

Respiratory System

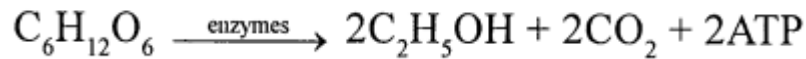
Synopsis —

- The energy released during respiration is stored as chemical energy in the form of ATP — adenosine tri-phosphate.

- **Aerobic respiration —**



- **Anaerobic respiration —**



- During vigorous exercise, the cells respire anaerobically and form lactic acid which accumulate in the muscle cells causing fatigue and pain.
- **The respiration in humans occur in three phases:**
 1. Breathing
 2. Gaseous Transport
 3. Cellular respiration
- The oxygen inhaled combines with haemoglobin present in the red blood cells forming an unstable compound called **oxyhaemoglobin**.
- The nasal chamber has got hairy lining to prevent dust particles from reaching the lungs. The lining also has mucous to trap germs and dust.
- The common passage for the food and air is the **pharynx**.
- Trachea is also called the **wind pipe**.
- The voice box or the Adam's apple is the **larynx** which contains ligamentous folds called **vocal cords**.
- Incomplete closure of epiglottis during swallowing causes coughing.
- The trachea is formed of incomplete C-shaped cartilaginous rings which keep them permanently distended.
- The lungs are protected outside by the two membranes called **outer** and **inner** pleura.
- Left lung is slightly smaller than the right lung.
- Left lung has two lobes while the right lung has three lobes.

Component	inspired air	expired air
O ₂	21%	16%
CO ₂	0.03%	4%
N ₂	79%	79%
Water vapors	low	high

- Breathing is an involuntary act.
- Even after maximum forced expiration, some air is left in the lungs called **residual volume**.
- In normal adults, the breathing rate is 12-18/minute while a newborn breathes at about 60 breaths per minute.

- Asphyxiation is a condition in which blood becomes venous by the accumulation of excess carbon dioxide and the oxygen supply is diminished.
- The gas composition in artificial respiration is 95% oxygen, 5% carbon-di-oxide.
- **Snoring:** Vibration of soft palate during breathing when mouth is kept open while sleeping.
- **Sneezing:** It is a protective mechanism through which a foreign irritant particle is thrown out of the lungs suddenly and forcefully.
- **Hiccups:** Jerky incomplete inspiration due to blockage of the respiratory tract.

Review Questions

Multiple Choice Questions

1. Put a tick (✓) against the most appropriate alternative in the following statements.

(i) In humans, taken in of the air through nostrils into the nasal cavity is called

- (a) Inhalation
 (b) Exhalation
 (b) Cellular respiration
 (d) Internal respiration

(ii) The front opening of the wind pipe is guarded by —

- (a) Glottis
 (b) Exoglottis
 (c) Epiglottis
 (d) Trachea

(iii) The process during which food is oxidised and energy is released is called

- (a) Cellular respiration
 (b) Excretion
 (c) Digestion
 (d) Transpiration

Short Answer Questions

1. Answer briefly the following:

1. Why do our body cells require oxygen ?

Ans. Body cells require oxygen for the break down of glucose and release energy for carrying out various life functions.

2. What is the difference between breathing and respiration?

Ans. Breathing is a simple physical process of drawing in air through the nostrils

and expelling it out.

Respiration is a chemical process which involves the breakdown of food and release energy.

3. Name the by-product formed during the oxidation of food.

Ans. The by- products formed are

1. carbon-di-oxide
2. water

4. Name the agency which transports oxygen to all parts of the body.

Ans. Blood .

5. What is the role of epiglottis during swallowing ?

Ans. Epiglottis closes the wind pipe at the time of swallowing.

Question 2.

Describe in brief the function of ribs and diaphragm in breathing.

Answer:

1. **Ribs muscles**—During inhalation, the ribs muscles contract and push the ribs upward and outward.
During exhalation these relax and cause the ribs to return to original position.
2. **Diaphragm:** During inhalation it becomes flattened while during exhalation it relaxes and moves up and back into convex (dome) shape.

Question 3.

Name the gas which is expelled out during expiration. Where is it originally produced in our body ?

Answer:

The gas which is expelled during expiration is carbon-di-oxide. It is produced as a result of oxidation of glucose in the tissues. (Cellular respiration)

Question 4.

Name the following:

1. Respiratory process
2. in which oxygen is not utilized.
Ans. Cellular respiration
3. Respiratory process in which oxygen is utilized.
Ans. Gaseous transport
4. The microscopic air-sacs of the lungs.
Ans. Alveoli
5. The two membranes which protect the lungs.
Ans. Outer pleura, inner pleura

Long Answer Questions:

Question 1.

Why is a respiratory system necessary ?

Answer:

Respiratory system is very important for the body. Respiration in human beings is divided into two distinct parts. The first part involves taking in oxygen from the air or what we commonly call breathing. The respiratory system is responsible for breathing in and out of air, and exchange of gases. The main parts of the respiratory system consist of the nostrils, trachea or wind pipe and lungs.

The blood, then, transports the oxygen to the individual cell where it is used for the chemical process of respiration. This is known as cellular respiration. The second part involves taking out carbon dioxide, which is a waste product of cellular function.

Question 2.

What factors are most likely to affect the breathing rate ?

Answer:

Breathing is a necessary function for human beings. It supplies oxygen for a process called cellular respiration, which is how cells manufacture the energy they need for their life functions.

There are lots of things that can affect the rate of breathing in humans and they are:

1. Exercise is one of those things, particularly aerobic exercise. Aerobic exercise is any exercise that causes the person to breathe more, such as running jogging, playing basketball, football, running track, or playing soccer.
2. Even Breathing rate also changes while the person is sleeping, sitting at rest or even after climbing the stairs.
3. Another factor that can influence breathing rate is allergic reactions to stimuli from the environment, such as pollen. This can inflame the passageways leading to the lungs, making them smaller, requiring more air.
4. Smoking is a habit that can influence the development of lung cancer, which in turn influences the rate a person breathes.
5. Nervous conditions and reactions to stimuli also influence the breathing rate, such as the fumed "fight or flight" syndrome.

Question 3.

What happens to the energy liberated during respiration?

Answer:

The energy liberated during respiration is utilised for carrying out various life processes. Some of the energy liberated during the breakdown of the glucose molecule, is in the form of heat, but a large part of it is converted into chemical energy called Adenosine Triphosphate (ATP). Any activity inside the cell is carried out by the energy released by these ATP molecules.

Question 4.

What do you understand by inhalation and exhalation ? How are they different from each other ?

Answer:

The physical process, by which the air containing oxygen is drawn into the lungs and air containing carbon dioxide is forced out from lungs is called breathing. Breathing involves two steps, inhalation (inspiration) and exhalation (expiration).

Inhalation (Inspiration)

1. Ribs move upwards and outwards.
2. Diaphragm is pushed downwards and flattens.
3. Volume of chest cavity increases.
4. Lungs expand, air pressure becomes low.
5. Atmospheric air at higher pressure rushes into the lungs

Exhalation (Expiration)

1. Ribs move downwards and inward.
2. Diaphragm moves upwards and becomes dome shaped.
3. Volume of chest cavity decreases.
4. Lung size reduces, air pressure becomes high.
5. Air rushes out of lungs as atmospheric air pressure is lower.

Question 5.

What do you understand by the term respiratory diseases ? Name any three common respiratory diseases.

Answer:

Any of the diseases and disorders that affect human respiration are called Respiratory diseases. Diseases of the respiratory system may affect any of the structures and organs that have to do with breathing, including the nasal cavities, the pharynx (or throat), the larynx, the trachea (or windpipe), the bronchi and bronchioles, the tissues of the lungs, and the respiratory muscles of the chest cage.

1. **Bronchitis** — It is a respiratory infection in which the lining of the bronchi becomes inflamed. As this irritated membrane begins to swell, it narrows or shuts off the bronchial passages, resulting in breathlessness and coughing spells.
2. **Asthma** — It is a chronic disease that also causes inflammation and swelling in the airways. But this happens periodically. During an asthmatic attack, a patient experiences tightness in the chest, shortness of breath and wheezing. This condition improves considerably with medication.
3. **Pneumonia** — It is a respiratory infection caused by a bacteria. This bacteria enters the air sacs, multiplies there and the air sacs may get filled with fluid. This disease causes chest pain, chills and high fever.

Question 6.

State the cause and treatment for the following diseases

1. Tuberculosis
2. Pneumonia
3. Bronchitis

Answer:

1. **Tuberculosis — Cause:** Caused by bacteria that can spread by air, dust or sputum.
Treatment: BCG vaccine, antibiotic — Streptomycin.
2. **Pneumonia — Cause:** Mainly caused by bacteria inhaled through air or by contact.
Treatment: Antibiotics—Penicillin.
3. **Bronchitis — Cause:** This respiratory infection is mainly caused by a virus. Air pollution and smoking can also cause bronchitis.
Treatment: Drinking plenty of fluids, following a well balanced diet, frequent hand washing and adequate rest can prevent and improve bronchitis.

ADDITIONAL QUESTIONS

A. Fill in the blanks.

1. The respiration is of two types **aerobic** and **anaerobic**.
2. In human beings, exchange of gases takes place in **lungs**.
3. Bronchi divide into smaller tubes called **bronchioles**.
4. **Haemoglobin** is present in the red blood cells and helps in the transport of oxygen.
5. **Diaphragm** is a muscular membrane present below the lungs.
6. Malpighian body consists of Bowman's capsule and **glomerulus**.
7. Sweat serves to excrete excess of **water urea** and **salts**.

B. Write true or false for each statement. Rewrite the false statements correctly.

1. Respiration and breathing are two different processes.
True
2. Breathing is a chemical process.
False. Respiration is a chemical process.
3. The oxidation of food to release energy and water is called breathing.
False. The oxidation of food to release energy and water is called Respiration.
4. The exchange of gases through the skin is called cutaneous respiration.
True
5. The trachea branches into two tubes called bronchioles.
False. The trachea branches into two tubes called bronchi.
6. The microscopic air sacs present in the lungs are called bronchi.
False. The microscopic air sacs present in the lungs are called alveolar sacs.

7. The walls of alveoli are richly supplied with veins.
False. The walls of alveoli are richly supplied with blood capillaries.
8. The mature roots and woody stems of certain trees have openings called lenticels.
True

C. Arrange the following organs in the correct order to show the path of air.

1. trachea, nose, bronchioles, bronchi, larynx, alveoli, pharynx, lungs

Answer:

nose, pharynx, larynx, trachea, bronchi, lungs, bronchioles.

D. Differentiate between

Question 1.

Aerobic respiration and Anaerobic respiration.

Answer:

Aerobic Respiration

1. It takes place in the presence of oxygen.
2. Complete oxidation of food takes place.
3. 38 molecules of ATP are produced by oxidation of one gram mole of glucose.
4. CO_2 and H_2O are the end products.

Anaerobic Respiration

1. It takes place in the absence of oxygen.
2. In complete oxidation of food takes place.
3. 2 molecules of ATP are produced by oxidation of gram mole of glucose.
4. Ethyl alcohol ($\text{C}_2\text{H}_5\text{OH}$) and CO_2 are the end products.

Question 2.

bronchi and alveoli.

Answer:

Bronchi

1. The two branching tube of trachea are called bronchi.
2. There are two bronchi
3. The walls of bronchi are not richly supplied with blood capillaries.

Alveoli

1. The out growths of microscopic air sacs are called alveoli.
2. There are millions of alveolar sacs.
3. The walls of the bronchioles are richly supplied with blood capillaries.

Question 3.

Breathing and Respiration.

Answer:

Breathing

1. It is a physical process.
2. Air containing oxygen is taken into the lungs and air loaded with carbondioxide is given out.
3. Lungs are mainly involved.

Respiration

1. It is a catabolic process
2. Oxygen taken in is used in oxidizing glucose and energy is released.
3. Occurs in tissues and cells of the body.

Question 4.

Bowman's capsule and alveolus.

Answer:

Bowman's capsule

1. It is a part of kidney i.e. a excretory unit.
2. It is cup shaped structure at the end of **nephron**.
3. It helps in filtration of blood

Alveolus

1. It is a part of using i.e.a respiratory unit.
2. It is the outgrowth of air sacs (alveolar sacs).
3. It helps in exchange of gases (CO_2 and O_2).

E. Find the odd one out. Give reasons for your choice.

1. ureter, kidney, urinary bladder, lung, urethra
Ans. lung, because all others are organs of excretory system and it is a respiratory organ.
2. skin, heart, lung, liver, kidney
Ans. Heart because it helps to pump blood in our body and the rests help in excretion.
3. tannin, urine, latex, resin
Ans. urine, because it is excretory product of animals and rests are excretory products of plants.

F. Write short answers.

- Ans.** The process of conversion of glucose molecules in food into energy rich molecules, carbondioxide and water with the help of oxygen is known as respiration.

- Ans.** ATP is the energy currency of cell its full form is Adenosine Triphosphate.

- Ans.** The exchange of gases through moist skin and blood capillaries underneath is called cutaneous respiration.

- Ans.** Diaphragm moves up and down and helps in the exchange of air between the atmosphere and lung

It involves a series of chemical reactions controlled by different enzymes. The energy released in the process is stored in the form of energy rich substance called ATP (Adenosine triphosphate). The ATP molecules are stored in the cells and later on can be broken down to release energy for various metabolic activities. The entire process

takes place partially in the cytoplasm and partially in the mitochondria of our body cells. The process of conversion of glucose molecules in food into energy rich molecules, CO_2 and water with the help of oxygen is known as respiration

Question 3.

How is aerobic respiration different from anaerobic respiration ?

Answer:

Aerobic respiration

1. It occurs in the presence of oxygen
2. It occurs inside the mitochondria.
3. Complete oxidation of food takes place.
4. The end products are CO_2 and water.
5. 38 ATP molecules are produced by oxidation of one gram mole of glucose.

Anaerobic respiration

1. It occurs in the absence of oxygen.
2. It occurs outside the mitochondria.
3. Incomplete oxidation of food takes place.
4. Ethyl alcohol or lactic acid are the end products.
5. 2 ATP molecules are produced by oxidation of one gram mole of glucose.

Question 4.

What happens to Oxygen after it enters the lungs?

Answer:

Each lung contains millions of alveoli. The walls of the alveoli are richly supplied with blood capillaries. The air which reaches the alveoli after passing through trachea, bronchi, bronchioles is rich in oxygen and contains very little CO_2 . The blood capillaries of the alveoli contain blood that has more carbon dioxide and little oxygen. The oxygen diffuses from the thin walls of the capillaries into the blood and combines with hemoglobin in the red blood cells of blood thereby forming oxyhaemoglobin. Hemoglobin is a type of protein which contains iron. The blood carries oxygen to all the cells of the body. In the cells a series of chemical reactions, CO_2 , water and energy are released. The carbon dioxide released combines with the hemoglobin to form carbaminohaemoglobin. Then the blood rich in carbaminohaemoglobin leaves the cells and reaches the alveoli where CO_2 gas is released and is exhaled out through the nose.

Question 5.

Why is it better to breathe through your nose than your mouth?

Answer:

It is better to breathe through our nose than our mouth because our nasal cavity is lined by hair. The air we breathe in contains fine dust particles. These particles get trapped in the hair in the nasal cavity and are thereby prevented from reaching the lungs. The inside of the nose is also covered by a sticky fluid called mucus. Dust and germs stick to the mucus and thus, the air taken in is cleaned. The air is also warmed up by blood vessels present in the nasal cavity