

SCIENCE

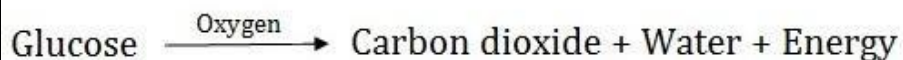
Chapter-10: Respiration in Organisms



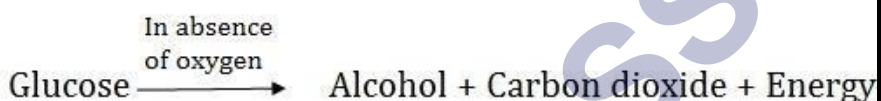
Respiration in Organisms

What is Respiration?

- A process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide, is called **respiration**.

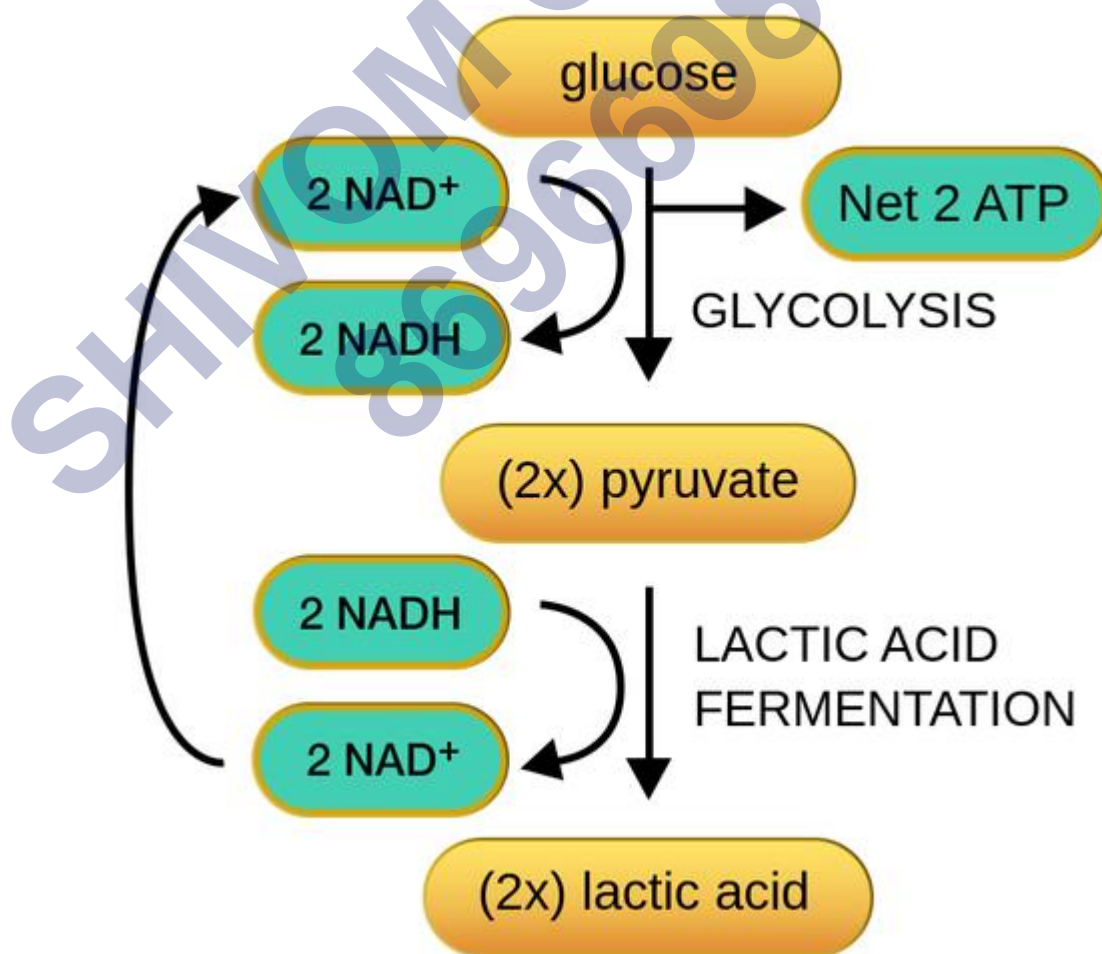


- When the breakdown of food, i.e. glucose, occurs in the presence of oxygen, it is called **aerobic respiration**.



- When the breakdown of food, i.e. glucose, occurs in the absence of oxygen, it is called **anaerobic respiration**.

Anaerobic Respiration in Muscles



We (human beings) normally obtain energy by aerobic respiration. But under certain conditions (when extra energy is needed), anaerobic respiration can take place in our muscles for a short time. When the oxygen gets used up faster in our muscle cells than can be supplied by the blood, then a temporary deficiency of oxygen occurs in the muscle cells.

For example: When we do a heavy physical exercise (fast running, cycling or weightlifting, etc.), our muscles need a lot of energy. To produce more energy, our muscles need more oxygen. But the supply of oxygen through blood is limited and hence insufficient. Under these conditions, anaerobic respiration takes place in the muscle cells (without oxygen) to produce extra energy and fulfil the demand for more energy.

When anaerobic respiration takes place in our muscle cells in the absence of oxygen, then glucose (food) breaks down partially to form lactic acid and releases some energy. This extra energy helps us in doing hard physical exercise.

After a heavy physical exercise (very fast running, etc.), we sometimes get muscle cramps (Painful contractions of muscles are called cramps). During heavy exercise, some of our muscles respire anaerobically. The anaerobic respiration by muscles brings about partial breakdown of glucose (food) to form lactic acid. This lactic acid accumulates in the muscles. Thus, muscle cramps occur due to the accumulation of lactic acid in muscles when the muscles respire anaerobically (without oxygen) while doing hard physical exercise.

We can get relief from cramps in muscles caused by heavy exercise by taking a hot water bath or a massage. Hot water bath (or massage) improves the circulation of blood in the muscles. Due to improved supply of oxygen to the muscles, lactic acid accumulated in muscles is broken down into carbon dioxide and water, and hence gives us relief from cramps.

Similarity between aerobic and anaerobic respiration

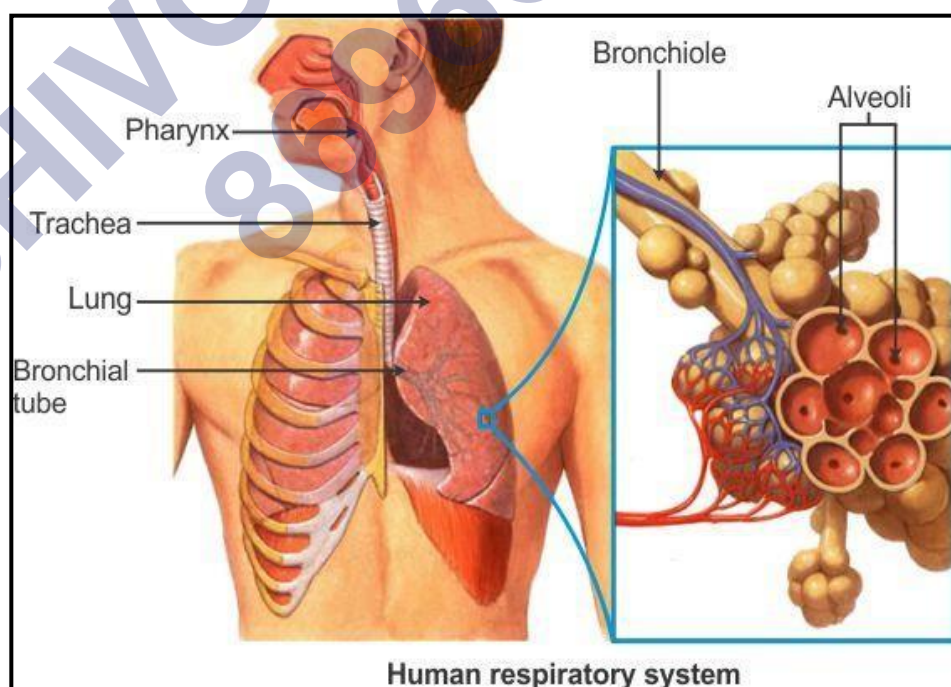
Aerobic Respiration	Anaerobic respiration
Energy is produced by breakdown of food like glucose.	In this also energy is produced by breakdown of food like glucose.
It takes place in the cells of the organism.	It also takes place in the cells of the organism.

Difference between aerobic and anaerobic respiration

Aerobic Respiration	Anaerobic respiration
It takes place in the presence of oxygen.	It takes place in the absence of oxygen.
Complete breakdown of food occurs in this.	Partial breakdown of food occurs in this.
The end products are Carbon dioxide, water and energy.	The end products are alcohol and carbon dioxide or lactic acid.
It produces large amount of energy.	It produces less amount of energy.

Respiration in Humans

- The process of taking in oxygen rich air into the body is called **inhalation** and giving out of air rich in carbon dioxide is known as **exhalation**.



- The process of inhalation and exhalation together is called **breathing**.

Breathing Rate

The number of times person breathes in one minute is called breathing rate.

The average breathing rate in an adult human being at rest is 15-18 times per minute. Women breathe slightly faster than men.

The breathing rate of a person changes according to the oxygen requirements of the body.

1. The breathing rate of a person is the slowest when he is sleeping because minimum energy is required by the body during sleep which can be provided by a slow rate of breathing.
2. The breathing rate of a person increases with increased physical activity (like exercise, running, weightlifting, etc.). When the breathing rate increases, greater amount of air goes into the lungs. With more air going into the lungs, the blood can absorb oxygen at a faster rate. Thus, faster breathing supplies more oxygen to the body cells for producing more energy (by the rapid breakdown of food) needed for doing heavy physical exercise, etc.

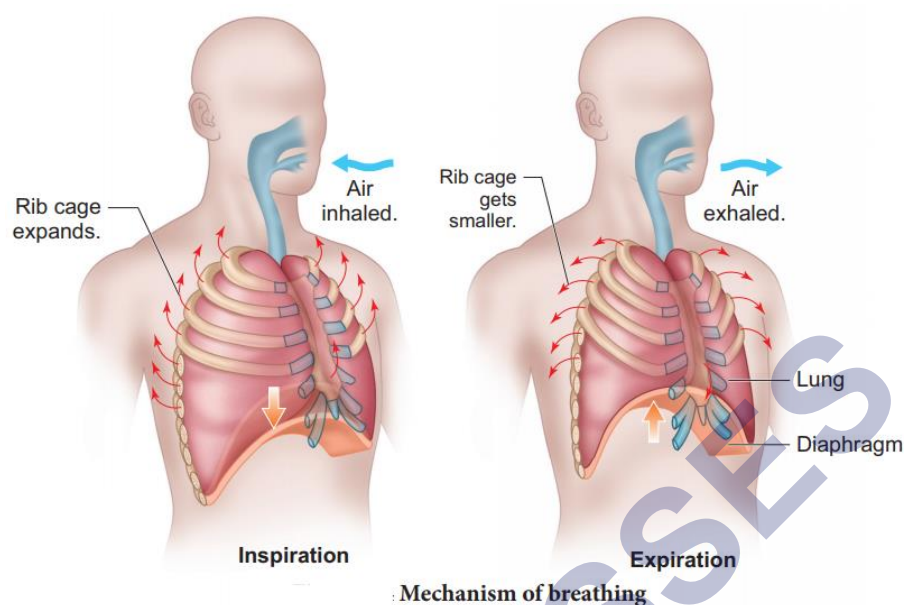
When we run, we also take deep breaths so as to inhale more air (and get more oxygen) for the speedy release of energy from food. Athlete breathes faster and deeper than usual even after finishing a race. This is because during the race, the leg muscles of athlete have produced extra energy by doing anaerobic respiration (without using oxygen). By breathing faster and deeper, the athlete is giving back oxygen to the muscles which it could not give earlier at the time of running.

We feel hungry after doing a heavy physical exercise. This is because to provide extra energy for doing heavy physical exercise, the food has broken down very rapidly (by faster breathing) and made us feel hungry.

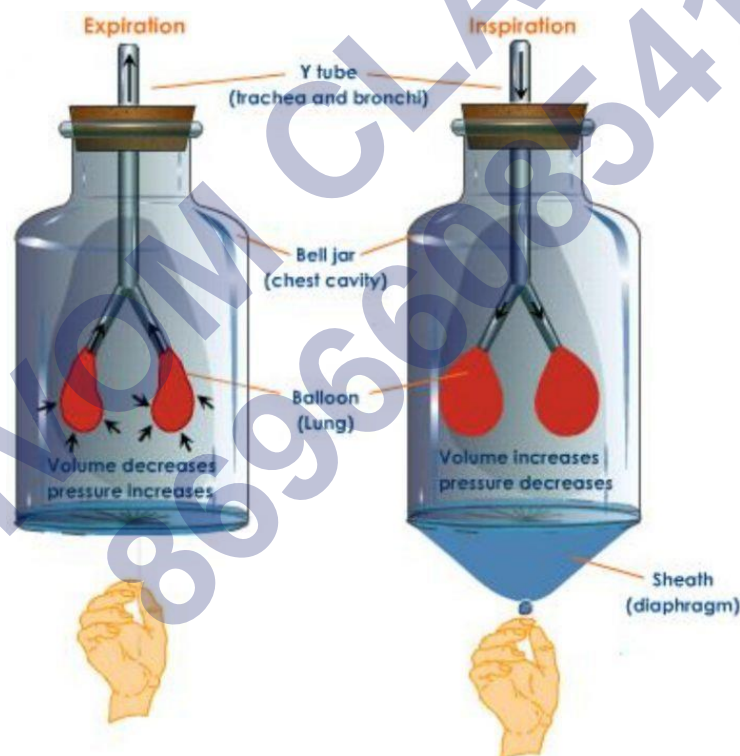
Children breathe about 20 to 30 times per minute

Mechanism of Breathing

- Air inhaled through the **nostrils** passes into the nasal cavity and reaches the **lungs** through the windpipe.
- The windpipe, also known as **trachea**, branches into two smaller tubes called **bronchi** at its lower end; the two bronchi are connected to the two lungs.
- Lungs are present within the chest cavity which is surrounded by ribs on the sides.
- Each bronchus is further divided into still smaller tubes called **bronchioles** which have air-sacs at their ends called **alveoli**.
- Exchange of respiratory gases between air and blood occurs in the alveoli.



Activity: Mechanism of Breathing



A big bell jar is taken (The bell jar is a glass jar whose bottom is open). A glass tube branching into two smaller tubes at its lower end is fitted in the mouth of the bell jar with the help of a cork. Two balloons are tied at the two ends of the tube. A thin rubber sheet is tied around the open bottom of the bell jar. In this apparatus, the space inside the bell jar represents the chest cavity, the balloons represent the lungs whereas the rubber sheet represents the diaphragm.

(1) To show the process of breathing in air, we pull the rubber sheet downwards. In this case, the space in the bell jar increases, lowering the air pressure inside the bell jar. The air from

outside rushes in through the tube into balloons due to which the balloons get inflated (their size increases). This shows the action of diaphragm during inhaling of air.

- (2) To show the process of breathing out of air, we release the rubber sheet. In this case, the space in the bell jar decreases. The air from inside the balloons goes out through the tube due to which the balloons get deflated (their size decreases). This shows the action of diaphragm during exhaling of air.

When the diaphragm moves downward during inhaling, the lungs get filled with air. But when the diaphragm moves upward during exhaling, then the air is forced to go out of the lungs.

Air Which We Breathe During Respiration

The air which we breathe in from the atmosphere is called inhaled air and the air which we breathe out (from our lungs through nose or mouth) is called exhaled air.

The only difference in the inhaled air and exhaled air is that they contain different proportions of oxygen, carbon dioxide and water vapour.

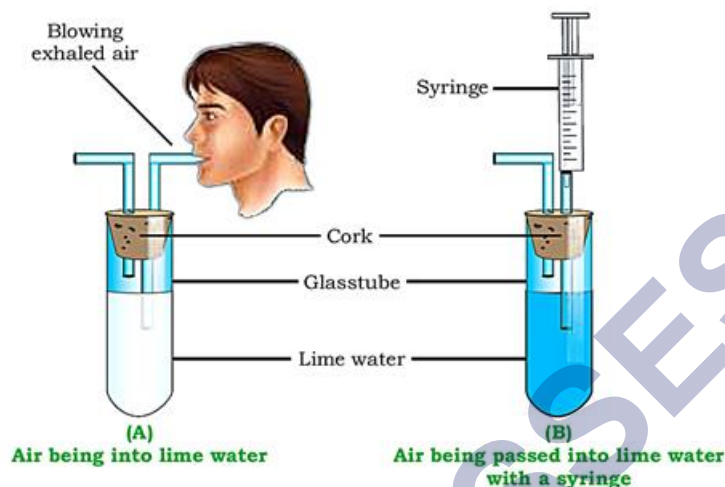
- (1) **The Case of Oxygen:** The air which we inhale contains a higher proportion of oxygen. Some of the oxygen of inhaled air is used up in breaking down glucose food during respiration. So, the exhaled air which comes out after the process of respiration contains a lower proportion of oxygen. Thus, exhaled air contains less oxygen than inhaled air.
- (2) **The Case of Carbon Dioxide:** The air which we inhale contains a lower proportion of carbon dioxide. Now, during respiration when oxygen breaks down glucose food, then some carbon dioxide is produced. Thus, exhaled air contains more carbon dioxide than inhaled air.
- (3) **The Case of Water Vapour:** The air which we inhale contains only a little of water vapour. When glucose (food) is broken down by oxygen during respiration, then water is also produced (along with carbon dioxide). So, the exhaled air contains a lot more water vapour than inhaled air.

If we exhale air on a mirror through our mouth, then a patch of moisture is formed on the mirror surface. This is because the exhaled air coming from our mouth contains a lot of water vapour. This water vapour condenses on the mirror surface to form tiny droplets of water which appear as a patch of moisture.

Activity: Carbon dioxide is produced during respiration

The apparatus consists of two boiling tubes and fitted with two-holed corks. The boiling tubes are connected through a special type of glass tube. The left arm of glass tube is short which goes in the boiling tube. The right arm of glass tube is long and dips in lime water in boiling tube. The boiling tube has another bent glass tube whose longer side dips in lime-

water contained in it. The boiling tube has also another short, bent tube E in it which does not dip in lime-water.

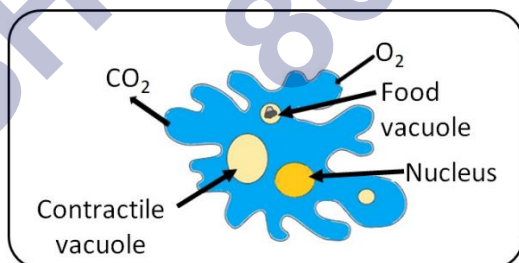


We put the top end of the tube in mouth and breathe in and 'breathe out gently'. When we breathe in, then the inhaled air (fresh air) enters the glass tube and passes through the lime-water in boiling tube. And when we breathe out, then the exhaled air (coming from our lungs) passes through the lime-water in boiling tube. We continue to breathe in and breathe out for about five minutes.

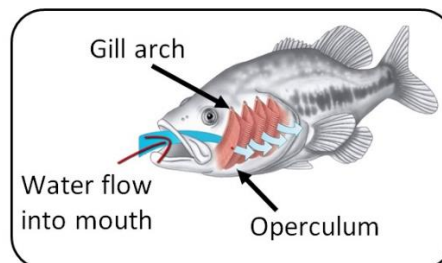
We will find that the lime-water in boiling tube (in which inhaled air is passed) turns milky only slightly but the lime-water in boiling tube (in which exhaled air is passed) turns milky appreciably. This shows that less carbon dioxide is present in inhaled air but much more carbon dioxide is present in exhaled air.

Respiration in Animals

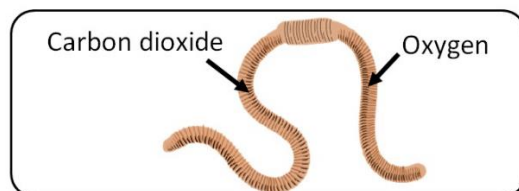
RESPIRATION IN ANIMALS



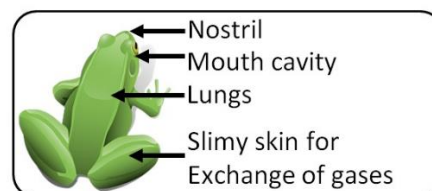
Respiration in Amoeba - Diffusion



Respiration in Fishes - Gills



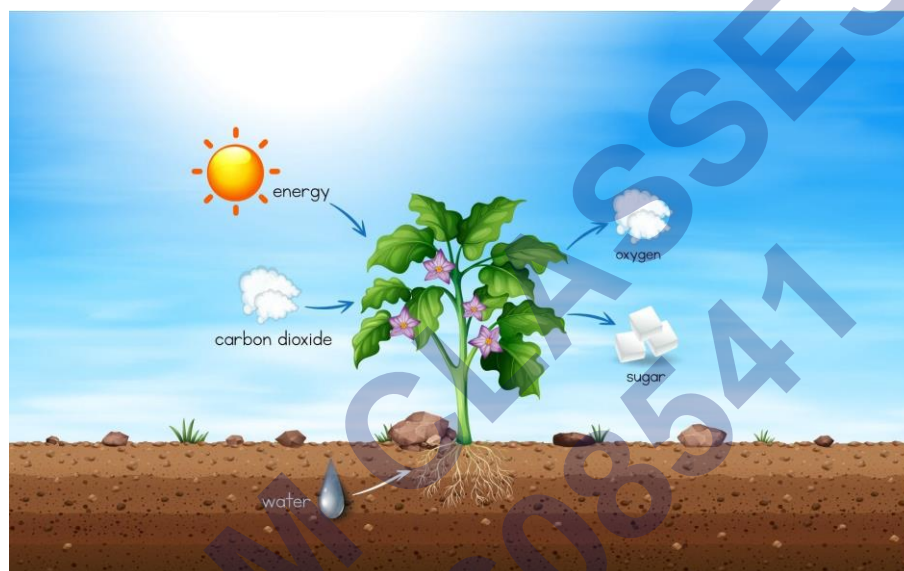
Respiration in Earthworm



Respiration in Frog

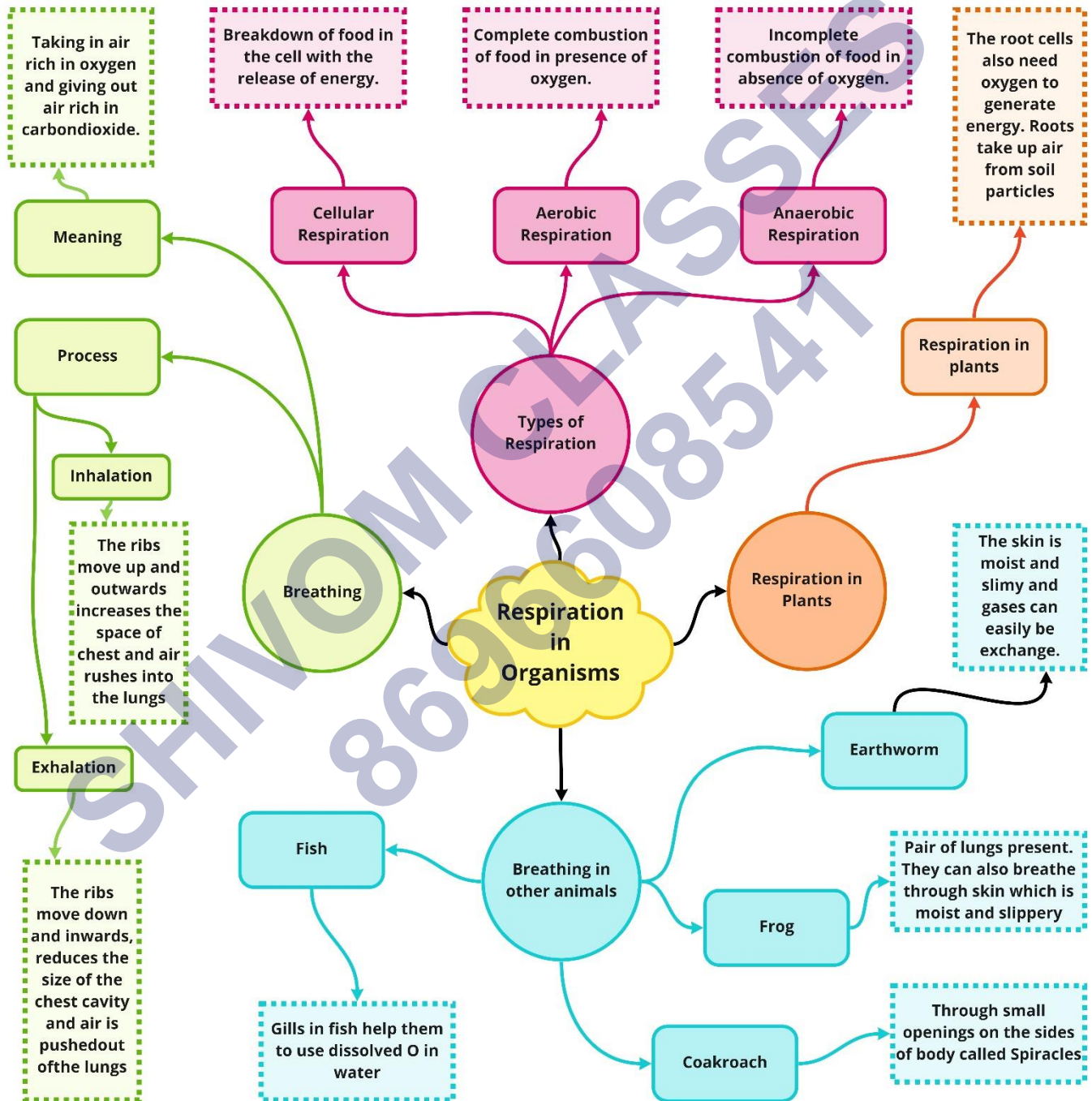
- Animals such as insects respire through **spiracles** through which air enters and is transported to every cell of the body.
- Fishes breathe through **gills**. They take in the oxygen dissolved in water.
- Earthworms breathe through the **skin**. They absorb oxygen from the air which is then transported to all the cells in the body via blood.
- Frogs can breathe through their **lungs** as well as their **moist skin**.

Respiration in Plants



- Plants breathe in oxygen and give out carbon dioxide.
- In plant cells, glucose is broken down into carbon dioxide and water in the presence of oxygen.
- The exchange of gases occurs by means of tiny openings called **stomata** present on the lower surface of the leaves.
- Oxygen enters the leaf through the stomata and reaches all the cells by **diffusion**. Carbon dioxide produced also diffuses out through the same stomata.

Class : 7th Science
Chapter-10: Respiration in Organisms



Important Questions

➤ Multiple Choice Questions:

Question 1. All organisms are made of small microscopic units which cannot be seen with the naked eyes, called

- (a) animals
- (b) cells
- (c) tissues
- (d) organs

Question 2. Organisms get energy through

- (a) food
- (b) eating
- (c) sleeping
- (d) none of these

Question 3. Cellular respiration is carried out in the

- (a) cells
- (b) organs
- (c) tissues
- (d) muscles

Question 4. The process of breakdown of food in the cell is known as

- (a) breakdown process
- (b) cellular respiration
- (c) food breakdown
- (d) none of these

Question 5. An example of aerobes is

- (a) cat
- (b) dog
- (c) human being
- (d) all of these

Question 6. When breakdown of glucose occurs with the use of oxygen, it is called

- (a) anaerobic respiration

- (b) aerobic respiration
- (c) regular respiration
- (d) all of these

Question 7. Name the type of respiration which causes muscle cramps.

- (a) Aerobic respiration
- (b) Anaerobic respiration
- (c) Both (a) and (b)
- (d) None of these

Question 8. Name the term which means 'taking in of air rich in oxygen into the body'.

- (a) Exhalation
- (b) Inhalation
- (c) Breathing
- (d) Respiration

Question 9. Which gas is given out during exhalation?

- (a) Oxygen
- (b) Nitrogen
- (c) Carbon dioxide
- (d) All of these

Question 10. The gills help the fish to

- (a) take in oxygen from air
- (b) take in oxygen dissolved in water
- (c) absorb nutrients present in water
- (d) release waste substance in water

Question 11. Yeast are used to make

- (a) curd
- (b) wine and beer
- (c) bakery items
- (d) both (b) and (c)

Question 12. Earthworms breathe through

- (a) skin

- (b) legs
- (c) trachea
- (d) nose

Question 13. The organ through which fishes breathe is

- (a) nose
- (b) gills
- (c) skin
- (d) spiracles

Question 14. In the cells, oxygen is used to break down glucose into

- (a) carbon dioxide, water and energy
- (b) fats
- (c) alcohol, carbon dioxide and energy
- (d) lactic acid, water and energy

Question 15. Cockroaches breathe by using an organ called

- (a) nose
- (b) tracheae
- (c) both (a) and (b)
- (d) none of these

➤ **Fill In the Blanks:**

1. A person breathes while running.
2. Windpipe is also known as
3. At the end of the bronchioles, small rounded structures called air sac or are present.
4. The process of breakdown of food in the cell with the release of energy is called
5. Organisms which can survive in the absence of air are known as
6. is a single-celled organism used to make beer and wine.

➤ **True or False:**

1. Intense physical exercise slows down the breathing rate.
2. Breathing is a part of respiration.

3. Oxygen breaks down glucose outside the cell of organisms.
4. Exhaled air contains more percentage of carbon dioxide than inhaled air.
5. From lungs, oxygen is transferred to different parts of the body through blood in human beings.
6. During exercise, muscle cells respire aerobically to form lactic acid.

➤ **Very Short Question:**

1. Name the respiratory organ of frogs.
2. Name the respiratory organ of earthworm.
3. How does exchange of gases take place in unicellular and smaller multicellular animals?
4. How does exchange of gases take place in insects?
5. Name the respiratory organ of birds.
6. Name the tiny pores present in the leaves of the plants for exchange of gases.
7. What is the end product of anaerobic respiration?
8. Name the chemical used to test the presence of CO_2 in exhaled air.
9. State the name of wind pipe.
10. What is the site of cellular respiration?

➤ **Short Questions:**

1. Explain soil and factors affecting soil.
2. Define the following:
 - a) Soil profile
 - b) Horizon
3. Why is top soil known as the habitat of many living organisms?
4. Why Upper most layers in a soil profile are considered as most productive?
5. What is the similarity between physical and chemical weathering.
6. State the factors on which nature of soil depends?
7. Classify soil on the basis of the proportion of particles of various sizes.
8. Plants help the development of the soil. How?

➤ **Long Questions:**

1. Humans use yeast every day. What is yeast?
2. Why does an athlete breathe faster and deeper than usual after finishing the race?

3. Why do we often sneeze when we inhale a lot of dust-laden air?
4. Why we get muscle cramps after heavy exercise?

✓ **Answer Key-**

➤ **Multiple Choice Answers:**

1. (b) cells
2. (a) food
3. (a) cells
4. (b) cellular respiration
5. (d) all of these
6. (b) aerobic respiration
7. (b) Anaerobic respiration
8. (b) Inhalation
9. (c) Carbon dioxide
10. (b) take in oxygen dissolved in water
11. (d) both (b) and (c)
12. (a) skin
13. (b) gills
14. (a) carbon dioxide, water and energy
15. (d) none of these

➤ **Fill In the Blanks:**

1. faster
2. trachea
3. alveoli
4. cellular respiration
5. anaerobes
6. Yeast

➤ **True or False:**

1. False

2. True
3. False
4. True
5. True
6. False

➤ **Very Short Answers:**

1. Answer: Skin and lungs
2. Answer: Moist skin
3. Answer: By diffusion
4. Answer: Exchange of gases takes place in insect through spiracles into trachea.
5. Answer: Lungs.
6. Answer: Stomata.
7. Answer: CO₂, alcohol and energy.
8. Answer: Lime water
9. Answer: Trachea
10. Answer: Mitochondria

➤ **Short Answer:**

1. Answer: We respire to use the oxygen, to oxidise our food and release energy. This is similar like burning but a slower process. It also needs respiratory enzymes. Respiration is a slower process than burning and energy released can be stored for later use.
2. Answer: The food has stored energy which is released during respiration, thus we should eat regularly.
3. Answer: The air we breathe in transported to every parts of body and ultimately it is transported to each cell, in the cells, oxygen in the air helps in the breakdown of food, this process of breakdown of food in the cell with the release of energy is called cellular respiration.
4. Answer: The air we breathe in transported to every parts of body and ultimately it is transported to each cell, in the cells, oxygen in the air helps in the breakdown of food, this process of breakdown of food in the cell with the release of energy is called cellular respiration. Cellular respiration occurs in the cells of all organisms.
5. Answer:
 - Both aerobic and anaerobic respiration are necessary for the survival of living organism.

- In both type of respiration, the food is broken and energy is released for the functioning of an organism.
 - In both type of respiration, Carbon Dioxide, Water and Energy is produced finally
6. Answer: Human breathing mechanism is called tidal breathing because air comes in and out using the same path.
 7. Answer: Yeast is single celled organism that respire anaerobically and during this process yield alcohol. Yeast get energy through anaerobic respiration, in the absence of oxygen, glucose breaks down into oxygen and carbon dioxide.
 8. Answer: Mountaineers carry oxygen with them because the amount of air available to a person is less than that available on the ground.

➤ Long Answer:

1. Answer: If we want to make our own bread, we can buy yeast in the grocery store. This yeast consists of little brown grains. The little brown grains of yeast may not seem to be alive, but if we put them in water with sugar, the yeast will carry out cellular respiration and grow. We can grow yeast in a test tube filled with water and sealed with a balloon. Under anaerobic conditions, yeast carries out alcoholic fermentation, so it produces lactic acid and energy.
2. Answer: The food has stored energy, which is released during respiration. Therefore, all living organisms respire to get energy from food by breathing the air. During heavy exercise, fast running, cycling, walking for many hours or heavy weight lifting, the demand for energy is high. Therefore, to meet the extra demand of energy, an athlete breathes faster and deeper than usual after finishing the race.
3. Answer: When we inhale a lot of dust-laden air, the dust particles get trapped in the hair present in our nasal cavity. However, sometimes these particles may get past the hair in the nasal cavity. Then they 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.
4. Answer: During heavy exercise the demand for energy is high. But the supply of oxygen to produce energy is limited. Then anaerobic respiration takes place in the muscle cells to fulfil the demand of energy.

Glucose in absence of oxygen → Lactic Acid + Energy The cramps occur only when the muscle cells respire anaerobically. The partial breakdown of glucose produces lactic acid. The accumulation of lactic acid causes muscle cramps.