Chapter

1 Respiratory System

New topic alert!
How do you feel?

Learning Objectives

1. Identify the organs of the human respiratory system
2. Create a simple lung model to understand how lungs work during breathing
3. Describe common respiratory disorders
4. Explain how to keep the respiratory system healthy

Focus on

- Human respiratory organs
- Breathing process
- Respiratory disorders
- Caring for the respiratory system

Warm Up

After running around the field, Pascal stopped and felt tired.
He noticed that his chest was moving up and down very quickly.

What do you think is making his chest move like that?

Breathing is the process of taking in air that contains oxygen and releasing air that contains carbon dioxide. This happens through a system in our body called the respiratory system. Breathing happens all the time, even when we are sleeping, to keep us alive and full of energy.

When we breathe, we take in oxygen from the air. The oxygen that enters the body is used to convert nutrients from food into energy. In addition to energy, this process also produces waste substances, such as carbon dioxide gas and water vapour, which are removed from the body through breathing.

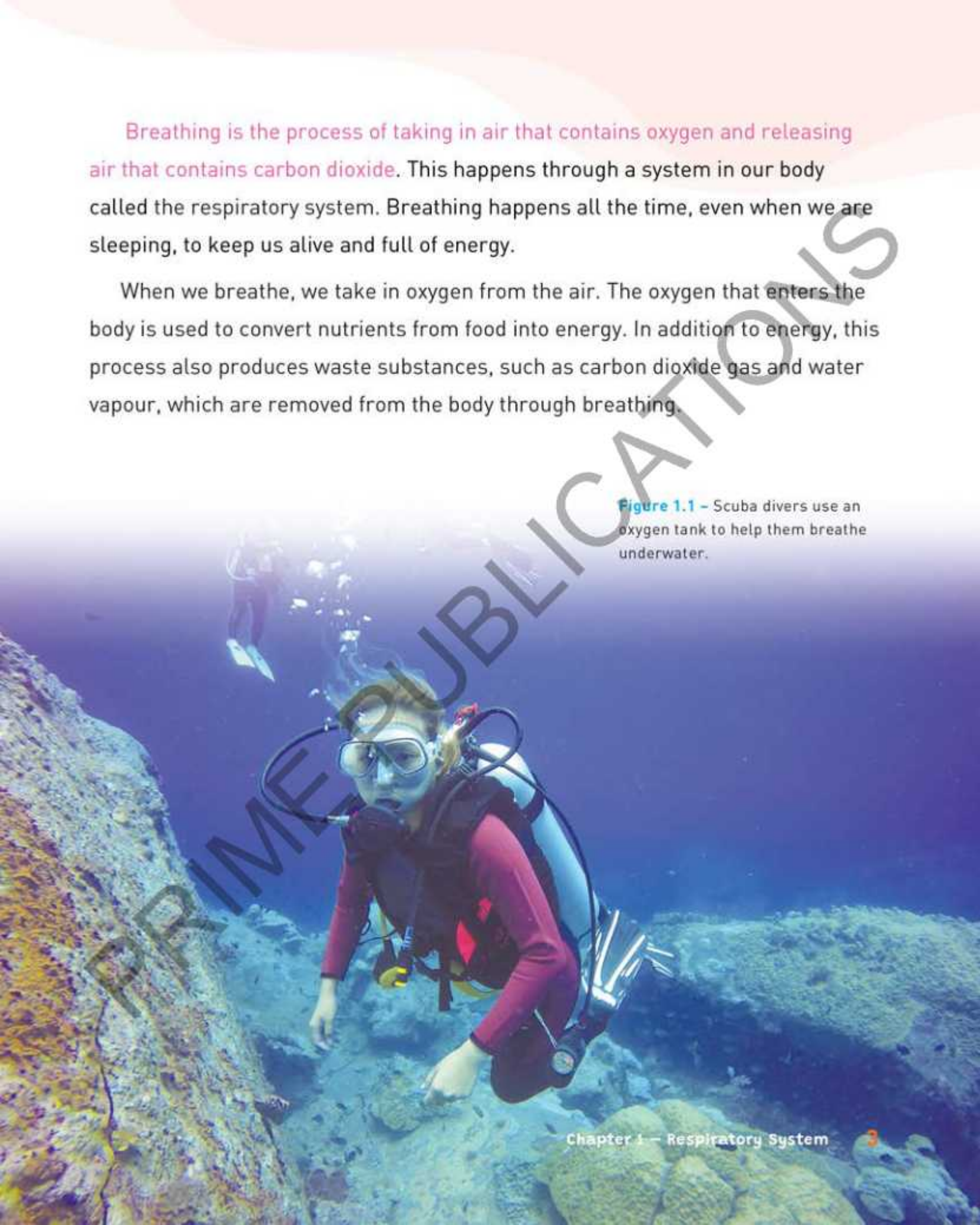


Figure 1.1 – Scuba divers use an oxygen tank to help them breathe underwater.

Human Respiratory Organs

The human respiratory organs consist of the nose, throat, and lungs. The inhaled air enters the lungs through nose and throat.

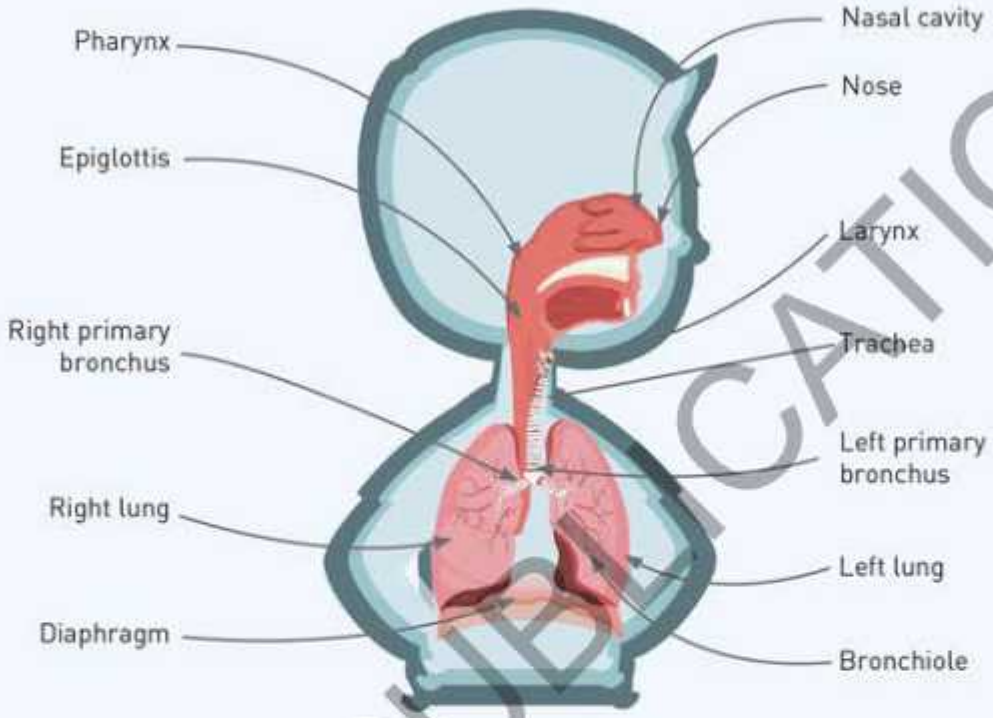


Figure 1.2 – Human respiratory organs

Nose

When air enters the nasal cavity, it goes through some important processes. First, the air is filtered by tiny hairs and mucus to remove dust, dirt, and germs. Then, the air is warmed to match the body's temperature. Finally, it is moistened to protect the respiratory organs from dryness. These steps help ensure the air is safe and comfortable for the lungs.

Nifty Insight

Sometimes people breathe through their mouth, but it is better to breathe through the nose. Air that goes through the mouth is not filtered, so more germs can enter the body.

Throat

The throat is the passage that allows air to move from the nose to the lungs. The parts of the respiratory tract in the throat include:

- Pharynx is the meeting point between the respiratory tract and the digestive tract.
- Larynx is the passage that connects the pharynx to the trachea. At the top of the larynx is a flap called the epiglottis, which closes when we swallow to prevent food or drink from entering the airway.
- Trachea (windpipe) is a pipe-like passage made of rings of cartilage that carries air to the lungs.
- Bronchus refers to the branches of the trachea that lead to the right and left lungs.

Lungs

The lungs are located inside the chest cavity (thorax). Inside the lungs, bronchioles branch into smaller and thinner tubes. At the end of these branches are tiny air sacs called alveoli (plural for alveolus). These air sacs are the parts of the lungs where the exchange of oxygen and carbon dioxide takes place.

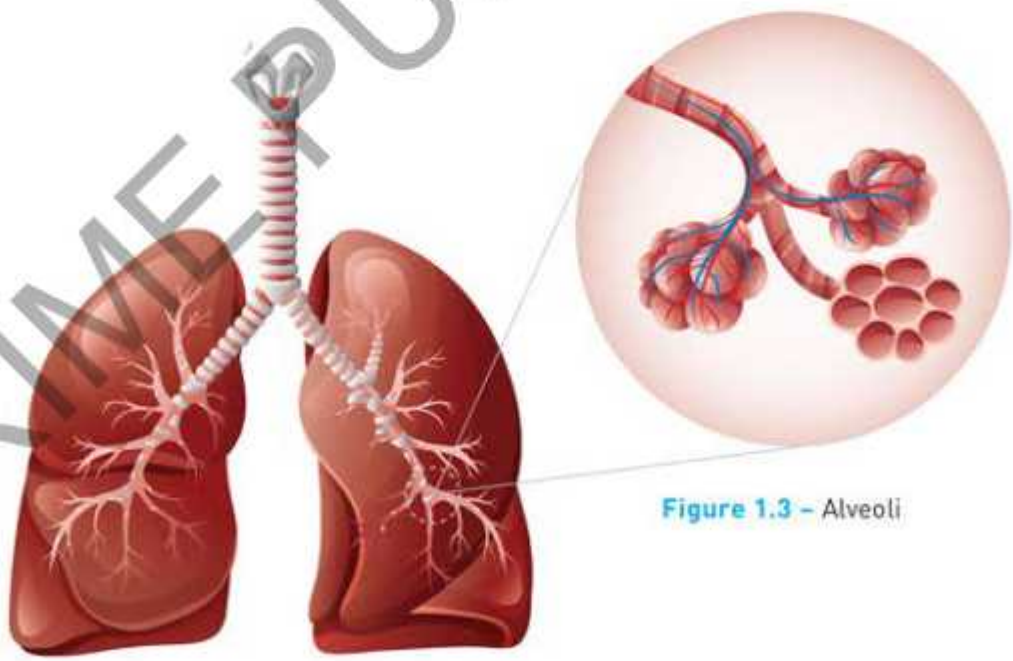


Figure 1.3 – Alveoli

Breathing Process

When we breathe, we inhale and exhale air. The process of breathing in is called inspiration, and the process of breathing out is called expiration. The air we breathe in is rich in oxygen, while the air we breathe out contains more carbon dioxide. The breathing process begins when air enters the nose as we inhale. From the nasal cavity, air flows through the throat, into the bronchi, bronchioles, and finally reaches the alveoli. In the alveoli, the exchange of oxygen and carbon dioxide takes place.

Think and Share

Why do you think our body uses two types of breathing?

As we breathe, the lungs expand and contract due to the movement of the intercostal muscles (the muscles between the ribs) and the diaphragm. The diaphragm is a layer of muscle with a curved shape that separates the chest cavity from the abdominal cavity. Based on the movement of these muscles, breathing is divided into two types: thoracic breathing (chest breathing) and abdominal breathing.

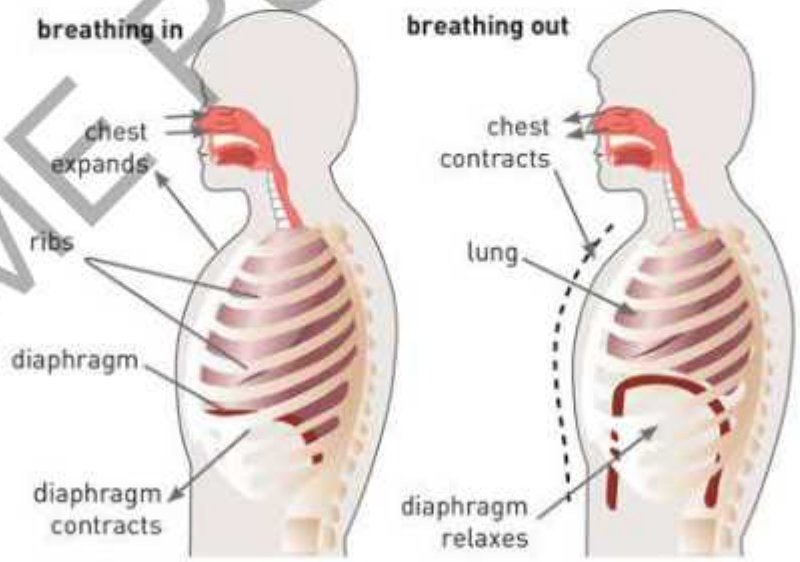


Figure 1.4 – The breathing process involves the movement of the intercostal muscles and the diaphragm.

Thoracic Breathing (Chest Breathing)

Chest breathing is breathing that happens due to the movement of the muscles between the ribs. The mechanism can be explained as follows:

- During Inhalation (Inspiration)
  Chest breathing begins when the intercostal muscles (muscles between the ribs) contract, causing the chest cavity to expand. This makes the air pressure inside the chest cavity lower than the air pressure outside the body, allowing oxygen-rich air to enter the lungs.
- During Exhalation (Expiration)
  Chest breathing continues as the intercostal muscles relax and return to their original position. This is followed by the lowering of the ribcage, which causes the chest cavity to become smaller. As a result, the air pressure inside the chest becomes higher than the pressure outside, and carbon dioxide-rich air is pushed out of the lungs.

Abdominal Breathing

Abdominal breathing is a type of breathing that involves the diaphragm muscle. For this reason, it is also called diaphragmatic breathing. The mechanism can be explained as follows:

- During Inhalation (Inspiration)
  Breathing begins when the diaphragm contracts, causing the chest cavity to expand. This makes the air pressure inside the chest cavity lower than the pressure outside the body, allowing oxygen-rich air to enter.
- During Exhalation (Expiration)
  Breathing continues as the diaphragm relaxes and returns to its original position. This is followed by the lowering of the rib cage, which makes the chest cavity smaller. As a result, the air pressure inside the chest becomes higher than the pressure outside, and carbon dioxide-rich air is pushed out.

Breathing and Respiration: Are They the Same?

Breathing and respiration are not the same, even though they are closely related. Breathing is the process of taking in air through the nose and mouth and then releasing it. This brings oxygen into the body and removes carbon dioxide. Respiration, on the other hand, happens inside our cells. It is the process where oxygen is used to break down sugar from the food we eat to produce energy. So, while breathing brings oxygen into the body, respiration uses that oxygen to give us the energy we need to live and grow.

Remember and Recall

Answer the following questions.

1. What are the three main parts of the human respiratory system?

2. What organ filters dust and germs from the air we breathe in?

3. Where does the exchange of oxygen and carbon dioxide take place?

4. What is the name of the pipe that carries air from the throat to the lungs?

5. What is the flap in the throat that stops food from entering the windpipe?

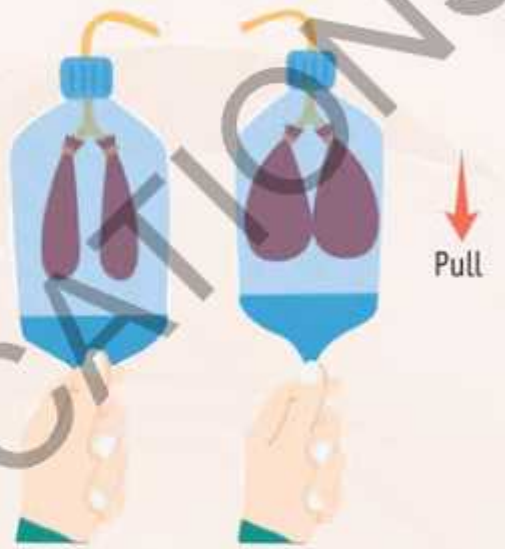
Try and Learn

Let's make a model of the lungs.

You need : A Y-shaped pipe, a plastic hose similar in size to the Y-shaped pipe, two small balloons, one large balloon, a one-litre plastic bottle (such as a mineral water bottle), some plasticine, scissors, tape, and a rubber band.

Steps :

1. Cut the bottom of the plastic bottle, leaving about 20 cm in height.
2. Insert the Y-shaped pipe into the plastic hose. Then, attach a small balloon to each branch of the pipe (refer to the picture).
3. Place the pipe assembly into the bottle.
4. Cover the bottom of the bottle with a large balloon. Secure it tightly using a rubber band. You can also use tape to make it airtight.
5. Seal the bottle opening with plasticine.
6. Gently pull the bottom part of the large balloon and observe what happens to the small balloons inside the bottle.



What did you discover from the experiment?

Respiratory Disorders

Scan Me!

Illnesses can prevent the respiratory organs from working properly. Here are some examples of respiratory disorders:

Influenza

Influenza is caused by a virus. Its symptoms include fever, headache, nasal congestion, and sometimes a sore throat.

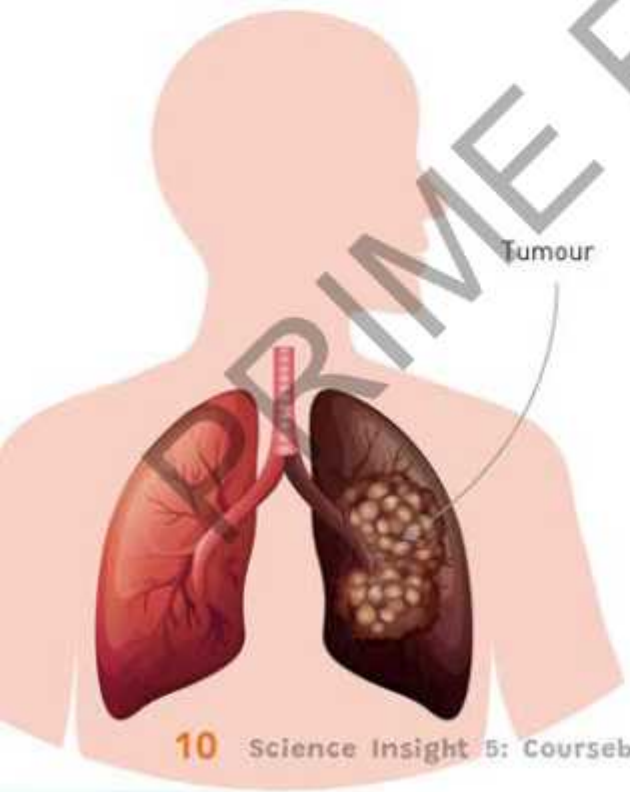
Asthma

Asthma is caused by inflammation and narrowing of the airways, specifically the bronchi and bronchioles. It is often triggered by substances that cause allergic reactions, such as dust. Although asthma cannot be completely cured, it can be managed with proper care.

Figure 1.5 – An inhaler helps people with asthma breathe better.

Tuberculosis (TB)

Tuberculosis is a lung disease caused by bacteria called *Mycobacterium tuberculosis*. The symptoms include shortness of breath, frequent coughing, and weight loss. In severe cases, the patient may cough up blood. TB can be prevented by giving the BCG vaccination to uninfected infants and adults.

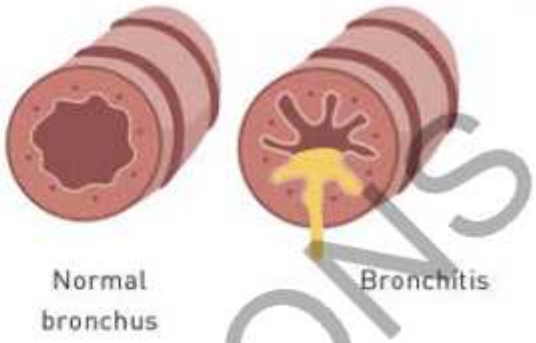


Lung Cancer

Lung cancer is a tumour that develops in the bronchus. It is often caused by harmful stuff such as cigarettes. To prevent lung cancer, follow a healthy lifestyle and avoid smoking.

Bronchitis

Bronchitis is a disease caused by an infection of the bronchus. The main symptom is inflammation of the trachea or bronchus, which leads to shortness of breath and wheezing. People with bronchitis often have a persistent cough.



Caring for the Respiratory System

The respiratory organs are important parts of our body. Therefore, we should always keep them healthy. Here are some ways to keep our respiratory organs healthy:

- Keeping the air clean. To help maintain clean air, we should keep our surroundings tidy, plant more trees and greenery, and avoid burning rubbish inappropriately.
- Avoiding breathing in polluted air. Wearing a mask when the air is smoky or dusty, and staying indoors when the air outside is not clean, can help protect our lungs.
- Having a healthy lifestyle, such as eating nutritious food, exercising regularly, and getting enough rest, helps keep the respiratory organs healthy. Nutritious food supports the immune system, regular exercise strengthens the lungs, and rest helps the body recover and stay strong.

Figure 1.6 – A mask helps filter the air we breathe by blocking dust and smoke.

Teacher's Corner

Use visual aids or a simple balloon-lung model to demonstrate how the diaphragm and lungs work during breathing. Encourage classroom discussion about the importance of clean air and healthy habits. Integrate science with environmental awareness by connecting breathing to air pollution and tree planting.

Key Terms

Alveoli	:	tiny air sacs in the lungs where oxygen and carbon dioxide are exchanged
Diaphragm	:	a curved muscle below the lungs that helps in breathing
Exhalation	:	the act of breathing out air (also called expiration)
Inhalation	:	the act of breathing in air (also called inspiration)
Lungs	:	a pair of organs inside the chest that responsible for the process of breathing

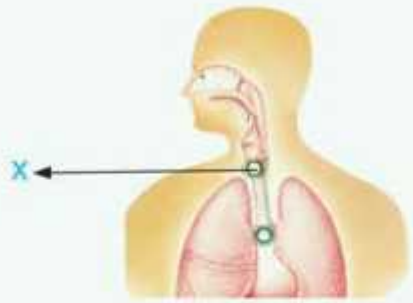
Points to Reflect

- Breathing is the process of taking in air that contains oxygen and releasing air that contains carbon dioxide.
- When we breathe in (inhale), we take in oxygen, and when we breathe out (exhale), we release carbon dioxide.
- The main human respiratory organs are the nose, throat, and lungs.
- Asthma, bronchitis, TB, and lung cancer are common respiratory disorders.
- We must care for our respiratory system by keeping the air clean, avoiding polluted air, and living a healthy lifestyle.

Assess Yourself

A. Cross (X) the correct answer.

1. Look at the following picture!



The human respiratory organ marked with X in the picture above is called the _____.

a. trachea
b. alveolus
c. larynx
d. bronchus

2. The gas in the air that is the result of respiration is _____.

a. oxygen
b. nitrogen
c. hydrogen
d. carbon dioxide

3. Gas exchange in lungs occurs in the _____.

a. thorax
b. bronchus
c. alveolus
d. bronchioles

4. What happens when the diaphragm moves down?

a. The lungs flatten
b. Air is pushed out
c. The chest relaxes
d. The lungs expand

5. When we inhale, our rib cage moves _____.

a. down
b. inward
c. up
d. flat

6. Which part of the respiratory system connects the throat to the lungs?

a. Bronchus
b. Liver
c. Nasal cavity
d. Diaphragm

7. A respiratory disorder caused by bacterial infection is _____.

a. asthma
b. TB
c. lungs cancer
d. influenza

8. A respiratory disorder caused by habit of smoking is _____.

a. asthma
b. bronchitis
c. lungs cancer
d. influenza

9. What is the main function of the respiratory system?
   a. To digest food
   b. To pump blood
   c. To help us breathe
   d. To filter water

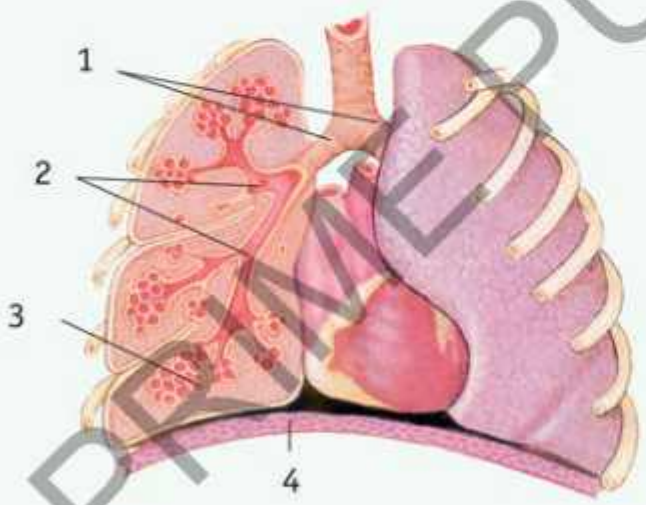
10. One way to keep our respiratory organs healthy is by _____.
   a. eating lots of sweets
   b. smoking
   c. breathing clean air
   d. staying up late

B. Write 'T' for true statements and 'F' for false ones.

1. The main job of the respiratory system is to help the body breathe ☐
2. The lungs take in oxygen and release carbon dioxide. ☐
3. The diaphragm pushes air into the lungs when it moves upward. ☐
4. The stomach is part of the human respiratory system. ☐
5. We can keep our respiratory organs healthy by not smoking. ☐

C. Observe the picture of the lungs below.

Picture Based Analysis



Choose two parts and explain what they do in the process of breathing.

_____

_____

_____

_____

_____

D. **Answer the following questions.** Critical Thinking

1. What is the respiratory system, and why is it important for our body?

2. Why is it better to breathe through the nose than through the mouth?

3. How can planting more trees help our respiratory system?

Life Skills and Subject Integration

F. **Sometimes we pass areas with smoke or dust, like near the busy roads. Breathing in this air can irritate our lungs and cause coughing or breathing problems.**

1. What do you think happens to our lungs if we often breathe in dirty or smoky air?

2. What can you do to keep your lungs healthy when the air is not clean?

Think Green

Too many cars driving around can make the air dirty. For short trips, walking or riding a bike is a fun and healthy choice. It keeps the air cleaner and helps our lungs stay strong. Let's try walking or cycling more to take care of ourselves and the Earth!

Figure 1.7 – Cycling in the nature introduce clean and fresh air to our body, keeping our lungs strong and healthy.