very long time?

Sol. 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 during respiration. Thus it is not a healthy thing to breath in a closed room for a very long time.

Q21. What happens to the leg muscle of an athlete who runs a marathon race?

Sol. While running a marathon race, the internal muscle respire 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 oxidized later by other tissues.

Q22. The venous blood in the lungs has a  $\text{PCO}_2$  of 46mm Hg. Should the alveolar  $\text{PCO}_2$  exceed or be less than 46mm Hg to result in diffusion of  $\text{CO}_2$  from the blood into the alveolus?

Sol. Less (40 mm Hg).

Q23. Why is haemoglobin called conjugated protein?

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

Q24. Write any three differences between larynx and pharynx.

Sol.

| 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. |

Q25. Define external respiration.

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

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