# Breathing And Exchange of Gases Class 11 Study Notes

Breathing is an essential process for all living beings as they derive energy from it to perform various activities. The chapter, ‘Breathing and Exchange of Gases’ of NCERT biology class 11 covers this topic in detail. Through this chapter students will understand that living cells need a continuous supply of O2 for the process, and the CO2 produced must be released. This process is also referred to as respiration. So let’s get started and go through this interesting chapter.

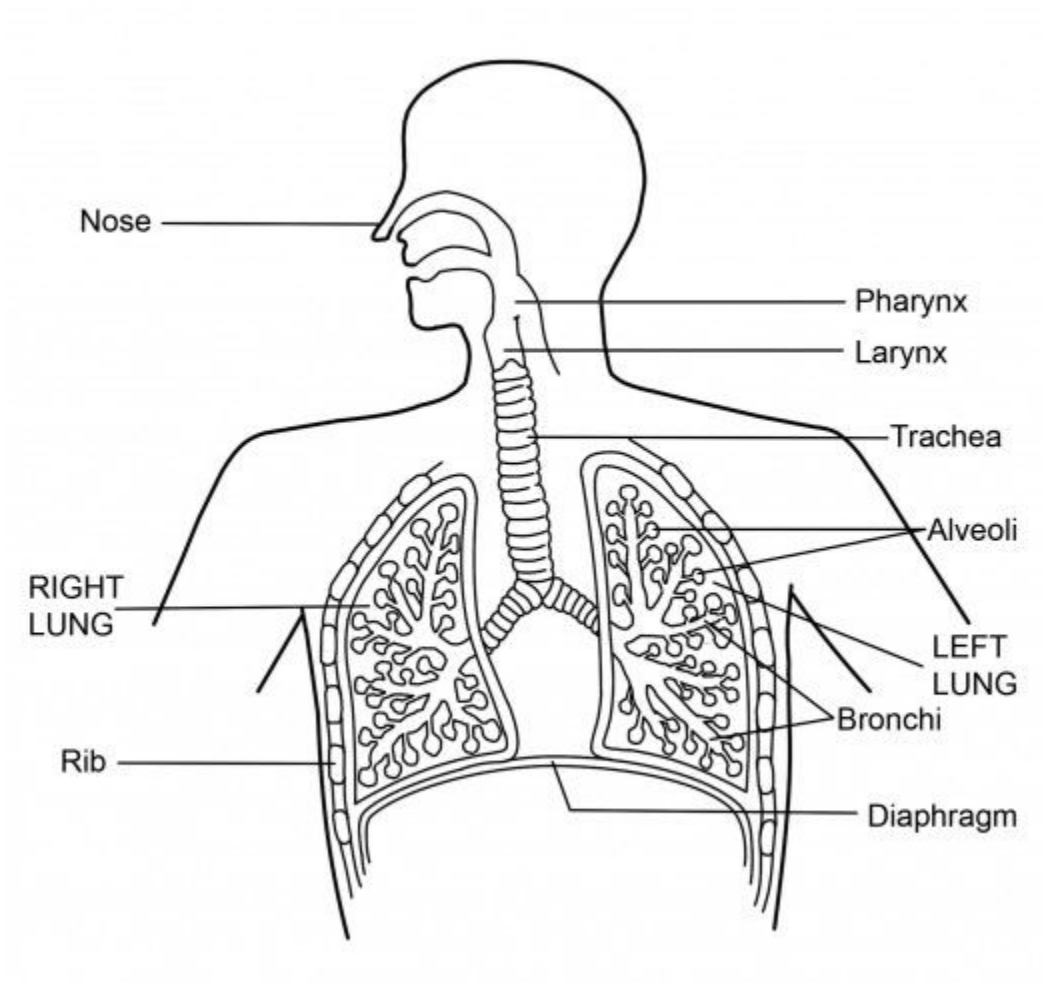
## Respiratory Organs

Based on habitats and levels of the organization, different groups of living organisms have different types of respiratory organs. As explained in NCERT biology class 11 books, while the lower invertebrates respire through the entire body surface, the aquatic arthropods and mollusks use gills, and the terrestrial animals use the vascularised organs called lungs.

## Human Respiratory System

The human respiratory system consists of the following parts:

- A pair of nostril
- Pharynx
- Larynx
- Trachea
- Primary Bronchi
- Secondary and Tertiary bronchi
- Lungs
- Alveoli
- Heart

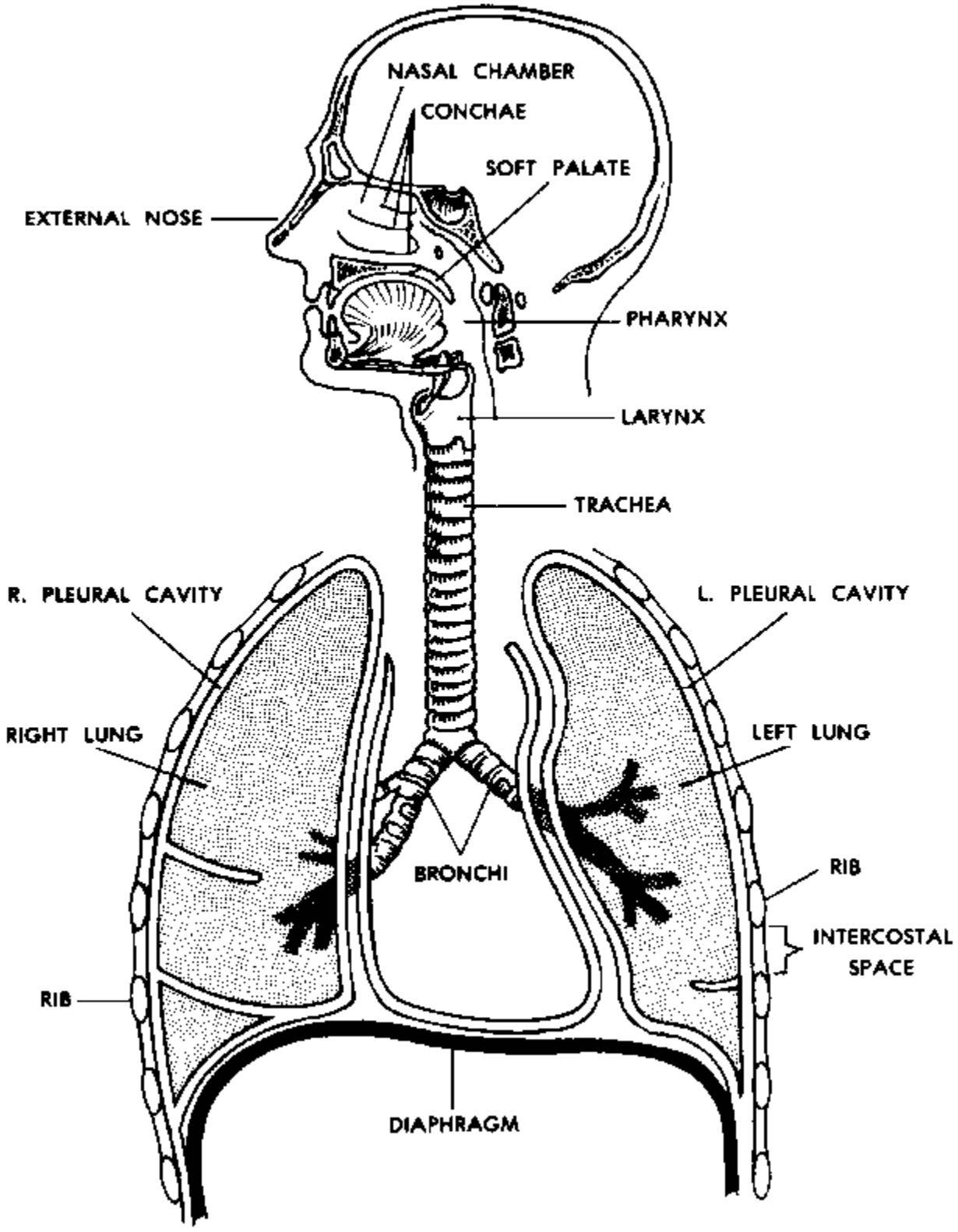



Courtesy: Pinterest

## The Process Of Respiration

As explained in the chapter breathing and exchange of gases, the process of respiration takes place in the following steps:

- The atmospheric oxygen enters the body through pulmonary respiration, and CO2-rich alveolar is released
- In the next step, the diffusion of O2 and CO2 occurs across the alveolar membrane
- The blood transports O2 and CO2 across different parts of the body
- The diffusion of O2 and CO2 then occurs between blood and tissues
- The O2 is utilized in cellular respiration and releases energy and CO2

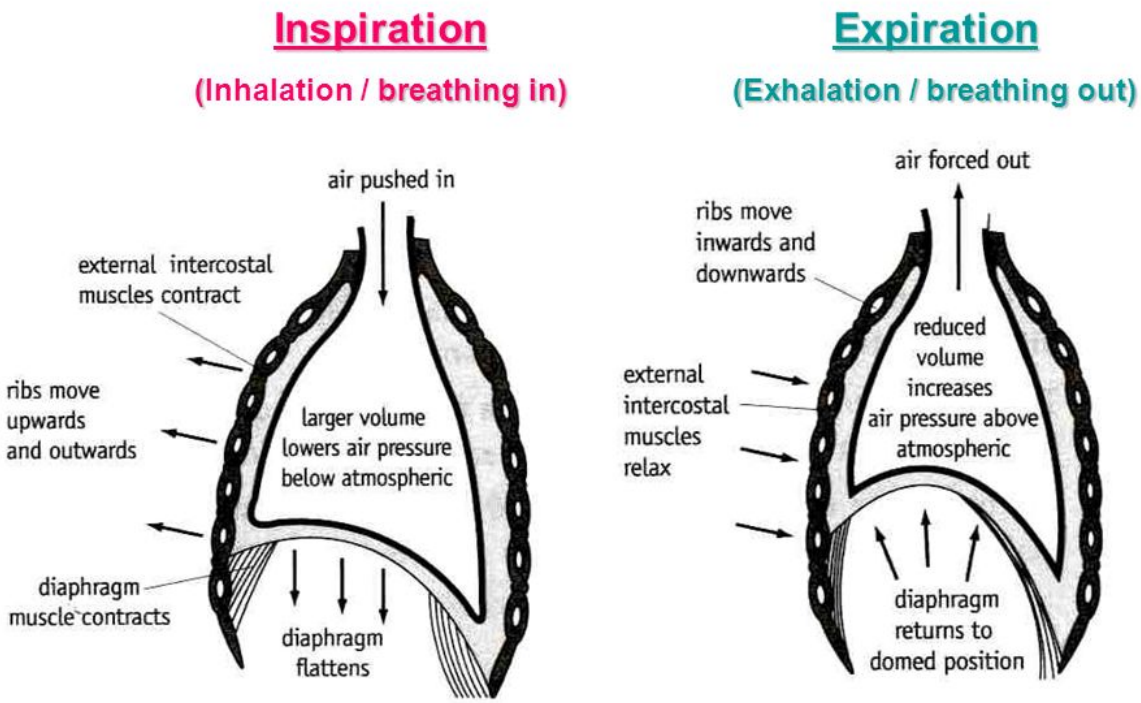



Courtesy: GUWS Medical

## Mechanism of Breathing

The respiration process and the breathing mechanism are two different and i exchange of gases. Like the respiration process consists of different steps, the breathing mechanism involves two stages: Inspiration and Expiration. When the atmospheric air is drawn within, it is called inspiration, and when alveolar air is released out, it is called expiration.

During inspiration, the pulmonary volume increases due to lower intrapulmonary pressure. On the other hand, the pulmonary volume decreases during expiration due to increased pulmonary pressure. The pulmonary pressure increases and decreases due to the contraction and relaxation of the diaphragm and intercostals muscles.

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## Respiratory Volumes and Capacities

According to the chapter breathing and exchange of gases, the respiration process includes the following terms:

- ***Tidal Volume (TV)*:** It is the volume of the air inspired and expired in one breath. 500mL is considered a healthy TV in human adults

- ***Inspiratory Reserve Volume (IRV)***: It is the forcible inspiration or the additional air volume of air. It can be between 2500mL to 3000mL
- ***Expiratory Reserve Volume (ERV)*****:** It is the forced volume of air expelled after a normal inspiration. It is around 1200mL in addition to 500mL
- ***Residual Volume (RV)*****:** It is the volume of air remaining in the lungs even after forcible expiration. It is between 1100mL and 1200mL. It cannot be measured by spirometry
- ***Inspiratory Capacity (IC)*****:** It is TV + IRV and is defined as the total air a person can inspire after a normal expiration
- ***Expiratory Capacity (EC)*****:** It is TV + ERV and is defined as the total volume of air a person can exhale after a normal inspiration
- ***Functional Residual Capacity (FRC):*** It is ERV + RV and is defined as the volume of air remaining in the lungs after a normal expiration
- ***Vital Capacity (VC)*****:** It is the maximum volume of air that can be breathed in after forcible expiration. It is also the maximum volume of air that can be breathed out after forcible inspiration
- ***Total Lung Capacity (TLC)***: It is the sum of vital capacity (VC) and residual capacity (RC)

## Exchange of Gases

As per the class 11 Biology syllabus, *the primary site of the exchange of gases is alveoli*. However, it also occurs between blood and tissues. The exchange between O2 and CO2 is the result of the pressure/concentration gradient. The table given below shows the partial pressure (in mmHg) of Oxygen and Carbon dioxide in the diffusion process and in the atmosphere derived from the chapter breathing and exchange of gases.

| Respiratory gas | Atmospheric gas | Alveoli | Deoxygenated Blood | Oxygenated blood | Tissues |
|---|---|---|---|---|---|
| **O2** | 159 | 104 | 40 | 95 | 40 |
| **CO2** | 0.3 | 40 | 45 | 40 | 45 |

# Transport of Gases

The chapter Breathing and Exchange of Gases explain that O2 and CO2 transportation occurs via the blood. While the blood transports 97% of O2, the remaining 3% is transported through plasma in a dissolved state. Mentioned below are some of the important points related to the transport of gases-

## Transportation of Oxygen

As mentioned in the chapter, the O2 molecule binds with hemoglobin present in the RBCs and forms oxyhemoglobin. The 100mL of oxygenated blood delivers around 5mL of O2 to the tissues.

## Transportation of Carbon Dioxide

The transportation of CO2 can be explained as carbamino-hemoglobin. The 100mL of deoxygenated blood delivers around 4mL of CO2 to the alveoli.

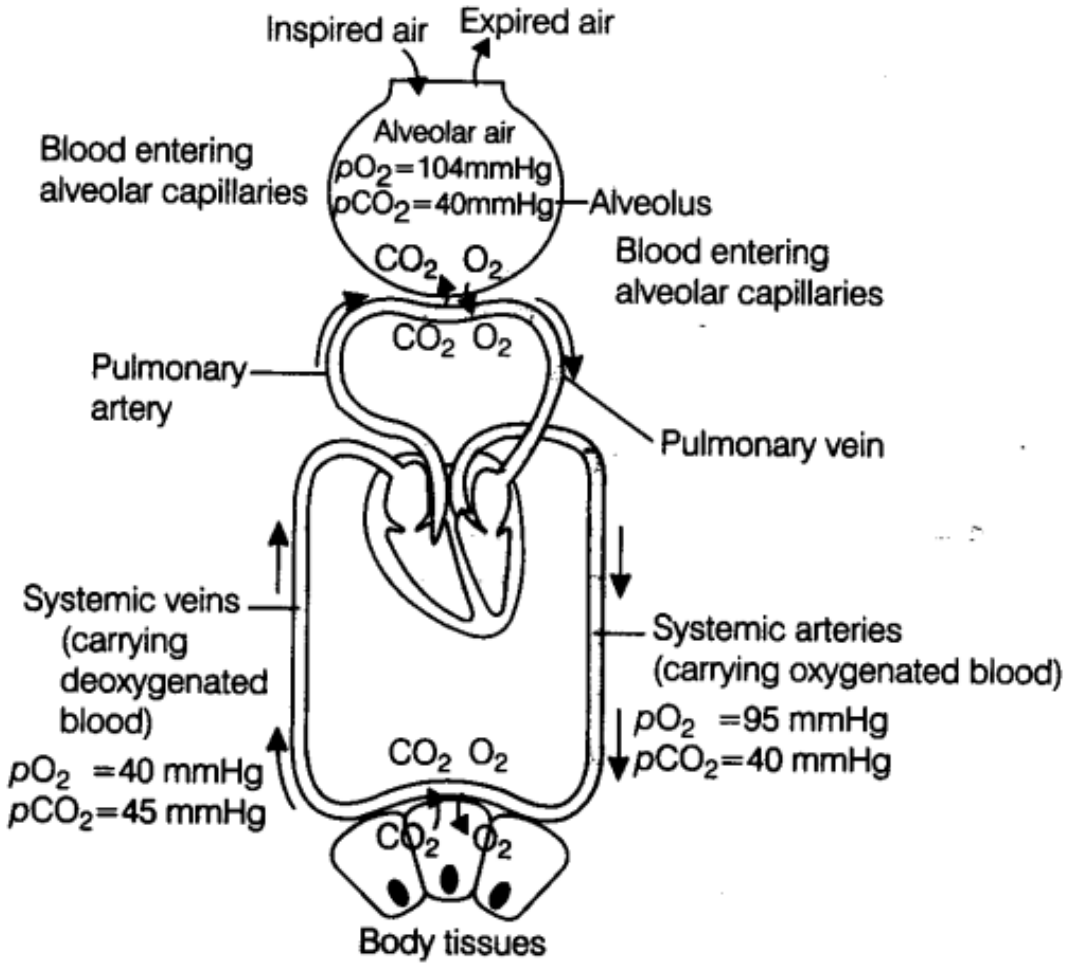


**Fig. 17.4** Diagrammatic representation of exchange of gases at the alveolus and the body tissues with blood and transport of oxygen and carbon dioxide

Courtesy: Pinterest

## Disorders of Respiratory System

As explained in the breathing and exchange of gases chapter in the NCERT biology book, the disorders associated with respiration are as follows:

- ***Asthma*** – This condition causes difficulty in breathing due to inflammation in the bronchi and bronchioles
- ***Emphysema*** – In this condition, the respiratory surface decreases because of damage caused by alveolar walls. The major cause is cigarette smoking

- ***Occupational Respiratory Disorder*** – The lungs are damaged due to fibrosis. It is common in industries where workers have long exposure to too much dust