Respiratory system in plants: Plants respire through tiny holes or openings called stomata. Stomata trap air and exchange of gases takes place inside plant cells.

Starch(sugar)+ oxygen ⟶ energy + carbon dioxide + water

Respiration requires air containing oxygen. But sometimes respiration takes place in the absence of oxygen. Thus, there are two types of respiration:

1. Aerobic Respiration
2. Anaerobic respiration,

Aerobic Respiration: The word aerobic means in presence of oxygen. In aerobic respiration, the food molecules are combined with oxygen and get oxidised inside cell. These food molecules are then broken down into carbon dioxide and water to release energy. All food molecules contain carbon, hydrogen and oxygen atoms. The process of oxidation converts the carbon to carbon dioxide (CO_2) and the hydrogen to water (H_2O). At the same time, this process sets free energy which the cell can use to drive other reactions. Aerobic respiration can be summed up by the following word equation:

Glucose + Oxygen $\xrightarrow{\text{Enzyme}}$ Carbon dioxide + Water + Energy

Although the energy produced is used for variety of processes, some of it always appears as heat. In 'warm-blooded' animals (birds and mammals), some of the heat released is retained to maintain their body temperature. In 'cold-blooded' animals (reptiles and fish), the heat may build up for some time and allow the animals to move about faster. In plants, the heat is lost to the surroundings as soon it is produced.

Anaerobic Respiration: The organisms like yeast and some bacteria which carry out aerobic respiration are known as anaerobes. The word anaerobic means in the absence of oxygen. In this process energy is released from food by breaking it down chemically but the reactions do not use oxygen though they often produce carbon dioxide. A common example of anaerobic respiration is the action of yeast on sugar solution. The sugar is not completely oxidized to carbon dioxide and water but is converted to carbon dioxide and alcohol. This process is called fermentation and is shown by the following word equation:

Glucose ⟶ Ethyl alcohol + Carbon dioxide + Energy

The processes of brewing (to make fermented alcoholic beverages) Dread-making rely on anaerobic respiration by yeast. Anaerobic ration takes place in small steps and needs several different enzymes. The energy produced by anaerobic respiration is much less that produced by aerobic respiration. Besides yeast, certain types of bacteria and some body tissues also respire anaerobically.

Differences between Aerobic Anaerobic Respiration

Aerobic Respiration	Anaerobic Respiration
It occurs in all living organisms.	It occurs only in some bacteria, fungi, germinating seeds and certain animal tissues.
Oxygen is required.	Oxygen is not required.
Complete oxidation of food occurs during the process.	Oxidation of food remains incomplete in this process.
Oxidation of glucose produces carbon dioxide, water and energy.	Oxidation of glucose produces ethyl alcohol and carbon dioxide. It also produces some amount of energy.

ABHYAS Academy, Behind Pragat Shiv Mandir, Near Govt. College, Nishat Cinema Road, Ambala Cantt.
Ph No. +91-171-2631595, 9416541198, e-Mail: anusethi1968@yahoo.com Website: www. abhyasonline.in

Respiration and Gaseous Exchange in Animals: We know that animals obtain energy from food they eat. Before the energy can be used by the cells of the body, it must be released from the chemicals of the food by respiration. We have seen that aerobic respiration needs a supply of oxygen to breakdown the food which releases energy. During respiration animal cells produce carbon dioxide as a waste product. All cells, therefore, must be supplied w oxygen and must be able to get rid of carbon dioxide.

Earthworm: The earthworm inhabits burrows in damp soil and emerges to feed in the darkness. Gaseous exchange occurs through its skin. The thin moist skin is supplied with a network of capillaries which absorb oxygen from the atmosphere and deliver it to the rest of the body. The absorbing surface or the network of capillaries also eliminate carbon dioxide from the body.

Insects: Some species of insects breathe through the entire body surface by diffusion. Air reaches the various parts and organs of an insect via an elaborate system of branching tubes called tracheae. The tracheae open up on the exterior body surface as spiracles. Most adult insects have two pairs of spiracles on the thorax and eight pairs on the abdomen. Large tracheal tubes run along and across the body. Smaller tracheae branch profusely from these larger ones finally forming tiny tubelets or tracheoles. Oxygen diffuses into the cells at the fine endings of the tracheal system. Carbo dioxide is carried out of the body by tracheoles too.

Grasshoppers and many other insects also have air sacs in their tracheae system. These air sacs function during vigorous body movements, speeding up the movement of gases to and from the tissues. Some insects that live in water (partially or completely) have gill-like structures, found in fish, for breathing.

Fish: Fish absorb dissolved oxygen from the water by means of gills. Fish gulps water through the mouth and forces it between the gills on each side of its head. The blood vessels present in the gills take out dissolved oxygen from the water and send this oxygen to all parts of the body. The oxygen is made use of to produce energy and carbon dioxide. The waste products and the carbon dioxide are transported back by the blood into the gills for throwing out into the surrounding.

Frogs: Exchange of gases in frog, when it is in water, takes place through its thin, moist and smooth skin that is richly supplied with blood capillaries. Frogs also have lungs to respire on land.

Respiration in Plants: In Leaves and Stem: Exchange of gases like oxygen and carbon dioxide in plants takes place through the tiny pores in the leaves known as stomata. Even the stems have openings known as lenticels that help in the exchange of gases. These pores on leaves and stems allow oxygen, carbon dioxide and water vapour to come in or go out of the plant body.

In Roots: The root cells too require oxygen to produce energy. Roots have numerous tiny hairs on them. The soil has air trapped inside it. The oxygen (air) present in the soil diffuses into the root hair and is transported to the entire plant. The waste products formed in the form of water vapour and carbon dioxide are sent back to the surrounding through root hair by the process of diffusion. The soil of the potted plant is tilled so that air can reach to the soil at the bottom of the pot. If the plant is watered continuously, then the level of oxygen will decrease because too much of water will remove all the air present between the soil particles and the plant may die due to suffocation.

ABHYAS Academy, Behind Pragat Shiv Mandir, Near Govt. College, Nishat Cinema Road, Ambala Cantt.
Ph No. +91-171-2631595, 9416541198, e-Mail: anusethi1968@yahoo.com Website: www. abhyasonline.in