

# 5

# RESPIRATION IN ORGANISMS

## INTRODUCTION

All living organisms need energy to do work. Energy is required to perform various functions of life such as nutrition, excretion, growth, movement, transportation and reproduction. Without energy, organisms cannot do any work

The energy, as you know comes from the food you eat. Respiration is the process which converts energy stored in food into a form which the body can use.

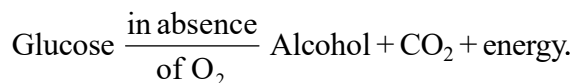
## WHY DO WE RESPIRE

The process of oxidation of food into carbon dioxide and water to produce energy is called **respiration**. On the basis of presence of oxygen respiration is of two types :

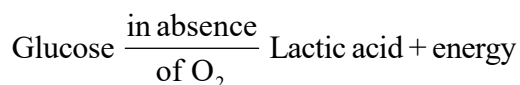
- (a) **Aerobic respiration** : When break-down of glucose occurs with the use of  $O_2$ , it is called aerobic respiration. In this process there is complete breakdown of food, so maximum production of energy.



- (b) **Anaerobic respiration** : When breakdown of glucose occurs in lack or limited supply of  $O_2$  is called anaerobic respiration.



During heavy exercise, when the supply of oxygen to our muscle cell is insufficient, food breakdown occurs by anaerobic respiration.

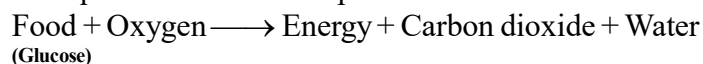


## TYPES OF RESPIRATION

There are two types of respiration – aerobic and anaerobic respiration.

1. **Aerobic Respiration** : When the breakdown of food substances (like glucose) takes place in the presence of oxygen with the release of a large amount of energy, it is called **aerobic respiration**. In this process, carbon dioxide and water are released as waste products.

The overall equation for aerobic respiration is:

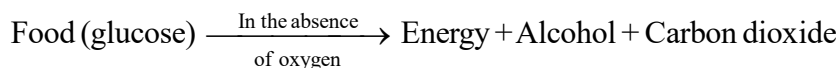


Most animals including humans and green plants respire aerobically.

2. **Anaerobic Respiration** : **Anaerobic respiration** is the breakdown of food substances with the release of a small amount of energy in the absence of oxygen. It occurs in certain organisms like yeast and some bacteria. These organisms are called **anaerobes**.

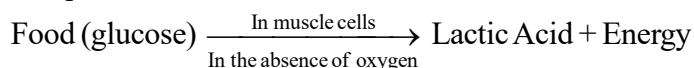
In the absence of oxygen, glucose breaks down into alcohol and carbon dioxide with the release of comparatively less energy.

The equation for anaerobic respiration is:



### Aerobic respiration In Human Being

Aerobic respiration is more efficient than anaerobic one, as more energy is produced during aerobic respiration. Anaerobic respiration in humans can take place only for a short time. It takes place in our muscles when our body undergoes vigorous muscular activity during heavy exercise or fast running. Muscular cramps may develop as a result of heavy exercise or fast running. In fact, when muscle cells respire anaerobically, there is a partial breakdown of glucose and lactic acid is produced. Accumulation of lactic acid causes muscle cramps.



Relief from muscle cramps can be obtained by a hot water bath or a massage. Circulation of blood in the body is improved by these acts. As a result, the supply of oxygen (which becomes short during heavy exercise causing the muscles to respire anaerobically) to the muscles increases. Increase in supply of oxygen brings about complete breakdown of lactic acid into carbon dioxide and water.

### Differences between aerobic and anaerobic respiration

Sr.No.	Aerobic respiration	Anaerobic respiration
1.	It occurs in the presence of oxygen.	It occurs in the absence of oxygen.
2.	Food is completely broken down into carbon dioxide and water.	Food is partially broken down into alcohol and carbon dioxide.
3.	More energy is produced. <b>Overall equation</b> $\text{Food (Glucose)} \xrightarrow{(+)\text{Oxygen}} \text{Carbon dioxide} + \text{Water} + \text{Energy}$	Much less energy is produced. <b>Overall equation</b> $\text{Food (Glucose)} \xrightarrow{(+)\text{Oxygen}} \text{Carbon dioxide} + \text{Water} + \text{Energy}$

### BREATHING

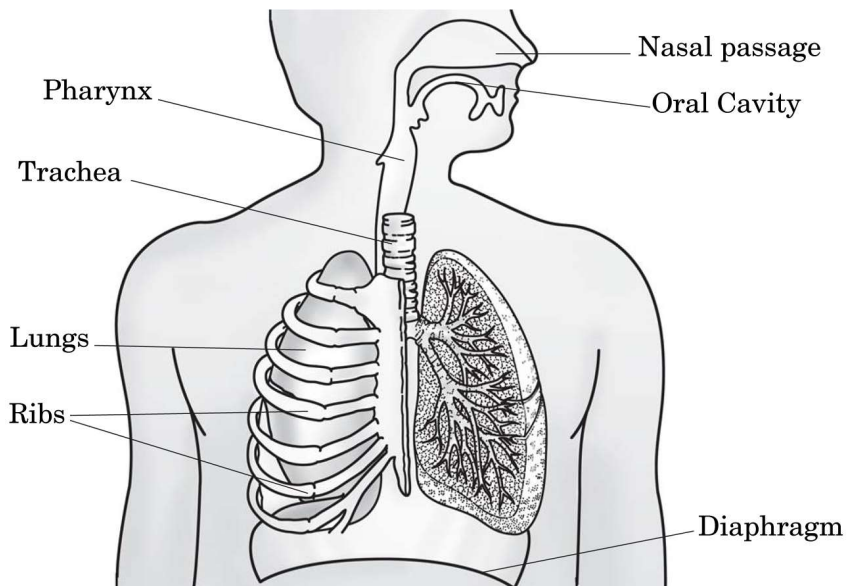
- Exchange of gases or taking in O<sub>2</sub> and giving out CO<sub>2</sub> with the help of respiratory organs is called breathing.
- The taking in of air rich in oxygen is called **inhalation** and giving out CO<sub>2</sub> rich air is called **exhalation**.
- It is a continuous process which goes on all the time and throughout the life of an organism.
- The number of times a person breathes in a minute is called the **breathing rate**.
- Normal breathing of adult human beings at rest is about **15-18 per min**. But it can change according to requirement of O<sub>2</sub> by the body.
- Thus, whenever a person needs extra energy breathing rate increases.
- So, during heavy exercise, the breathing rate can increase upto 25 times per minute and also we take deep breaths to inhale more oxygen.
- As a result more oxygen is supplied to our cells.
- So speeds up the breakdown of food and more energy is released.
- That is the cause we feel hungry after a physical activity.

## HUMAN RESPIRATION SYSTEM

In humans, several organs take part in the process of respiration. These different organs together form the **respiratory system**.

### Organs of the Respiratory System

- Nostrils
- Nasal cavity or passage
- Windpipe (trachea)
- Bronchi (singular bronchus)
- Lungs



Human respiratory system

Air enters our body through the nostrils. From the **nostrils**, the air containing oxygen is taken into the **nasal cavity**. From here it goes down the windpipe or **trachea**, from trachea it goes to two smaller tubes called **bronchi** (Singular bronchus). One bronchus enters each **lung**. Inside the lungs, each bronchus divides repeatedly into a large number of small branches called the **bronchioles**. Each bronchiole ends in a number of air sacs known as **alveoli** (singular alveolus). The walls of the alveoli have a large number of very thin **blood capillaries**.

Lungs are present in the chest cavity. This cavity is surrounded by **ribs** on the sides. Ribs form a cage-like structure called the **rib cage**. A large muscular sheet called **diaphragm** forms the floor of the chest cavity. Breathing involves the movement of the diaphragm and the rib cage.

## MECHANISM OF BREATHING IN HUMANS BEINGS

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. 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. Breathing involves the movement of the diaphragm and the rib cage.

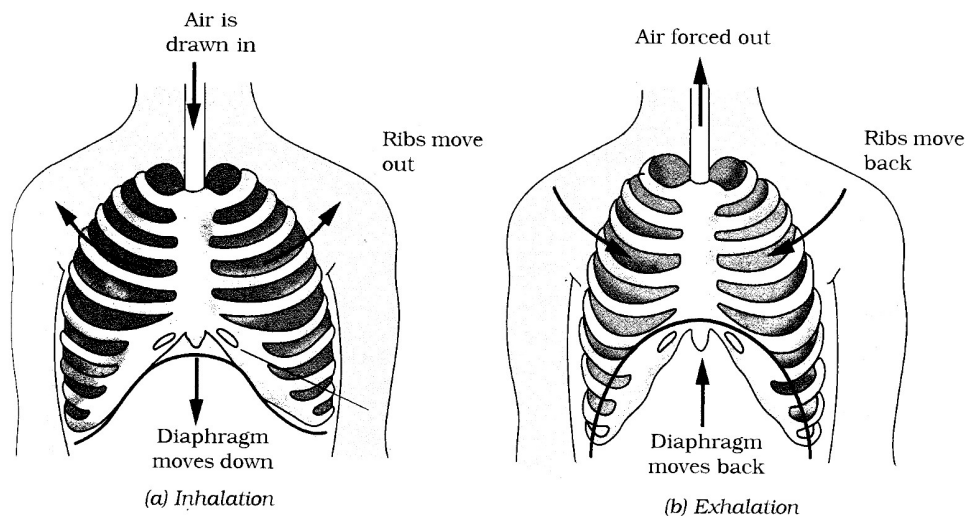
- **During inhalation-**

Ribs move up and outwards and diaphragm moves down. Its movement increases space in our chest cavity and air rushes into the lungs. The lungs get filled with air and exchange of gases take place by the process of difference in alveoli.

- **During exhalation -**

Ribs move down and inwards, while diaphragm moves up to its former position. This reduces the size of the chest cavity and air is pushed out of the lungs.

Smoking damages lungs and also causes cancer. When we inhale, unwanted particles like smoke, dust, pollens etc. present in air gets trapped by hairs of nasal cavity. But sometimes these particles may get passed the hair in nasal cavity and causes sneezing to expel out the foreign particles. So, clean air reaches our lungs



*Mechanism of breathing in human beings*

- **To show that carbon dioxide is given out during breathing.**

Take a test tube with freshly prepared lime water [ $\text{Ca}(\text{OH})_2$ ]. With the help of a plastic straw dipped in the lime water, breathe out into the test tube a few times. The lime water turns milky (due to the formation of  $\text{CaCO}_3$ ). This shows that carbon dioxide is present in the exhaled air.



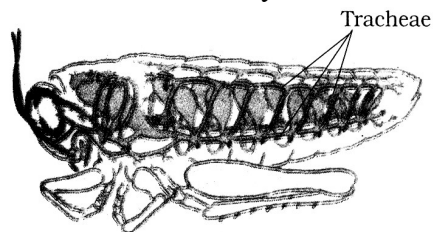
- **To show that exhaled air contains water vapour.**

Stand in front of a clean mirror. Breathe out some air from your mouth on the mirror. The mirror becomes cloudy. Sometimes even water droplets may be seen on the mirror. This activity shows that exhaled air contains water vapour.



## BREATHING IN OTHER ANIMALS

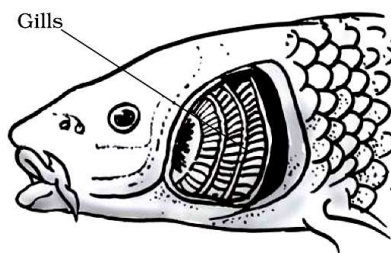
- Animals such as elephants, lions, cows, goats, frogs, lizards, snakes, birds have lungs in their chest cavities like the human beings.
- **Respiration in insects:** A cockroach has small openings on the sides of its body. Other insects also have similar openings. These openings are called **spiracles**. Insects have a network of air tubes called **tracheae** for gas exchange. This type of respiration is called **tracheal respiration**. Oxygen rich air rushes through spiracles into the tracheal tubes, diffuses into the body tissue, and reaches every cell of the body. Similarly, carbon dioxide from the cells goes into the tracheal tubes and moves out through spiracles. These air tubes or tracheae are found only in insects and not in any other group of animals.



*Tracheal system*

- **Respiration in Earthworm:** Earthworms breathe through their skin. **This is called cutaneous respiration.** The skin of an earthworm feels moist and slimy on touching. Gases can easily pass through them. Though frogs have pair of lungs like human beings, they can also breathe through their skin, which is moist and slippery by the process of diffusion.

## BREATHING UNDER WATER



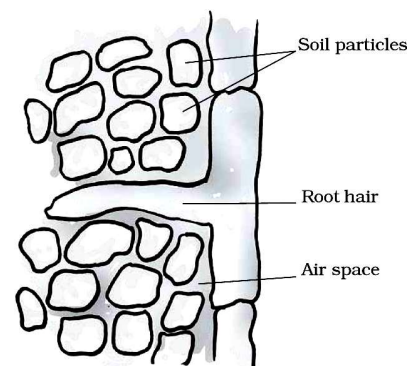
*Breathing organs in fish*

**Gills in fish help them to use oxygen dissolved in water.** Gills are projections of the skin. Gills help in breathing. Gills are well supplied with blood vessels for exchange of gases. But breathing in water is quite difficult as water is dense and having less dissolved oxygen than air.

## DO PLANTS ALSO RESPIRE?

They also take in oxygen from the air and give out carbon dioxide. In the cells oxygen is used to break down glucose into carbon dioxide and water as in other organisms. In plants each part can independently take in oxygen from the air and give out carbon dioxide. **The leaves of the plants have tiny pores called stomata for exchange of oxygen and carbon dioxide.**

Like all other living cells of the plants, the root cells also need oxygen to generate energy. **Roots take up air from the air spaces present between the soil particles with the help of root hairs.** Lenticels in old stems and general surface of roots help in respiration. Lenticells in old stem and general surface of roots help in respiration.



*Roots absorb air from the soil*

# CONCEPT APPLICATION LEVEL - I [NCERT Questions]

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

**Ans.** An athlete requires more energy during and after the race. Since demand for the energy is high, so oxidation of food must be speeded up. This requires more oxygen to be supplied. This is why an athlete not only breathes fast, but also takes deep breathes and thus inhale more oxygen.

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

**Ans. Similarities:**

Aerobic Respiration	Anaerobic Respiration
1. It starts with the breakdown of a nutrient (glucose).	1. It also starts with the breakdown of a nutrient (glucose).
2. It yields byproducts.	2. It also yields byproducts.
3. It takes place in a cell.	3. It also takes place in a cell.
4. In this process energy is released.	4. In this process also energy is released.

**Differences :**

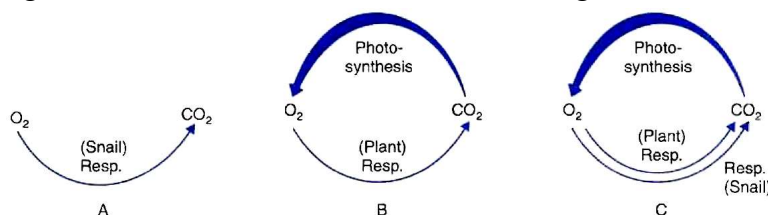
Aerobic Respiration	Anaerobic Respiration
1. It is the process of breakdown of glucose in the presence of oxygen.	1. It is the process of breakdown of glucose in the absence of oxygen.
2. Glucose is completely oxidised.	2. Glucose is incompletely oxidised.
3. The end products formed are CO <sub>2</sub> , H <sub>2</sub> O and energy.	3. The end products formed are CO <sub>2</sub> , ethyl alcohol, organic acid and energy.
4. Energy released is more. (38 ATP molecules).	4. Energy released is less (2 ATP molecule).
5. It takes place in all higher organisms.	5. It takes place in lower organisms like yeast and muscles of man.
6. Reaction is Glucose + Oxygen → Carbon dioxide + Energy	6. Reaction is : Glucose → Ethyl alcohol + Carbon dioxide + Energy.
7. The reactions take place in the cytoplasm and mitochondria.	7. The reactions take place only in the cytoplasm.

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

**Ans.** When we inhale dust particles, pollens, etc., the particles get trapped in the hair present in our nasal cavity. However, sometimes these particles may pass the hair in the nasal cavity, where 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 dustfree, clean air enters 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 test-tube A, a water plant in test-tube B, and in C keep snail and plant both. Which test-tube would have the highest concentration of CO<sub>2</sub>?**

**Ans.** The exchange of gases in three test-tubes can be shown as in Fig.



- Fig.** (A) In test tube A ; CO<sub>2</sub> is produced by respiration of snail (No consumption of CO<sub>2</sub>).  
 (B) In test tube B ; CO<sub>2</sub> is produced by respiration of plant and much higher amount of CO<sub>2</sub> is consumed during photosynthesis.  
 (C) In test tube C ; CO<sub>2</sub> is produced by respiration of snail and plant and CO<sub>2</sub> is consumed during photosynthesis.  
 It is clear from the above observation that the highest concentration of CO<sub>2</sub> will be 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
- (E) The mountaineers carry oxygen with them because:  
 (i) at an altitude of more than 5 km there is no air.  
 (ii) the amount of air available to a person is less than that available on the ground.  
 (iii) the temperature of air is higher than that on the ground.  
 (iv) the pressure of air is higher than that on the ground.

- Ans.** (A) (iii) spiracles (B) (ii) lactic acid (C) (ii) 15-18 (D) (ii) move downwards  
 (E) The amount of air available to a person is less than that available on the ground.

**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.** (a)-(iii), (b)-(iv), (c)-(i), (d)-(v), (e)-(ii), (f)-(vi)

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

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

- Ans.** (i) F, (ii) F, (iii) T, (iv) F, (v) T

# CONCEPT APPLICATION LEVEL - II

## Section – A

**Q.1 What is a cell?**

**Ans.** A cell is the smallest structural and functional unit of an organism

**Q.2 Why do all animals respire?**

**Ans.** All living organisms respire to get energy from the glucose or reserve food in form of glycogen.

**Q.3 Define aerobic respiration and anaerobic respiration.**

**Ans. Aerobic respiration:** When breakdown of glucose takes place with the use of oxygen it is called aerobic respiration.

**Anaerobic respiration:** Food can also be broken down, without using oxygen. This is called anaerobic respiration.

**Q.4 Explain only by equations:**

**(i) Aerobic respiration**

**(ii) Anaerobic respiration in yeast**

**(iii) Anaerobic respiration in muscle cells.**

**Ans.** (i) Glucose  $\xrightarrow{\text{with the use of oxygen}}$  Carbon dioxide + Water + Energy

(ii) Glucose  $\xrightarrow[\text{(in plant cells)}]{\text{without the use of oxygen}}$  Carbon, dioxide + Alcohol + Energy

(iii) Glucose  $\xrightarrow[\text{(in animal cells)}]{\text{in the absence of oxygen}}$  Lactic Acid + Energy

**Q.5 Why do we get muscle cramps after heavy exercise?**

**Ans.** 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  $\xrightarrow{\text{in the absence of oxygen}}$  Lactic Acid + Energy

The cramps occur only when muscle cells respire anaerobically. The partial breakdown of glucose produces lactic acid. The accumulation of lactic acid causes muscle cramps/fatigue.

**Q.6 What are yeasts? Why are they used to make wine and beer?**

**Ans.** Yeasts are single celled organisms. They respire anaerobically and during this process, yield alcohol.

Glucose  $\xrightarrow{\text{in the absence of oxygen}}$  Carbon dioxide + Alcohol + Energy

They are therefore used to make wine and beer.

**Q.7 Explain, why we get relief from cramps after a hot water bath or a massage?**

**Ans.** We get relief from cramps after a hot water bath or a massage, because they improve circulation of blood. As a result, the supply of oxygen to the muscle cells increases. The increase in the supply of oxygen results in the complete oxidation of lactic acid and results in the release of energy, carbon dioxide and water.

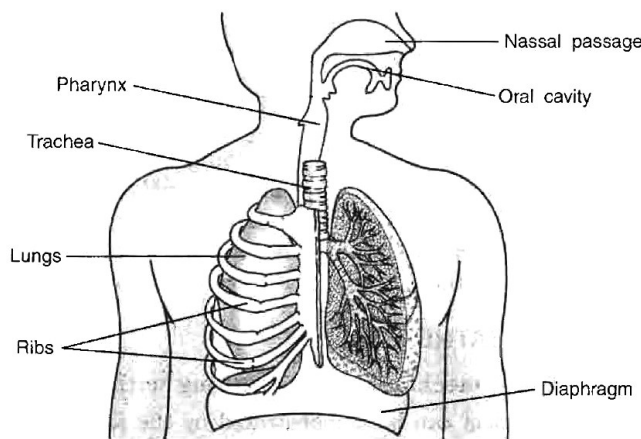
**Q.8 Why do we sometime yawn when we are sleepy or drowsy?**

**Ans.** We yawn usually when we are sleepy or drowsy because during such conditions we do not breathe as we normally do and our breathing rate slows down. Due to slower breathing rate less oxygen goes into our body which is insufficient for respiration and causes yawning.



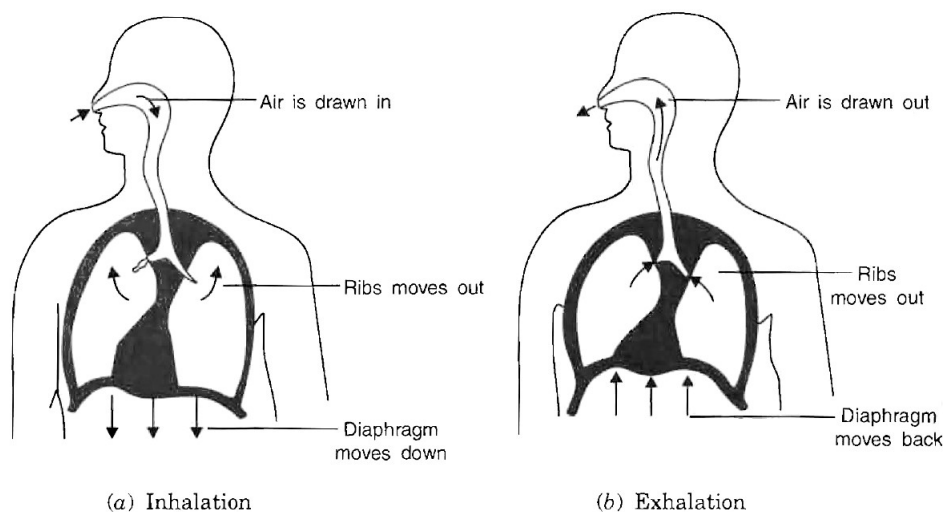
**Q.9 Explain the mechanism of breathing with the help of diagram.**

**Ans.** Air is taken in through nostrils. From nostrils, this air is passed into the nasal cavity. From the nasal cavity, air reaches to lungs through windpipe. 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. Breathing involves the movement of the diaphragm and the rib-cage.



**Fig.** Human respiratory system

We know that breathing involves the lowering of diaphragm and the expansion of rib-cage. The role of diaphragm in breathing is as described below:



**Fig. A.** Role of diaphragm in breathing

**(i) Inhalation:** During breathing in (inhalation) of air, the diaphragm gets lowered (Fig. a), it makes the chest cavity bigger. It lowers the air pressure in the chest cavity, due to which lungs expand and air rushes in.

**(ii) Exhalation:** During breathing out (exhalation) of the air, the diaphragm moves upward (Fig. b) thus reducing the size of chest cavity, due to which the air pressure increases inside the chest cavity and the lungs shrink and air rushes out.

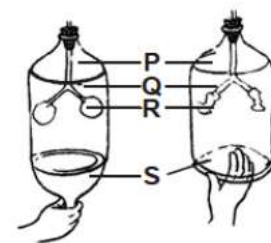
**Q.10 What could be the difference in the chest size of an adult during inhalation and exhalation?**

**Ans.** During the process of inhalation or breathing in, the muscles between the ribs contract causing the rib cage to move upward and outward. Also the diaphragm contracts and moves downward. This increases the space in the chest cavity and makes it larger. When we breathe out or exhale, the rib cage moves downward and inward and the diaphragm moves upwards. This decreases the space in our chest cavity and make it smaller.

**Section – B****PREVIOUS YEAR'S NSO QUESTIONS**

Q.1 In mammals the diaphragm is a muscular membrane that divides the thorax from abdomen. It plays an essential role in breathing. Which of the following labelled parts represents diaphragm in the given figure? [NSO 2010]

- (A) P (B) Q (C) R (D) S



Q.2 Which of the following does not happen during exhalation ?

- (A) The space in chest cavity decreases (B) Diaphragm goes up  
(C) Air is released (D) Ribs are pushed upward and outward.

[NSO 2011]

Q.3 Which of the following is incorrect regarding exhalation process in breathing mechanism?

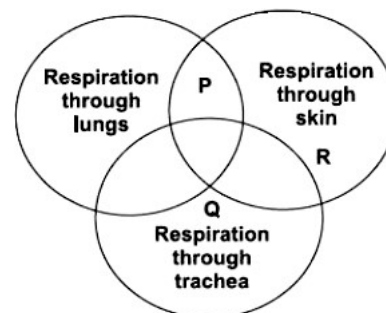
- (A) Air moves out. (B) Diaphragm relaxes.  
(C) Chest cavity becomes smaller. (D) External intercostal muscles contract.

[NSO 2012]

Q.4 Refer the given Venn diagram and select the correct option.

- (A) P - Man  
(B) Q - Earthworm  
(C) R - Cockroach  
(D) P - Frog

[NSO 2012]

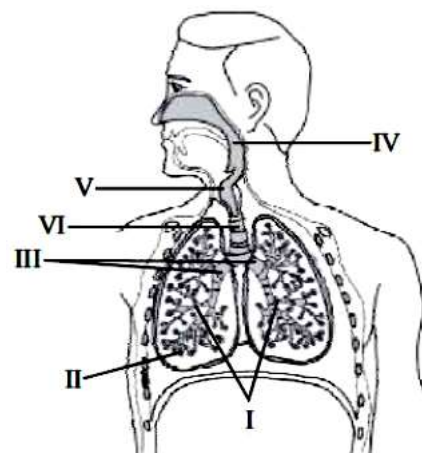


Q.5 Which one of the following is a possibility for most of us in regard to breathing, by making a conscious effort? [NSO 2013]

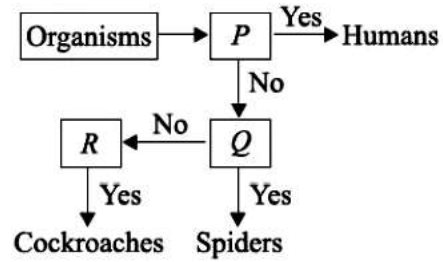
- (A) The lungs can be made fully empty by forcefully breathing out all air from them.  
(B) One can breathe out air through Eustachian tube by closing both nose and mouth.  
(C) One can consciously breathe in and breathe out by moving the diaphragm alone, without moving the ribs at all.  
(D) One can breathe out air totally without oxygen.

Q.6 Given below is the diagrammatic sectional view of the human respiratory system. Which set of three parts out of I-VI have been correctly identified? [NSO 2013]

- (A) (I) Bronchioles, (IV) Pharynx, (VI) Bronchus  
(B) (III) Bronchi, (IV) Pharynx, (VI) Trachea  
(C) (I) Bronchioles, (II) Alveolus, (VI) Bronchus  
(D) (II) Alveolus, (IV) Larynx, (V) Glottis



- Q.7 Refer to the given flow chart showing the characteristics P, Q and R which are present in some animals and absent in others.



Identify P, Q, R and select the correct option.

[NSO 2014]

- (A) P-Diaphragm, Q-Book lungs, R-Operculum  
 (B) P-Throat, Q-Spiracles, R-Book lungs  
 (C) P-Lungs, Q-Book lungs, R-Spiracles  
 (D) P-Diaphragm, Q-Operculum, R-Spiracles

# CONCEPT APPLICATION LEVEL - III

## SECTION - A

- **Fill in the blanks with suitable words.**
- 1. In higher animals, respiration occurs through \_\_\_\_\_ .
- 2. The food has \_\_\_\_\_ which is released during \_\_\_\_\_ .
- 3. Yeasts can survive in the absence of air. They are called \_\_\_\_\_ .
- 4. The accumulation of \_\_\_\_\_ causes muscle cramps.
- 5. The taking in of air rich in oxygen into body is called \_\_\_\_\_ .
- 6. Breathing involves the movement of the \_\_\_\_\_ and the \_\_\_\_\_ .

## SECTION - B

- **Match the following (one to one)**

Q.1	Column I	Column II
	(i) Unicellular organisms	(a) Skin
	(ii) Plants	(b) Spiracles
	(iii) Earthworm, Leech	(c) Cell membrane
	(iv) Insects	(d) Lungs, skin
	(v) Frog	(e) Stomata
	(vi) Mammals	(f) Gills
	(vii) Fish	(g) Lungs

## SECTION - C

- **Mark 'T' if the statement is true and 'F' if it is false:**
- 1. All living organisms respire to get energy from food.
- 2. Cellular respiration takes place in the cells of all organisms.
- 3. Muscles can also respire anaerobically.
- 4. During heavy exercise the breathing rate declines.
- 5. Breathing involves the upward movement of the diaphragm.
- 6. The percentage of carbon dioxide is higher in exhaled air in comparison to inhaled air.
- 7. Roots take up air from the air spaces present between the soil particles.

## SECTION - D

- **Choose the correct option in the following:**
- 1. The site of cellular respiration is  
 (A) chloroplast      (B) nucleus      (C) mitochondria      (D) cell membrane
- 2. What is the raw material for the cellular respiration?  
 (A) Glucose      (B) Sucrose      (C) Fructose      (D) Starch
- 3. Which of the following organisms can do anaerobic respiration?  
 (A) Euglena      (B) Yeast      (C) Paramecium      (D) Amoeba
- 4. What are the end products of aerobic respiration?  
 (A) Carbon dioxide, water and energy      (B) Alcohol, carbon dioxide and energy  
 (C) Lactic acid and energy      (D) None of the above

5. Which are the gases involved in breathing?  
 (A)  $O_2$  and  $NO_2$       (B)  $O_2$  and  $SO_2$       (C)  $O_2$  and  $O_3$       (D)  $O_2$  and  $CO_2$
6. Name the organ of the body in which the blood is oxygenated.  
 (A) Heart      (B) Lungs      (C) Liver      (D) Pancreas
7. After heavy exercise, due to the accumulation of which substance we get muscle cramps?  
 (A) Malaic acid      (B) Fumaric acid      (C) Lipoic acid      (D) Lactic acid
8. Yeasts are used in  
 (A) wine and beer industry      (B) bakery  
 (C) in both      (D) none of these
9. In the following figure of respiratory system organs labelled by 1 and 2 are respectively:

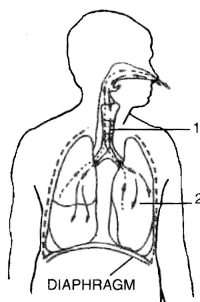


Fig. Respiratory system

- (A) Tracheae, Lungs      (B) Lungs, Tracheae      (C) Nasal cavity, Lungs (D) Lungs, Nasal cavity
10. Breathing rate in human beings in normal condition is  
 (A) 12-15 times in a minutes      (B) 15-18 times in a minutes  
 (C) 18-22 times in a minutes      (D) 22-25 times in a minutes
11. What are the end products of aerobic respiration?  
 (A)  $CO_2$  &  $H_2O$       (B) Ethyl alcohol +  $CO_2$       (C) Lactic acid      (D) All of these
12. What is the correct sequence of air passage during inhalation?  
 (A) Nostrils → Larynx → Pharynx → Trachea → lungs  
 (B) Nasal passage → trachea → pharynx → larynx → alveoli  
 (C) Larynx → Nostrils → Pharynx → lungs  
 (D) Nostrils → Pharynx → Larynx → trachea → alveoli

## ANSWER KEY

### CONCEPT APPLICATION LEVEL - II

#### SECTION - B

Q.1 D    Q.2 D    Q.3 D    Q.4 D    Q.5 C    Q.6 B    Q.7 C

### CONCEPT APPLICATION LEVEL - III

#### SECTION - A

(1) lungs                      (2) stored energy, respiration    (3) anaerobes  
 (4) lactic acid                (5) inhalation                      (6) diaphragm, rib-cage

#### SECTION - B

Q.1 (i)-(c), (ii)-(e), (iii)-(a), (iv)-(b), (v)-(d), (vi)-(g), (vii)-(f)

#### SECTION - C

1. True            2. True            3. True            4. False            5. False            6. True            7. True

#### SECTION - D

1. C    2. A    3. B    4. A    5. D    6. B    7. D  
 8. A    9. A    10. B    11. A    12. D