



RESPIRATION IN ORGANISMS

RESPIRATION

- ✕ The process of breakdown of food in the cells of the living beings with the release of energy is called **cellular respiration**.
- ✕ During respiration, we breathe in air rich in oxygen and breathe out air rich in carbon dioxide.
- ✕ The **air rich in oxygen is transported to all parts of the body** and ultimately to each cell. This oxygen is **utilized by the cell for respiration**.

TYPES OF RESPIRATION

On the basis of the presence or absence of oxygen, respiration is classified into two types -

1. AEROBIC RESPIRATION -

- When **breakdown of food (glucose) occurs in the presence of oxygen**, it is called aerobic respiration.
- During aerobic respiration, **food (glucose) is completely broken down into carbon dioxide and water and energy is released**. It can be shown by the following equation.



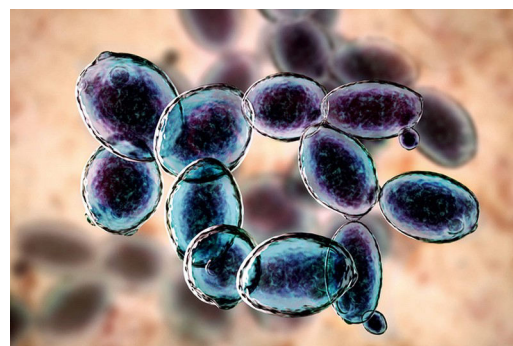
- Aerobic respiration occurs in most of the organisms such as humans, dogs, cats, lions, elephants, cows, buffaloes, goats, snakes, frogs, fishes etc.

2. ANAEROBIC RESPIRATION -

- When **breakdown of food (glucose)** takes place in the absence of oxygen, it is called anaerobic respiration.
- In this type of respiration, **food (glucose)** is not completely broken down into **carbon dioxide and water**.
- During this process an **intermediate compound is formed** with the release of less amount of energy.
- **Yeast** and certain bacteria carry out anaerobic respiration.
- The organisms that carry out respiration in the absence of oxygen are called **anaerobes**.

➤ Anaerobic Respiration in Yeast

- Yeast is a single-celled organism. In the absence of oxygen, **yeast breaks down glucose into alcohol and carbon dioxide**.
- Small amount of energy is released during this process.
- The by-product, i.e. alcohol produced in this reaction **is used in making beer and wine**.



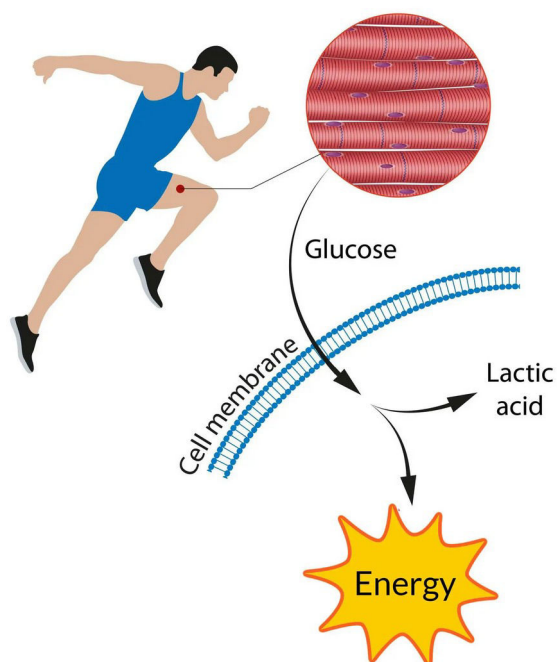
➤ Anaerobic Respiration in Muscles

- In human body, **when muscles are overworked**, e.g. during exercise, the **oxygen demand is not met through aerobic respiration**.
- Thus, muscle cells begin to respire anaerobically in low oxygen conditions due to which **glucose gets converted into lactic acid**.



- Accumulation of excess lactic acid in the muscles causes pain and leads to muscles **fatigue (cramp)**. We can get relief from muscle cramps by taking a hot water bath or massage.

- This improves the circulation of blood and therefore, oxygen supply to the muscle cells of affected area increases.
- The increased supply of oxygen results in the complete breakdown of lactic acid into carbon dioxide and water, thereby giving relief from cramps.



Differences between Aerobic and Anaerobic Respiration

Aerobic Respiration	Anaerobic Respiration
<ul style="list-style-type: none"> • It occurs in the presence of oxygen. 	<ul style="list-style-type: none"> • It takes place in the absence of oxygen.
<ul style="list-style-type: none"> • Complete breakdown of food takes place in aerobic respiration. 	<ul style="list-style-type: none"> • Partial breakdown of food occurs in anaerobic respiration.
<ul style="list-style-type: none"> • End products of aerobic respiration are CO_2 and water. 	<ul style="list-style-type: none"> • End products of anaerobic respiration are alcohol and CO_2 or lactic acid.
<ul style="list-style-type: none"> • Large amount of energy is produced during aerobic respiration. 	<ul style="list-style-type: none"> • Less amount of energy is produced during anaerobic respiration
<ul style="list-style-type: none"> • e.g. humans, dogs, fishes etc. 	<ul style="list-style-type: none"> • e.g. yeast.

BREATHING

Breathing is the process in which air rich in oxygen is taken inside the body and air rich in CO_2 is given, with the help of respiratory organ. Thus breathing involves following two steps which take place alternatively.

- (a) **Inhalation** – Taking in air rich in oxygen into our body is called Inhalation.
- (b) **Exhalation** – Giving out air rich in carbon dioxide from our body to the external environment is called exhalation.

Breathing is a continuous process which occurs all the time throughout the life of an organism.



Breathing Rate

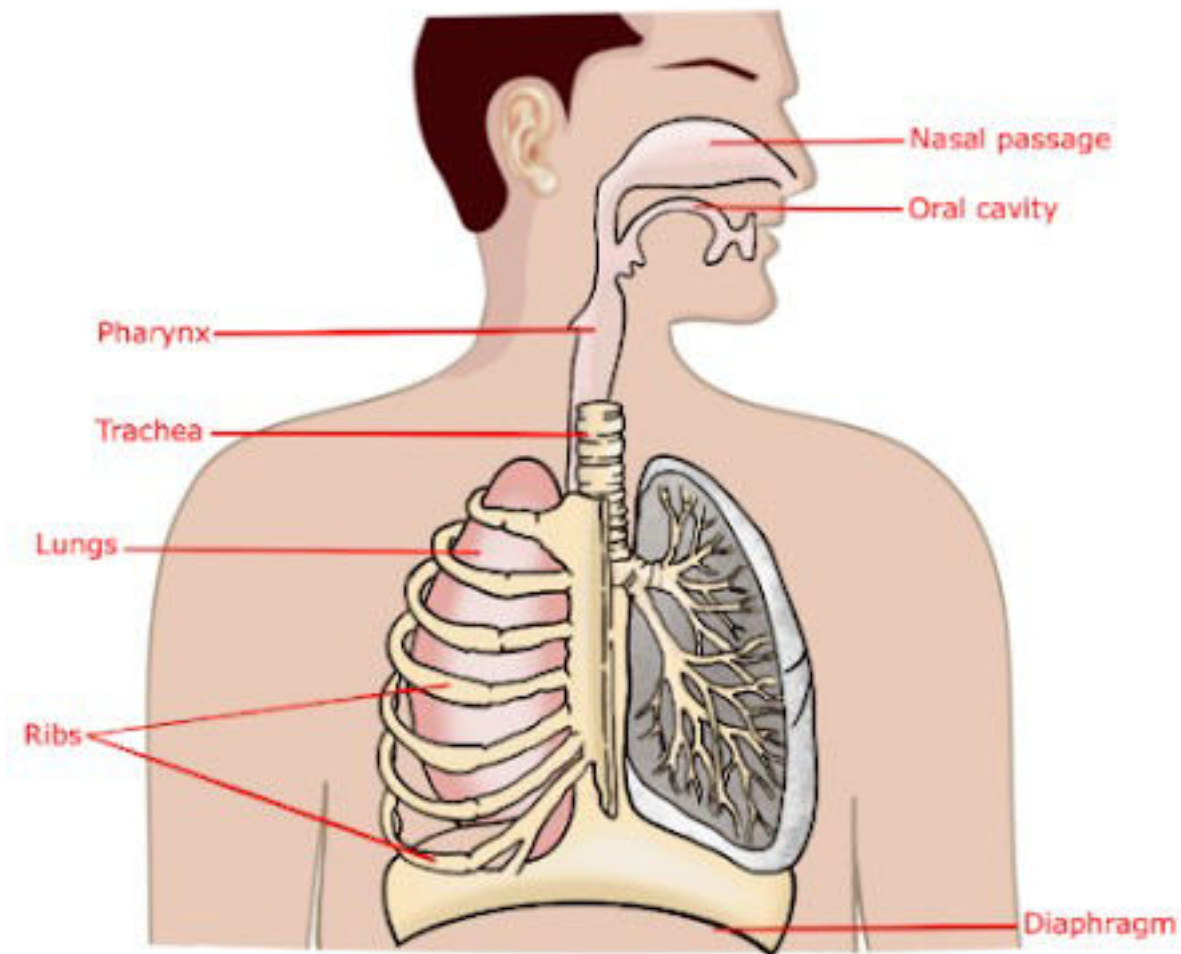
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The **number of times a person breathes in a minute** is termed as breathing rate.

Breathing rate of a person is not always constant. It changes according to the oxygen requirement of the body.

- i. During rest, an **adult human being can inhale and exhale 15-18 times** (average breathe rate of adult human being) **a minute**.
- ii. Breathing rate of **woman** is somewhat faster (**20-30 times/min**) in woman than in man.
- iii. Breathing rate is **slowest while sleeping** (as less energy is required), while maximum during heavy exercise (since much energy is required).
- iv. During **heavy exercise**, the breathing rate can **increase upto 25 times/min**. Because of this, food gets broken down at a faster rate thus, **making us feel hungry**.
- v. When we feel drowsy, sleepy or tired, we yawn (i.e., open our mouth wide to take a long and deep breathe) because our breathing rate slows down and our body does not receive sufficient oxygen.

MECHANISM OF BREATHING



The air enters into our lungs in following ways -

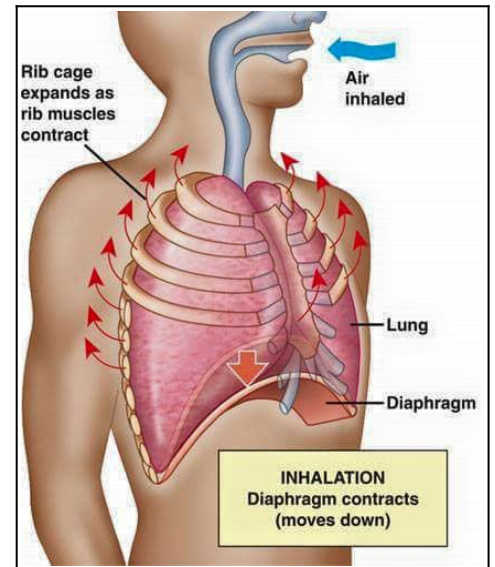
- Normally, we take in air through our **nostrils**. When we inhale air, **it passes through our nostrils into the nasal cavity**.
- From the nasal cavity, the air reaches our lungs through the windpipe or trachea.
- Lungs are present in the chest cavity. This cavity is surrounded by ribs on the sides.
- A large, muscular sheet called diaphragm forms the floor of the chest cavity.

The mechanism of breathing involves the movement of the diaphragm and ribcage. The complete process of breathing is discussed as follow.

• Breathing In (Inhalation)

- ✕ The term inhalation refers to the process of taking in air into the lungs. It occurs in the following steps -

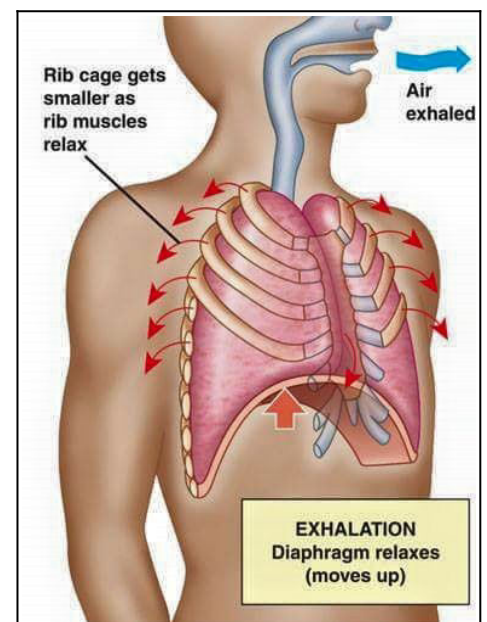
- When we breathe air in (or inhale) two processes occurs together, i.e. the ribcage moves upwards and outwards, while the diaphragm contracts and moves downwards.
- The movement of the ribcage and diaphragm increases the space in the chest cavity.
- As the chest cavity becomes larger, it sucks air from outside and the lungs get filled with air and expands.



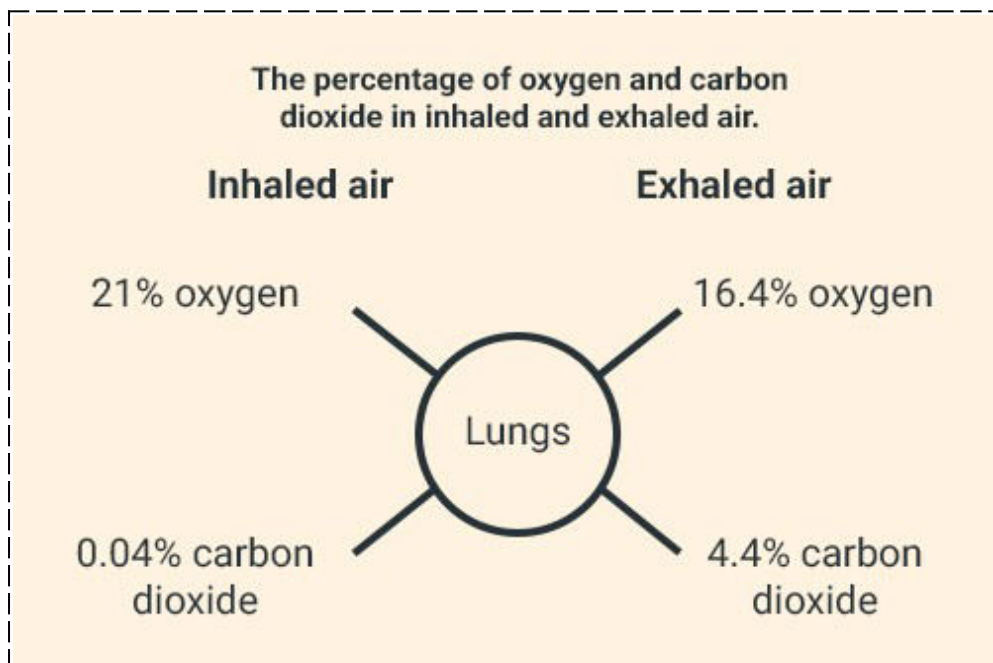
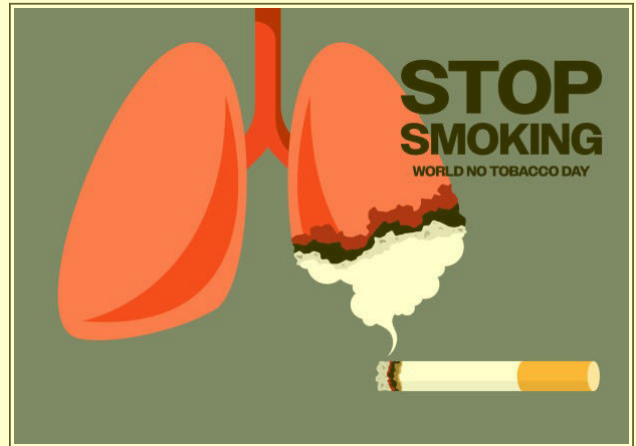
• Breathing Out (Exhalation)

- ✕ The term exhalation refers to the expulsion of the carbon dioxide rich air from the lungs to the outside. It is basically a reverse process of inhalation. It occurs in the following steps-

- When we breathe air out (or exhale), the reverse process takes place, i.e. the ribcage moves downwards and inwards, while the diaphragm relaxes and moves upwards.
- This movement of the rib cage and diaphragm decreases the space in our chest cavity.
- When the chest cavity becomes smaller, air is pushed out of the lungs.



SMOKING damage lungs as while smoking, the chemicals present in the tabacoo enter our body. These chemicals damage the lungs in many ways, thus making breathing difficult and causing lung cancer, heart disease, etc.



SNEEZING

The air around us has various types of unwanted particles, such as smoke, dust, pollens etc. When we inhale, the particles get trapped in the hair present in our nasal cavity. However, sometimes these particles may get past the hair in the nasal cavity. This may irritate the lining of the cavity, as a result of which we sneeze.

Sneezing expels these foreign particles from the inhaled air and a dust-free, clean air enters our body.

NOTE: Always cover your nose while sneezing so that the foreign particles you expel are not inhaled by other persons.



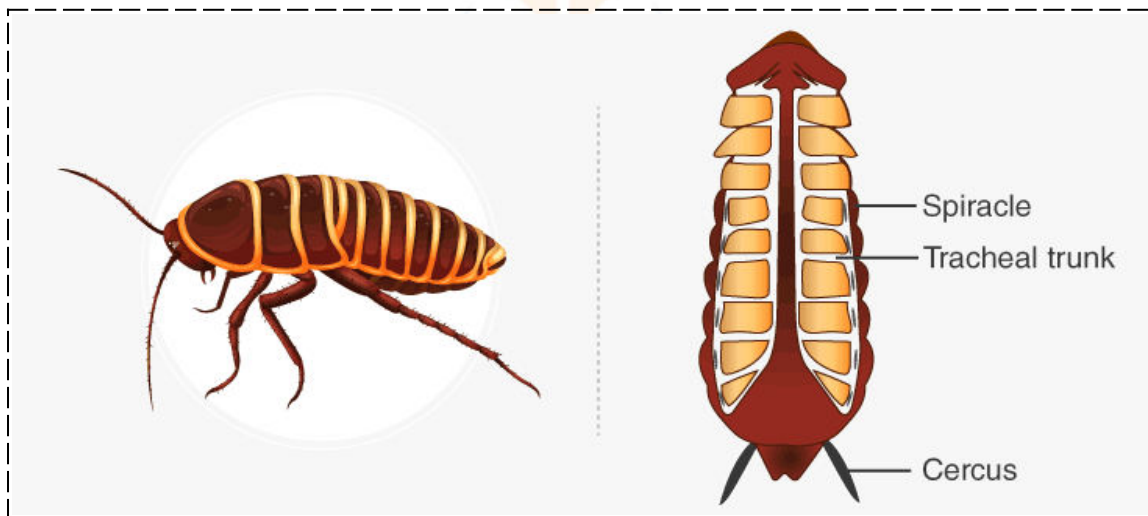
BREATHING IN OTHER ANIMALS

- ✕ Different animals possess different organs for the exchange of oxygen and carbon dioxide. Animals such as elephant, lions, crow, snakes, birds etc. Have lungs in their chest cavities just like humans, for respiration.
- ✕ The smaller animals like cockroaches, earthworms, fishes, ants and mosquitoes do not have lungs.

Therefore, respiration in these animals takes place by other means.

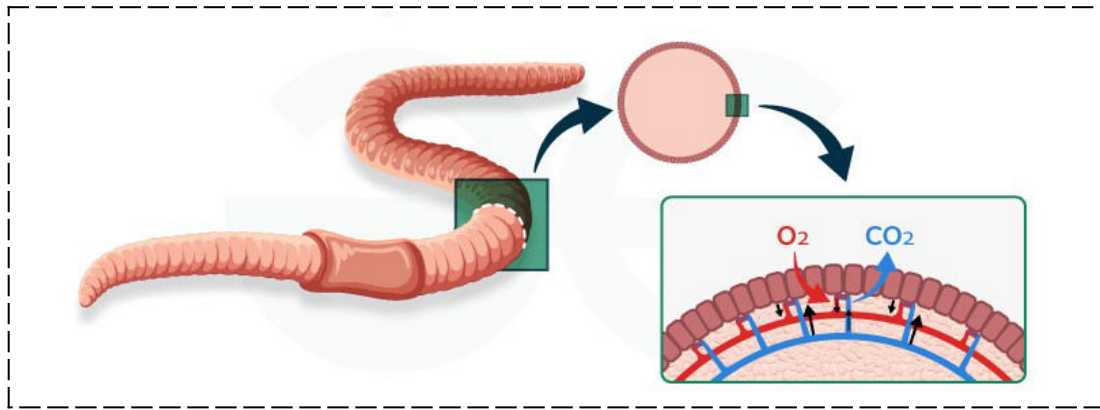
COCKROACH

- ✕ Insects like Cockroach, grasshoppers, etc. Have **small openings** on the sides of its body. These openings are called **Spiracles**.
- ✕ They have a network of air tubes called **tracheae** for gas exchange.
- ✕ Air enters through spiracles into the tracheal tubes, diffuses into the body tissues, and reaches every cell of the body.



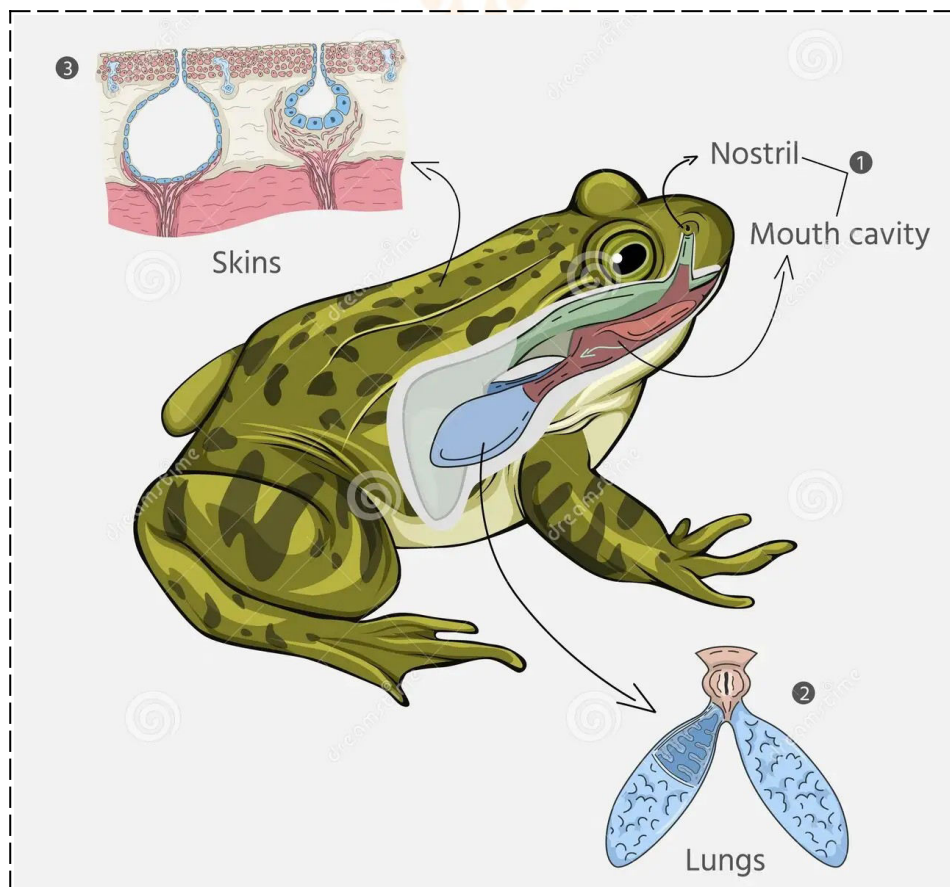
EARTHWORM

- ✕ Earthworms and leeches **breathe through their moist and slimy skin** because gases can easily pass through it.
- ✕ The atmospheric oxygen gets absorbed through their moist skin and transported through blood to all cells of body.



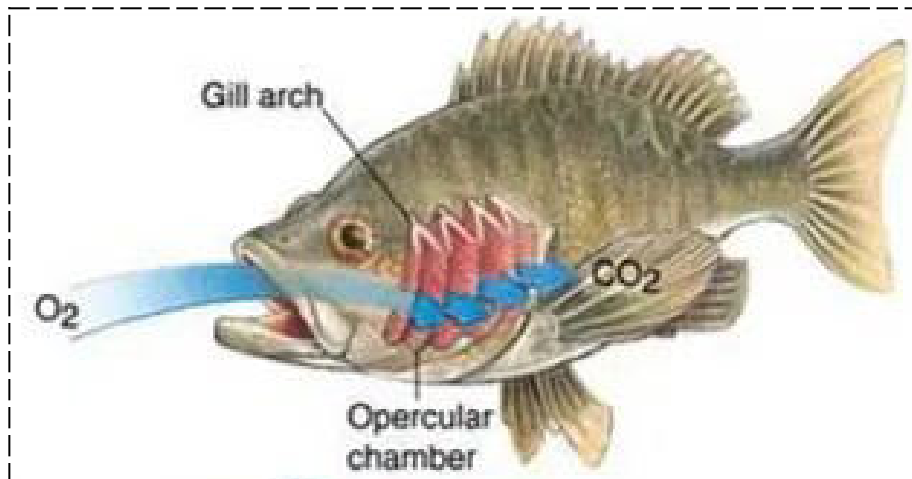
FROG

- ✗ The frog lives on land as well as in water.
- ✗ They have **lungs for breathing on land**.
- ✗ But, when **they are in water, they breathe through their moist and slippery skin**.



FISH

- ✗ Fish does not have lungs for breathing.
- ✗ They breathe through a special organ called **gill**.
- ✗ Gills are the respiratory organs in aquatic animals.
- ✗ Gills are the projections of the skin.
- ✗ Gills have blood vessels for the exchange of respiratory gasses.



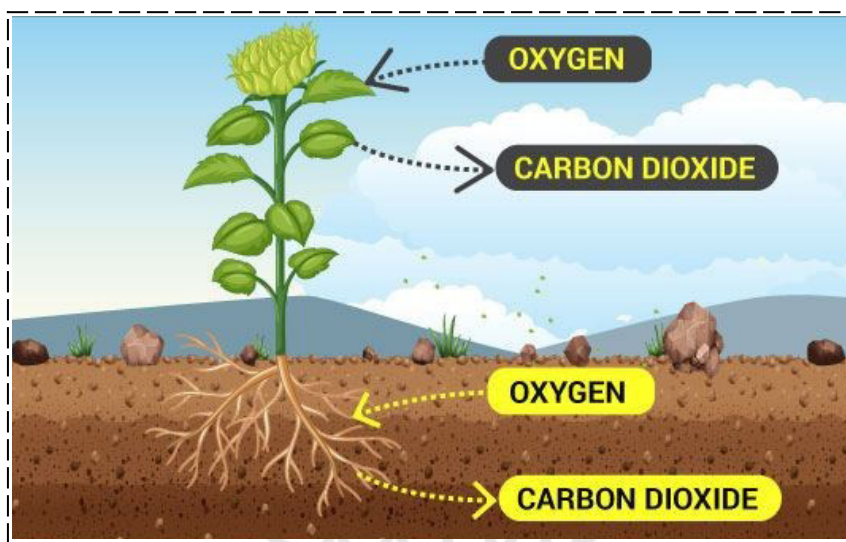
PULMONARY RESPIRATION – It is the respiration through **lungs**. Ex. Humans.

BRANCHIAL RESPIRATION – It is the respiration through **gills**. Ex. Fish

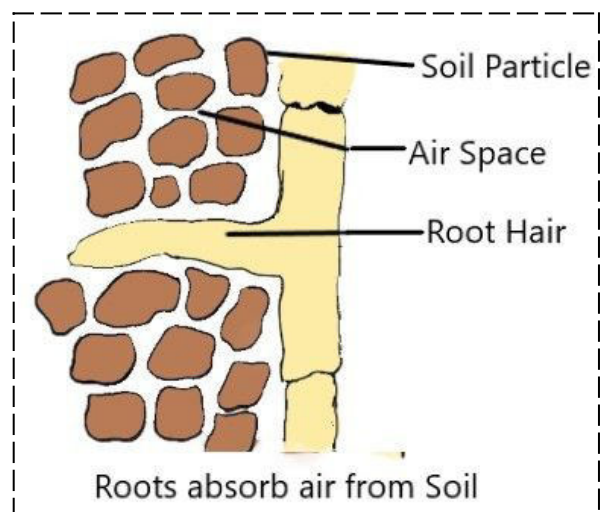
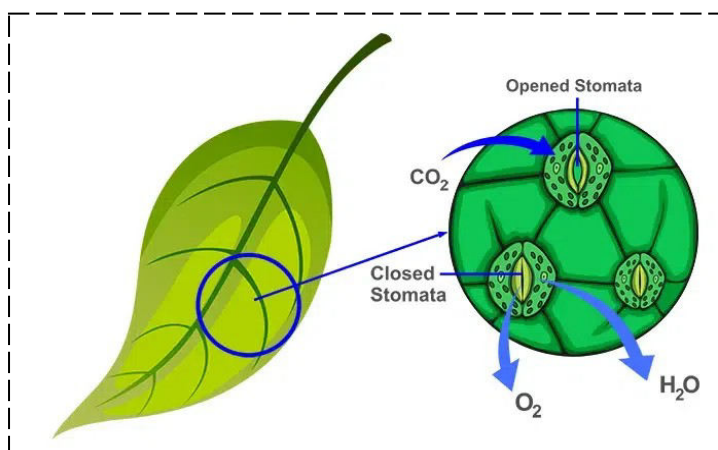
CUTANEOUS RESPIRATION – It is the respiration through **skin**. Ex. Earthworm

RESPIRATION IN PLANTS

- ✗ Like other organisms, the plants also respire for its survival.
- ✗ The plant gets energy by the process of respiration in which glucose breaks down in the presence of oxygen to form carbon dioxide and water with the release of energy.
- ✗ In plants, **each part can independently take in oxygen from the air and give carbon dioxide.**
- ✗ Respiration in plants occurs in **leaves (through stomata)** and **roots (by root hairs)**.



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GLOSSARY

- **Aerobic respiration** – Breakdown of food in the presence of oxygen.
- **Anaerobic respiration** – Breakdown of food in absence of oxygen.
- **Breathing rate** – The number of times a person breathes in a minute.
- **Cellular respiration** – The process of breakdown of food in the cells of an organism with the release of energy.
- **Diaphragm** – It is a muscle that helps in inhalation and exhalation.
- **Exhalation** – Process of breathing the air out or exhaling.
- **Gills** – These are the breathing organs present in aquatic animals, e.g. FISH.
- **Inhalation** – Process of breathing the air in or inhaling.
- **Lungs** – Main organs of respiratory system in land animals.
- **Ribs** – Bony framework in the chest region.
- **Spiracles** – Small opening on the body of insects that take in and give out the air.
- **Tracheae** – Air tubes connected to the spiracles in insects.