

Unit 10: Human Respiratory System

Short Questions

SHORT ANSWER QUESTIONS EXERCISE

Respiratory System of Man

Q1. Define respiratory surface and list its properties.

Ans. Respiratory surface is the area where actual gas exchange between environment and the blood takes place. Following are its properties.

- (i) Moist thin and permeable epithelium
- (ii) Located internally
- (iii) Has blood supply
- (iv) Well ventilated

Q2. How nasal cavity perform its functions?

Ans. Function of Nasal Cavity

1. As inhaled air flows through the nasal cavity it is warmed and humidified by blood vessels present very close to its surface.
2. Hairs in the nose and mucous produced by mucous membranes trap larger foreign particles in air before they go deeper into respiratory tract.

Q3. Trace the path of air through different parts of the respiratory system.

Ans. Air → nostrils → nasal cavity → pharynx → larynx → trachea → bronchi → bronchioles → alveolar duct → Alveoli.

Q4. Describe the structure and function of alveoli.

Ans. Alveoli are made of moist epithelial tissues only 0.1 micro meter thick. A network of tiny blood capillaries surround the alveolus. Oxygen in the air inside the alveoli is absorbed by the blood via diffusion.

Q5. What is the role of diaphragm during inhalation and exhalation?

Ans. During inhalation the diaphragm contracts and take a more flattened shape. This causes expansion of lungs, lowering air pressure in lungs and the air moves in. During exhalation diaphragm relaxes it takes dome like shape. This causes contraction of lungs, increasing air pressure in lungs and the air moves out.

Q6. What are the three ways of the transport of carbon dioxide in blood?

Ans.

1. 72% of CO₂ is transported in blood as bicarbonate.
2. 20% of CO₂ is carried as Carboxyhaemoglobin.
3. 8% of CO₂ is carried dissolved in water of blood plasma.

Q7. What are the advantages of having millions of alveoli rather than a pair of simple balloon-like lungs?

Ans. Millions of alveoli provide a large total surface area for gas exchange. They are also located internally and does not lose water to the atmosphere.

Q8. Differentiate between:

- (a) Internal and external respiration
- (b) Upper and lower respiratory tract
- (c) Bronchi and bronchioles
- (d) Haemoglobin and myoglobin

Ans.

(a) Internal and external respiration

Inter respiration (also called as cellular respiration) is metabolism of glucose in the cell to get energy.

External respiration involves breathing and exchange of oxygen and carbon dioxide in capillaries

(b) Upper and lower respiratory tract

Upper respiratory tract includes nasal cavity, pharynx and larynx while lower respiratory tract includes trachea, bronchi, bronchioles and alveoli.

(c) Bronchi and bronchioles

Trachea branches at the bottom into two branches and called bronchi. These bronchi enter the lung and form secondary bronchi which divides into tertiary bronchi which branch further to form small bronchioles.

(d) Haemoglobin and myoglobin

Haemoglobin is oxygen carrying protein found in RBCs in blood. Myoglobin is oxygen storing protein found in the muscles.

SLO BASED SHORT QUESTION ANSWERS

Respiratory System of Man

Q9. What are the largest organs of respiratory tract?

Ans. Lungs are the largest organs of respiratory system which are covered by two

membranes. Each lung is divided into lobes. Right lung is larger having three lobes. The left lung is smaller and contains two lobes.

Q10. What properties enable respiratory surfaces for effective diffusion of gases?

Ans. The following properties enable respiratory surfaces for effective diffusion of gases across them.

- It is moist and permeable, so that gases may pass through it.
- It has thin walls, so that gases have to travel minimum distance.
- It has blood supply, so that gases can diffuse in and out of blood.
- It has structural support, to remain open and does not collapse.
- It is located internally, that is why it has moist surface which does not lose water to the atmosphere.
- Air ventilates over it i.e., moves towards and away from it.
- Air reaches to it after passing a branched tubular way, so that air becomes saturated with water vapour before reaching it.

Q11. What do you mean by respiratory tract? Give its division.

Ans. The organs of the respiratory system form a continuous system of passages, called the respiratory tract, through which air flows into and out of the body. The respiratory tract has two major divisions: the upper respiratory tract and the lower respiratory tract.

Upper Respiratory Track: It consists of nasal cavity, pharynx and larynx.

Lower Respiratory Track: The lower respiratory tract includes trachea, bronchi, bronchioles and lungs.

Q12. What are vocal cords. How they produce sound.

Ans. Vocal cards are two bands of smooth muscles. The vocal cords vibrate when air flows over them to produce sound.

Q13. Why is larynx called voice box?

Ans. Larynx is called voice box it contains two bands of smooth muscles called vocal cords. These vocal cords vibrate when air flows over them and produce sound.

★Q14. What happen if swallowed material enters the larynx?

Ans. If swallowed material enter the larynx it irritates the larynx and stimulates a strong cough reflex. This helps to expel the material out of the Larynx and into the throat.

★Q15. How sound produced in larynx?

Ans. Muscles in the larynx move the vocal cords apart to allow breathing. Other muscles in the larynx move the vocal cords together to allow the production of vocal sounds. The latter muscles also control the pitch of sounds and help control their volume.

Q16. Write a note on layers of lungs.

Ans. The lungs are the largest organs of the respiratory tract. The outside of each lung is covered by two membranes. First membrane, visceral pleura, lines the lungs while the second membrane, parietal pleura, lines the inner wall of thoracic cavity.

Q17. What is pleural cavity? Give its function?

Ans. The small space between visceral and parietal pleural membranes, called pleural cavity is filled with fluid. This fluid allows the lungs to expand and contract freely during breathing.

Q18. What do you know about lobes of lungs?

Ans. The right lung is larger and contains three lobes. The left lung is smaller and contains two lobes. The smaller left-lung allows space for the heart.

★Q19. What is surfactant in alveoli? Give its function.

Ans. Some epithelial cells of alveoli secrete a liquid called surfactant, which lines the inside of alveoli. It prevents the alveoli from collapsing and sticking together when air moves out of them. In healthy lungs, surfactant is constantly secreted and reabsorbed.

★Q20. Write functions of pulmonary arteries and pulmonary veins.

Ans. Pulmonary arteries carry deoxygenated blood to the lungs and pulmonary veins carry oxygenated blood back to the heart.

Q21. Define breathing. Name the muscles involving in this process.

Ans. The movement of the air in and out of the body is called breathing or ventilation. It is done by creating negative and positive pressures in the lungs. This role is played by two sets of muscles i.e., (i) diaphragm (dome like large skeletal muscle that separates thoracic cavity and abdomen) and (ii) the intercostal muscles.

★Q22. What is effect of atmospheric pressure at high altitudes?

Ans. Atmospheric pressure is lower at high altitude. It requires greater increase in the space of thorax for inspiration. That is why it is difficult to breathe at high altitudes. Due to this reason athlete often undertake high altitude training before competitions

Q23. What are intercostal muscles. Give their role during breathing

Ans. Intercostal muscles are present between each pair of ribs. During inspiration the intercostal muscles contract and raise the ribs to expand rib cage while during expiration the intercostal muscles relax. Ribs are lowered and ribcage moves inward.

Q24. Differentiate between inspiration and expiration.

Ans.

Inspiration	Expiration
• Taking in air into the lungs is called inspiration or inhalation. • Diaphragm contracts and take more flattened shape. • Intercostal muscle contract. • Ribs moves upwards and outwards, expanding the ribs. • Thoracic cavity volume increases. • Lungs expand due to pleural membrane adherence.	• Moving the air out of lungs is called expiration or exhalation. • Diaphragm relaxes and becomes dome-shaped. • Intercostal muscles relax. • Ribs moves downwards and inwards, reducing rib cage volume. • Thoracic cavity volume decreases. • Lungs recoil due to elastic tension.

Q25. How breathing is controlled?

Ans. The process of breathing is controlled by respiratory center located in the medulla oblongata i.e. part of brain stem. Neuron from this center send impulse to diaphragm and intercoastal muscles, stimulating them to contract causing inspiration and vice versa.

Transport of Gases

Q26. Why blood plasma has less oxygen dissolved into it.

Ans. Blood plasma can dissolve a maximum of only about 3ml O₂ per litre. Yet whole blood carries almost 200ml O₂ per litre! The reason is that most of the oxygen is not dissolved in blood plasms but is bound to molecules of haemoglobin inside the RBCs.

Q27. Differentiate between oxyhaemoglobin and deoxyhaemoglobin.

Ans. Oxyhaemoglobin is bright red while deoxyhaemoglobin is dark red, this imparts bluish tinge to tissues. Due to these color changes, arteries carrying oxygenated blood are indicated with red color while veins carrying deoxygenated blood with blue color.

★Q28. What is significance of oxygen reserve in blood?

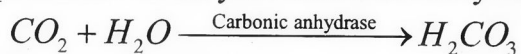
Ans. The oxygen reserve ensures that the blood contains enough oxygen to maintain life for four to five minutes if breathing is interrupted or if heart stops pumping.

Q29. Define Bohr effect.

Ans. The CO_2 produced by tissues lowers the pH of blood. This lowered pH reduces haemoglobin's affinity for oxygen and thus causes it to release oxygen more readily. The effect of pH on haemoglobin's affinity for oxygen is known as the Bohr effect.

Q30. How does carbonic acid is produced in RBCs?

Ans. Approximately 72% of carbon dioxide is carried in the blood as bicarbonate ions. CO_2 enters the RBCs and combines with water to form carbonic acid (H_2CO_3) in the presence of enzyme carbonic anhydrase.



★Q31. Give importance of carbonic acid.

Ans. Formation of carbonic acid is important in maintaining the acid base balance of the blood because bicarbonate serves as the major buffer of the blood plasma.

Q32. Define Hamburger phenomenon.

Ans. Carbonic acid (H_2CO_3) disassociates to form hydrogen ions (H^+) and bicarbonate ions (HCO_3^-). The hydrogen ion readily associates with oxyhaemoglobin and oxygen

of oxyhaemoglobin is released to the tissue. While the bicarbonate ions (HCO_3^-) is facilitated by a transporter that exchanges one chloride ion (Cl^-) for a bicarbonate ion (this is called the "chloride shift" or "Hamburger phenomenon").

Q33. Do CO_2 and O_2 compete to bind with haemoglobin?

Ans. CO_2 binds to the protein portion of haemoglobin while O_2 binds to the haem irons. So, both do not compete for attachment to haemoglobin.

★Q34. What is meant by carbon monoxide poisoning?

Ans.

- Incomplete combustion of fuels like wood, gasoline, propane or natural gas produce, CO (carbon monoxide) gas.
- If gas heaters are left burning overnight in closed rooms, CO accumulate in them.
- Carbon monoxide enters the body through inhalation and binds to haemoglobin with much higher affinity than oxygen.
- This binding reduces the amount of hemoglobin to transport oxygen to the body tissues, leading to tissue oxygen efficiency hypoxia.
- This leads to condition called CO poisoning.
- Its symptoms include headache, dizziness, weakness, nausea, confusion shortness of breath, chest pain and loss of consciousness.
- In severe cases it can cause permanent brain damage, and even death.

Respiratory Pigments

Q35. What are respiratory pigments? Give their functions. Also write their names.

Ans. Respiratory pigments are special proteins in blood or tissues and are involved

in transporting oxygen throughout body. They also serve for other purposes e.g., O₂ storage, CO₂ transport, and transport of substances other than respiratory gases. The two well-known respiratory pigments are haemoglobin and myoglobin.

Q36. Describe the structure of haemoglobin?

Ans. Haemoglobin is a protein present in RBCs. A haemoglobin molecule is composed of four globin (globular) polypeptide chains (two α chains and two β) and four haem groups. There are 141 and 146 amino acids in the α and β chains, respectively. Each polypeptide chain is folded in such a way that it contains a pocket where the haem group binds. So, each chain is associated with a haem group. A haem group consists of an iron held in a porphyrin ring. The iron ion is attached with four nitrogen atoms of the polypeptide chain. Under higher partial pressure of oxygen, iron ion attaches a molecule of O₂. In this way, one haemoglobin molecule can carry up to four O₂ molecules.

★Q37. What are bonds in polypeptide chains of haemoglobin?

Ans. The four polypeptide chains of haemoglobin are bound to each other by salt bridges, hydrogen bonds, and hydrophobic effect.

Q38. What is myoglobin? Give its function.

Ans. Myoglobin is the oxygen-binding protein in skeletal and cardiac muscle cells of vertebrates. It gives a distinct red or dark gray colour to muscles.

Q39. How the structure of myoglobin makes it more oxygen binding protein?

Ans. It is a monomer composing of a singly polynucleotide chain (made of 153 amino acids) and contains a single haem group. Therefore, it is capable of binding

with a single O₂ molecule. The binding affinity of myoglobin is high as compared to that of haemoglobin. As a result, myoglobin serves as the oxygen-strong protein in muscles. It releases oxygen when the partial pressure of oxygen is below 20mm Hg. In this way, myoglobin provides oxygen to the muscles when they need.

Respiratory Disorders

Q40. Enlist respiratory tract disorders.

Ans. Respiratory disorders can range from common cold to more severe diseases.

Upper respiratory tract infections

- Sinusitis
- Otitis media

Lower respiratory tract infections

- Pneumonia
- Pulmonary tuberculosis

Disorders of lungs

- COPD
- Emphysema

Q41. What is sinusitis? Give its symptoms.

Ans. It is the inflammation of the lining off the sinuses (four paired air-filled spaces that surround the nasal cavity i.e., under the eyes; above the eyes; between the eyes and behind the eyes). It may be acute (lasts for 7 to 10 days) or chronic (lasts longer than 12 week).

Symptoms of sinusitis include fever, plugged nose, pus-like nasal discharge, loss of sense of smell, facial pain, a feeling that phlegm is falling from the back of nose into throat, and headache that is sometimes aggravated by bending over.

Q42. What do you know about Otitis media? Also write its symptoms and treatment.

Ans. It is the inflammation of the middle ear. Otitis may be acute (rapid onset) or chronic (lasts more than six weeks).

Cause: The common cause of otitis media accumulation of fluid in Eustachian tube, which cannot be drained from the middle ear. When this fluid is not drained, it allows the growth of bacteria and viruses in the middle ear that lead to otitis media.

Symptoms of otitis media include severe ear pain, pulling at one or both ear, fever draining from ear(s), loss of balance, and hearing difficulties.

Treatment include oral and topical pain killers and antibiotics (if caused by bacterial infection).

Q43. How pneumonia affects lungs? Give the main cause of this disease.

Ans. Pneumonia is a form of acute respiratory infection.

Cause: It can lead to life-threatening illness. In pneumonia, the alveoli of one or both lungs are inflamed and are filled with pus and fluid. It makes breathing painful and limits oxygen intake.

Pneumonia is most commonly caused by viruses or bacteria. It is the single largest infectious cause of death in children worldwide.

A variety of organisms, primarily bacteria (particularly *Streptococcus pneumoniae* or viruses (e.g., human rhinovirus) and less commonly fungi, can cause pneumonia.

★Q44. What was the death rate of children in 2017 due to pneumonia?

Ans. Pneumonia killed more than 808000 children under the age of 5 in 2017, according for 15% of all deaths of children under 5 years.

Q45. What is pulmonary tuberculosis? Give its treatment.

Ans. Tuberculosis (TB) is a chronic infection caused by bacteria *Mycobacterium tuberculosis*. The tuberculosis of the lungs is called **pulmonary tuberculosis**. It is highly

contagious and spreads through cough or sneezes. The bacteria enter the lungs, multiply and cause inflammation and damage to the lung tissue, including the alveoli. The damage to the alveoli can lead to the formation of small cavities or holes in the lung tissue, which can make it difficult for the lungs to function properly.

Treatment includes the use of multiple antibiotics over a long period of time (for 9 months) regularly.

Q46. What is COPD? Give its symptoms and treatment.

Ans. Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory disease of lungs.

Causes: The common causes of COPD are tobacco smoking, long terms exposure to harmful pollutants and chemical fumes etc. A small percentage of genetic predisposition (protein alpha-1 antitrypsin deficiency) can also develop COPD, even without smoking or significant exposure to pollutants.

Symptoms: The symptoms of COPD are **persistent cough with mucus** (sputum), **shortness of breath wheezing chest, fatigue and frequent respiratory tract infections.**

Treatment: COPD is incurable but by minimizing exposure to smoke pollutants, and chemicals this disease can slow its progression. Other therapies include bronchodilators, inhaled corticosteroids, pulmonary rehabilitation and oxygen therapy. In some severe cases, surgery such as lung transplantation may be considered.

★Q47. Write a note on chronic bronchitis.

Ans. Chronic bronchitis: Chronic bronchitis is a type of COPD. It involves inflammation and narrowing of the bronchial tubes in the lungs. It leads to

increased mucus production, which can further block the airways and make breathing difficult. This disease lasts for three months to two years. It is caused by long-term exposure to irritants such as cigarette smoke, air pollution or industrial dusts.

Symptoms of chronic bronchitis are almost same as of COPD such as wheezing, shortness of breath, chest tightness and frequent respiratory infections.

Chronic bronchitis can be managed by quitting smoking. Other treatments are bronchodilators, pulmonary rehabilitation, and in some cases oxygen therapy.

Q48. What is emphysema? How it is caused?

Ans. Emphysema is a type of COPD. In emphysema, the inner walls of alveoli are damaged, causing them to eventually rupture. This creates one larger air space instead of many small ones and reduces the surface area available for gas exchange.

Cause: The primary cause of emphysema is smoking. It can also be caused by long-term exposure to air pollution, dust, or chemical fumes. Emphysema disease can also be caused by a genetic deficiency of a protein called alpha-1 antitrypsin.

LONG QUESTIONS (EXERCISE)

Q1. Describe the mechanism of inhalation and exhalation.

Ans. See Q5. of theory.

Q2. Describe the transport of oxygen through blood.

Ans. See Q7. of theory.

Q3. Describe the transport of carbon dioxide through blood.

Ans. See Q9. of theory.

Q4. Describe the structure and function of haemoglobin.

Ans. See Q10. of theory.

Q5. Describe the causes, symptoms and treatment of sinusitis.

Ans. See Q12. of theory.

Q6. Describe the causes, symptoms and treatment of pneumonia and pulmonary tuberculosis.

Ans. See Q14. and Q15. of theory.

Q7. Describe causes, symptoms and treatment of emphysema.

Ans. See Q18. of theory.

INQUISITIVE QUESTIONS

Q1. How does the structure of the alveoli optimize the exchange of gases like O_2 and CO_2 ?

Ans. Alveoli wall is only 0.1 micrometre thick and also moist. Due to these two factors the gaseous exchange is optimized.

Q2. How do disease like Chronic obstructive pulmonary disease effect gaseous exchange?

Ans. In Chronic obstructive pulmonary disease cause inflammation resulting in narrowing of bronchial tubes in the lungs. It leads to increase mucus production which block the airways. This ultimately affects the gaseous exchange efficiency.

Q3. Can you explain the process of external respiration and internal respiration in context of gaseous exchange respiration?

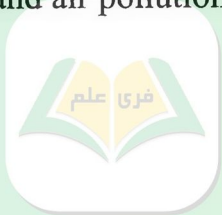
Ans. During external gaseous exchange i.e. intake of O_2 and out take of CO_2 takes place at the alveoli level. While during internal respiration the oxygen is taken in and CO_2 is given out at cellular level during cellular respiration.

Q4. How does the transport of oxygen in blood stream affects cellular respiration?

Ans. About 97% of the haemoglobin within RBCs combines with oxygen and becomes oxyhaemoglobin. As the blood travels through the blood capillaries oxyhaemoglobin releases oxygen. Here 75% of haemoglobin is left saturated It means that 22% of the oxyhaemoglobin has released its oxygen to the tissues for use in cellular respiration.

Q5. What are environmental factors that can influence gaseous exchange in human?

Ans. Gaseous exchange can be influenced by environmental factors like temperature, humidity, altitude, and air pollution.



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