

Lesson at a Glance

- Respiration is essential for survival of every living organism whether it is an animal or a plant. It is a process by which living organisms produce energy from the food they eat. This energy is necessary for various life activities. Oxygen is required for this process and carbon dioxide is formed as a waste.
- Respiration releases energy from the food which is required by each cell of the body to do various vital functions. So, each cell of the body respire.
- Respiration consists of:

(i) Breathing: The process of inhaling and exhaling of air is called *breathing*. The taking in of air rich in oxygen into the body is called *inhalation*. Inhaled oxygen is supplied to all the cells of the body. The giving out of air rich in carbon dioxide is known as *exhalation*. This carbon dioxide is collected from all cells of the body. Thus, breathing helps in supplying oxygen to the cells of the body and removal of carbon dioxide from them.

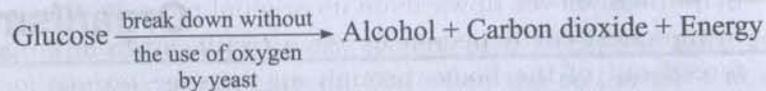
(ii) Cellular Respiration: The process of breakdown of food in the cell with the release of energy is called *cellular respiration*. Cellular respiration takes place in the cells of all organisms.

- **Aerobic Respiration:** When the breakdown of food (Glucose) takes place with the use of oxygen into carbon dioxide and water with the release of energy, the process is called *aerobic respiration*.

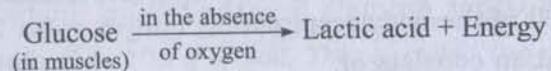
Glucose + Oxygen → Carbon dioxide + Water + energy

- **Anaerobic Respiration:** Some organisms, such as yeast, breakdown glucose in absence of oxygen. In such cases, glucose is not completely broken down into carbon dioxide

and water. There is formation of an intermediate compound with release of less amount of energy.



- **Anaerobes:** The organisms such as yeast that can survive in the absence of air (free oxygen) are called *anaerobes*.
- **Yeasts:** Yeasts are unicellular (single-celled) organisms. They respire anaerobically and during this process they yield alcohol. For this reason, yeast are used to make wine and beer.
- **Anaerobic Respiration in Human Muscles:** Human muscles during heavy exercise, such as running fast, when there is a temporary deficiency of oxygen, undergo anaerobic respiration.



The accumulation of lactic acid causes muscle cramps. When there is sufficient supply of oxygen, lactic acid breaks down into carbon dioxide and water. This leads to relief from cramps.

- **Breathing Rate:** A breathe means one inhalation plus one exhalation. The number of times a person breathe in a minute is termed as *breathing rate*.
- We take in air through our nostrils into nasal cavity. From the nasal cavity, the air reaches our lungs through the wind pipe.
- **Lungs:** We have two lungs which contain the *branchioles* (very small branches of wind pipe) and *air sacs*. Each lung present in the chest cavity is a soft, spongy and cone-shaped structure.
- The lower surface of each lung is concave as the *diaphragm* lies below it. The right lung is larger than the left lung. The right lung consists of three lobes whereas the left lung consists of two lobes only.
- **Diaphragm:** The chest cavity is separated from the abdomen by a muscular wall called *diaphragm*. When diaphragm moves downwards, the space in the chest cavity increases.

As a result, air from atmosphere rushes through nose, trachea to lungs (*inhalation or inspiration*). When the diaphragm moves upwards to its original position, the space in the chest cavity decreases. As a result, air from lungs is forced out of the body through air passage (*exhalation or expiration*). Ribs and muscles of the chest cavity also help in breathing along with diaphragm.

- **Ribs:** Ribs form the rib cage which encloses the chest cavity. During inhalation ribs move up and outward and diaphragm moves down. This movement increases space in chest cavity and air rushes into the lungs.

During exhalation, ribs move down and inward, while diaphragm moves up to its original position. This reduces the size of the chest cavity and air is pushed out of the lungs.

- **How do Other Animals Breathe?** Many animals such as goat, cow, dog, deer and others which live on land have lungs. They breathe like man. Insects and earthworms also live on land but they do not have lungs.

1. **Cockroach:** Insects like cockroach, housefly and moth have a special network of tubes called *trachea*. These tracheal tubes have openings called *spiracles*. Through these spiracles air comes in and goes out of the body.

2. **Earthworm:** Earthworms and leaches absorb the atmospheric oxygen through their moist and slimy skin.

Though frogs have pair of lungs like human beings, they can also breathe through their skin, which is moist and slippery.

3. **Gills:** Prawn, tadpoles of frog and fishes have special respiratory organ called *gills*. The gills are comb-like and deep red in colour. They are present on either side of the head. In some fishes, they are covered by a hard movable plate called *Operculum*. The gills are richly supplied with blood vessels.

4. **Breathing in Fish:** The opening and closing of mouth causes entrance of water through mouth. The water which enters through mouth bathes the gills and passes out through the opening of the operculum. As

the water flows over the gills exchange of gases takes place. The air dissolved in water provides oxygen to the blood present in gills. At the same time carbon dioxide diffuses from the blood into the flowing water. Thus, fish breathes by taking water through mouth and sending it over the gills and out through the opening of operculum.

• How does exchange of gases take place in plants?

Plants are also living objects. They also need energy for various activities. To get energy from the food they need oxygen. Plants have special structure for exchange of gases. These structures are called *stomata* (singular-stoma). Stomata may be present on both the surfaces of some leaves. A stomata is composed of an opening surrounded by two cells called *guard cells*. The exchange of gases in plants takes place through the opening of stomata.

The root cells which remain under the ground also need oxygen to generate energy. Roots take up air from the air spaces present between the soil particles.

■ TEXTBOOK QUESTIONS SOLVED ■

Q.1. Why does an athlete breathe faster and deeper than usual after finishing the race?

Ans. The athlete has to run fast during the race. The body needs more energy which increases the demand of oxygen to breakdown food. So, athlete has to breathe faster and deeper to inhale more oxygen.

Q.2. List the similarities and differences between aerobic and anaerobic respiration.

Aerobic Respiration	Anaerobic Respiration
1. It occurs in the presence of oxygen.	1. It occurs in the absence of oxygen.
2. Large amount of energy is released.	2. Small amount of energy is released.
3. Food molecules are broken down into water and carbon dioxide.	3. Food molecules are broken down into ethyl alcohol and carbon dioxide.

Similarities : Both aerobic and anaerobic respiration produce energy and give out carbon dioxide.

Q.3. Why do we often sneeze when we inhale a lot of dust-laden air?

Ans. Sometimes dust particles, pollen etc. pass nasal hair and irritate the lining of the nasal cavity. Then we sneeze as we want to get rid of the unwanted particles like dust, pollen etc. from our body. It allows only clean and dust free air to enter our body.

Q.4. Take three test-tubes. Fill 3/4th of each with water. Label them A, B and C. Keep a snail in a test-tube A, a water plant in test-tube B and in C keep snail and water plant both. Which test-tube would have the highest concentration of CO₂?

Ans. There will be highest concentration of CO₂ in test tube A.

Q.5. Tick the correct answer:

(a) In cockroaches, air enters the body through

(i) lungs (ii) gills

(iii) spiracles (iv) skin

(b) During heavy exercise, we get cramps in the legs due to the accumulation of

(i) carbon dioxide (ii) lactic acid

(iii) alcohol (iv) water

(c) Normal range of breathing rate per minute in an average adult person at rest is:

(i) 9-12 (ii) 15-18

(iii) 21-24 (iv) 30-33

(d) During exhalation, the ribs

(i) move outwards (ii) move downwards

(iii) move upwards (iv) do not move at all

Ans. (a) (iii) Spiracles

(b) (ii) Lactic acid

(c) (ii) 15-18

(d) (ii) move downwards

Q.6. Match the items in Column I with those in Column II:

Column I	Column II
(a) Yeast	(i) Earthworm
(b) Diaphragm	(ii) Gills
(c) Skin	(iii) Alcohol
(d) Leaves	(iv) Chest cavity
(e) Fish	(v) Stomata
(f) Frog	(vi) Lungs and skin
	(vii) Tracheae

Ans.

Column I	Column II
(a) Yeast	(iii) Alcohol
(b) Diaphragm	(iv) Chest cavity
(c) Skin	(i) Earthworm
(d) Leaves	(v) Stomata
(e) Fish	(ii) Gills
(f) Frog	(vi) Lungs and skin

Q.7. Mark 'T' if the statement is true and 'F' if it is false:

- During heavy exercise the breathing rate of a person slows down. (T/F)
- Plants carry out photosynthesis only during the day and respiration only at night. (T/F)
- Frogs breathe through their skins as well as their lungs. (T/F)
- The fishes have lungs for respiration. (T/F)
- The size of the chest cavity increases during inhalation. (T/F)

Ans. (i) False (ii) False (iii) True
(iv) False (v) True

Q.8. Given below is a square of letters in which are hidden different words related to respiration in organisms. These words may be present in any direction—upwards, downwards, or along the diagonals. Find the words for your respiratory system. Clues about those words are given below the square.

S	V	M	P	L	U	N	G	S
C	Z	G	Q	W	X	N	T	L
R	M	A	T	I	D	O	T	C
I	Y	R	X	Y	M	S	R	A
B	R	H	I	A	N	T	A	Y
S	T	P	T	B	Z	R	C	E
M	I	A	M	T	S	I	H	A
S	P	I	R	A	C	L	E	S
N	E	D	K	J	N	S	A	T

- The air tubes of insects
- Skeletal structures surrounding chest cavity
- Muscular floor of chest cavity
- Tiny pores on the surface of leaf
- Small openings on the sides of the body of an insect
- The respiratory organs of human beings
- The openings through which we inhale
- An anaerobic organism
- An organism with tracheal system

Ans. (i) Trachea (ii) Ribs (iii) Diaphragm
(iv) Stomata (v) Spiracles (vi) Lungs
(vii) Nostrils (viii) Yeast (ix) Ant

S	V	M	P	L	U	N	G	S	iii	vi	iv
C	Z	G	Q	W	X	N	T	L			
R	M	A	T	I	D	O	T	C	ii		
I	Y	R	X	Y	M	S	R	A			
B	R	H	I	A	N	T	A	Y			viii
S	T	P	T	B	Z	R	C	E			
M	I	A	M	T	S	I	H	A			
S	P	I	R	A	C	L	E	S	v		
N	E	D	K	J	N	S	A	T		vii	i

- Q.9.** *The mountaineers carry oxygen with them because:*
- At an altitude of more than 5 km there is no air.*
 - The amount of air available to a person is less than that available on the ground.*
 - The temperature of air is higher than that on the ground.*
 - The pressure of air is higher than that on the ground.*
- Ans.** (b) The amount of air available to a person is less than that available on the ground.

EXTENDED LEARNING — ACTIVITIES AND PROJECTS

Q.1. *Observe fish in an aquarium. You will find flap like structures on both sides of their heads. These are flaps which cover the gills. These flaps open and close alternately. On the basis of these observations, explain the process of respiration in the fish.*

Ans. Gills are the respiratory organs of the fish. There are two gills, one on either side of the head. Gills are projections of the skin which are well supplied with blood vessels for exchange of gases. In some fishes each gill is covered with a flap which opens and closes alternately. Their opening and closing is related to the opening and closing of the mouth.

When mouth of the fish opens, it engulfs water which passes over the gill. During this period exchange of gases takes place in the gills. In this period, the gill flap (called *operculum*) remains closed. After exchange of gases, the gill flap opens and the water is pushed out.

Q.2. *Visit a local doctor. Learn about the harmful effects of smoking. You can also collect material on this topic from other sources. You can seek help of your teacher or parents. Find out the percentage of people of your area who smoke. If you have a smoker in your family, confront him with the material that you have collected.*

Ans. Due to smoking, the smoke particles get deposited on the respiring surface affecting absorption of oxygen and release of carbon dioxide from the body. More over, nicotine present in tobacco smoke cause constriction of blood vessels and irritation of wind pipe. Thus, smoke, increased concentration carbon dioxide and constant irritation may cause T.B., bronchitis and lung cancer.

Q.3. *Visit a doctor. Find out about artificial respiration. Ask the doctor:*

- When does a person need artificial respiration?*
- Does the person need to be kept on artificial respiration temporarily or permanently?*
- From where can the person get supply of oxygen for artificial respiration?*

Ans. (a) When there is insufficient supply of oxygen due to lung troubles, heart troubles or drowning etc. The patient need artificial supply of oxygen.

(b) Artificial respiration is the arrangement to provide exchange of gases (oxygen and CO_2) to revive organs of the patient. It is not a permanent solution. However, some patients may be kept on artificial respiration to survive but they are not able to work or to do other social activities.

(c) The patient is supplied from oxygen cylinder having compressed oxygen stored in them.

Q.4. *Measure the breathing rate of the members of your family and some of your friends. Investigate:*

- If the breathing rate of children is different from that of adults.*
- If the breathing rate of males is different from that of females.*

If there is a difference in any of these cases, try to find the reason.

Ans. Do it yourself

- Yes, breathing rate of children is always more than adults because they are more active and require more O_2 for their metabolic activities.
- Yes, breathing rate of females is usually more than males.