

## Class-10subject-science

### Chapter 6 Respiration

#### Introduction to Respiration

- Respiration broadly means the exchange of gases.
- Animals and plants have different means of exchange of gases.
- At a cellular level, respiration means the burning of the food at the for generating the energy needed for other life processes.
- Cellular respiration may take place in the presence or absence of oxygen.

#### Respiration in Humans

- The human respiratory system is more complex and involves breathing, exchange of gases and cellular respiration.
- A well defined respiratory system helps breathing and exchange of gases.
- Breathing involves the inhalation of oxygen and exhalation of carbon dioxide.
- The gaseous exchange takes place in the lungs and oxygen is supplied to all cells of the body.
- Cellular respiration takes place in each and every cell.

#### Respiratory System

- The human respiratory system involves the nose, nasal cavities, pharynx, larynx, trachea/windpipe, bronchi, bronchioles and alveoli.
- Bronchioles and alveoli are enclosed in a pair of lungs.
- The rib cage, muscles associated with the rib cage and diaphragm, all help in inhalation and exhalation of gases.
- Exchange of gases takes place between an alveolar surface and surrounding blood vessels.
- Alveoli provide a large surface area for exchange of gases.

#### Physiology of Respiration

- Breathing in humans is facilitated by the action of internal intercostal and external intercostal muscles attached to the ribs and the diaphragm.
- When the dome-shaped diaphragm contracts and becomes flattened and the rib cage is expanded due to the action of intercostal muscles, the volume of the lungs increases, pressure there drops down and the air from outside gushes in. This is inhalation.
- To exhale, the diaphragm relaxes, becomes dome-shaped again, chest cavity contracts due to the action of intercostal muscles, the volume inside the lungs decreases, pressure increases and the air is forced out of the lungs.
- Inhaled air increases the concentration of oxygen in the alveoli, so oxygen simply diffuses into the surrounding blood vessels.
- Blood coming from cells has more concentration of carbon dioxide than outside air and thus carbon dioxide simply diffuses out of the blood vessels into the alveoli.
- Thus, breathing takes place due to the combined action of intercostal muscles and diaphragm while the exchange of gases takes place due to simple diffusion.

#### Inhalation and Exhalation

- The process of taking in air rich in oxygen is called inhalation.
- Similarly, the process of giving out air rich in carbon dioxide is called exhalation.
- One breath comprises one inhalation and one exhalation.
- A person breathes several times in a day.
- The number of times a person breathes in one minute is termed as his/her breathing rate.

#### Diffusion

Diffusion is the movement of molecules from high concentration area to the low concentration area without spending any energy.

#### Cellular Respiration

Cellular respiration is set of metabolic reactions occurring inside the cells to convert biochemical energy obtained from the food into a chemical compound called adenosine triphosphate (ATP).

- Metabolism refers to a set of chemical reactions carried out for maintaining the living state of the cells in an organism. These can be divided into two categories:
- Catabolism – the process of breaking molecules to obtain energy.
- Anabolism – the process of synthesizing all compounds required by the cells.
- Therefore, respiration is a catabolic process, which breaks large molecules into smaller ones, releasing energy to fuel cellular activities.
- Glycolysis, Krebs cycle and electron transport chain are the important processes of the cellular respiration.

### Aerobic Respiration

Aerobic respiration is a process in which the food i.e. glucose is converted into energy in the presence of oxygen.

- The general equation of aerobic respiration as a whole is as given below-

Glucose + oxygen  $\Rightarrow$  Carbon-dioxide + Water + Energy

- This type of respiration takes place in animals, plants and other living organisms.

### Respiration in Lower Animals

- Lower animals lack a sophisticated respiratory system like lungs, alveoli etc.
- Respiration in them takes place by simple exchange mechanisms.
- Animals like earthworms take in gases through their skin.
- Fishes have gills for gaseous exchange.
- Insects have a tracheal system, which is a network of tubes, through which air circulates and gaseous exchange takes place.
- Frogs breathe through their skin when in water and through their lungs when on land.

### Respiration in Muscles

- Respiration in muscles can be anaerobic when there is not enough oxygen.
- Glucose gets broken down to carbon dioxide and lactic acid.
- This results in the accumulation of lactic acid that makes the muscles sore.
- This type of anaerobic respiration is also known as lactic acid fermentation.

#### ATP

- It is the energy currency of the cell.
- ATP stands for Adenosine Tri-Phosphate.
- This molecule is created as a result reaction like photosynthesis, respiration etc.
- The three phosphate bonds present in the molecule are high energy bonds and when they are broken, a large amount of energy is released.
- Such released energy is then used for other metabolic reactions.

#### Respiration in Plants

- Unlike animals and humans, plants do not have any specialized structures for gaseous exchange
- They have stomata (present in leaves) and lenticels (present in stems) which are involved in the exchange of gases.
- Compared to animals, plant roots, stems, and leaves respire at a very lower rate.

#### Transpiration

- Transpiration is a biological process in which water is lost in the form of water vapour from the aerial parts of the plants.
- This process occurs mainly through the stomata where the exchange of gases (oxygen and carbon dioxide) occurs.
- Transpiration helps in the transportation of water from roots to upper parts of plants and this is explained by 'transpirational pull theory'.
- Loss of water, especially from leaves, acts as a straw effect and pulls water upwards from roots.

- Transpiration also acts as an excretory mechanism in plants as it helps to get rid of excess water.

### Why Do We Need Lungs

- In unicellular organisms like an amoeba exchange of gases takes place through a general body surface by osmosis.
- In lower animals like an earthworm, the gaseous exchange takes place through their moist skin.
- The requirement of oxygen is sufficiently met by these ways.
- But as the animal starts becoming more and more complex, for example, human, the requirement of oxygen cannot be met alone by diffusion.
- Moreover, diffusion will not be able to supply oxygen to the deep-seated cells.
- This difficulty has led to the evolution of a more complex mechanism of gaseous exchange and that is the development of lungs.
- The alveoli present in the lungs provide a large surface area required for the necessary gas exchange.

Ques 1. Write difference between aerobic and anaerobic respiration.

Ques 2. Write the

difference between respiration and photosynthesis.

Ques 3. Explain the process of

respiration in plant.