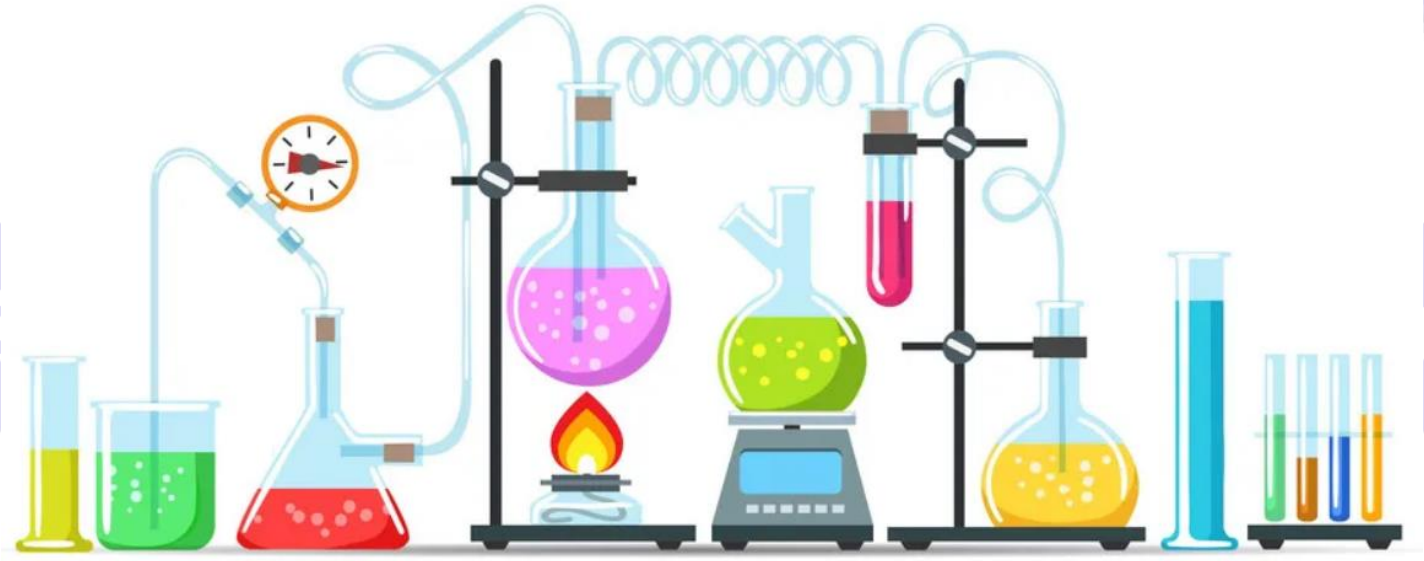
SCIENCE

Chapter 15: Air Around Us



Air Around Us

Air is an invisible and colourless form of matter. It is a mixture of several gases—oxygen, nitrogen, carbon dioxide, rare gases and water. Air occurs in the atmosphere above the Earth's surface and in the water on the Earth's surface. No living thing can exist without air. Air is present everywhere around us.

What is atmosphere?

The earth's surface is covered with a thick blanket of air called the atmosphere. It spreads above 500 km of the earth's surface.

The following influence of the atmosphere on the earth are:

- It protects the earth's surface from the UV rays of the sun.
- It maintains the water cycle process and the temperature of the earth.
- It contains required gases like oxygen and carbon dioxide that are responsible for the breathing process of living things.

The amount of oxygen is less in the higher altitude regions. Therefore, we carry oxygen cylinders with us to get the proper amount of oxygen to survive.

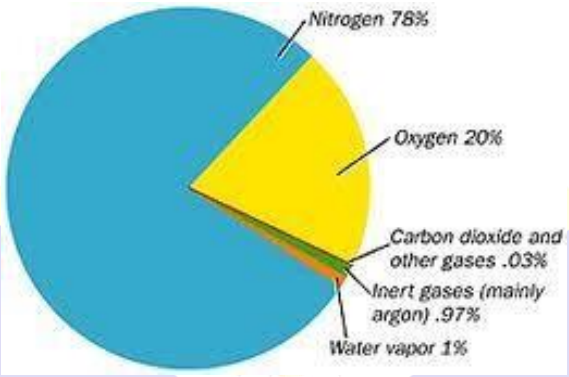
Properties of Air

Important Properties of Air:

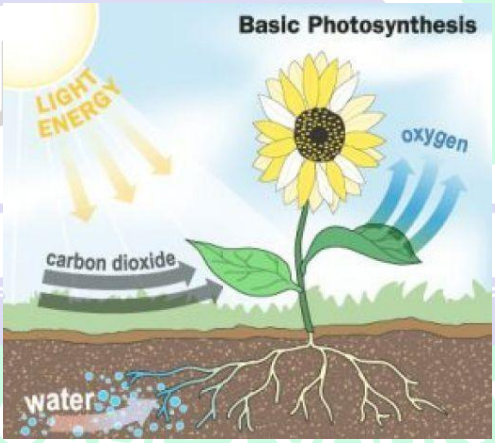
- Air is a colourless, tasteless and odourless gaseous substance.
- It has mass.
- It occupies space.
- It dissolves in water.
- It can be compressed.

Constituents of Air

- Air and some other components form a very thin layer (when compared to the radius of the Earth) over the Earth's surface. This layer is called the atmosphere.
- Gases such as hydrogen, oxygen, nitrogen, carbon dioxide and others along with dust particles together form a mixture called air. In air, all the gases have their original properties and can be recovered separately.



- The different gases present in the air have unique properties. Along with the composition of air, they play a vital role in the creation and evolution of life.
- Nitrogen makes up the major part of air (almost four-fifths). It is not required by us directly but in the form of compounds. It is essential for plant and animal growth and has various other uses.
- About one-fifth of the air is made of oxygen. It is required by all living things. Plants release oxygen into the air through **photosynthesis**. Compressed oxygen in cylinders is used by mountaineers and deep sea divers. Oxygen is essential for burning.
- The other important constituents of air are carbon dioxide, water vapour and inert gases.
- Carbon dioxide is required by plants to prepare their food during photosynthesis.



- Water vapour plays an important role in the water cycle. The amount of water vapour in the air is a measure of the humidity of that place.

Uses of Air

- Brings out changes in weather
- Helps in the drying of wet clothes and evaporation of sweat from the body
- Helps in the movement of yachts, parachutes, gliders and aeroplanes
- Helps birds, bats and insects in flying
- To make food by plants
- Plays an important role in the water cycle

Some of the important gases on earth are:

Nitrogen

- It occupies every four or fifth space filled by air.
- During the combustion of fuel, the burning is controlled by nitrogen.
- Plants absorb the molecules of nitrogen in the form of nitrates and nitrites. These molecules are present in the soil that carried by the root along with the water.
- Animals get nitrogen through plants by eating them as food.
- For the production of drugs and dyes, the companies need nitrogen for producing many products.
- Nitrogen is also used for the preservation of foods.

Oxygen

- Every one-fifth presence of the air in space contains oxygen.
- All living organisms require oxygen to stay alive. It is released by the plants and taken by the animals.
- In aquatic regions, oxygen is dissolved in the water, which helps the aquatic animals and plants to breathe.
- The animals such as earthworms, snakes and rats get oxygen from the pores of the soil.
- Oxygen is also helpful in burning the combustion of fuel.

Carbon dioxide

- It is one of the essential gas that is required to perform many functions to maintain the balance of the survival.
- The amount of CO_2 is very less. It aids in the process of photosynthesis in plants and respiration in

animals.

- It is responsible for the greenhouse effect.
- It is used as a refrigerant and is also called dry ice because it can freeze at low temperatures and converts into vapour without melting.
- It is used to manufacture soft drinks and urea.
- It is used to extinguish fire because it does not support combustion.

Water Vapour

- When water gets heated, it boils and starts forming vapours. This process is called evaporation. These vapours are found in gaseous state move to the sky and the formation of clouds takes place. The amount of water vapours present in the clouds is called humidity.
- The presence of water vapours is different in different regions and seasons. For example, coastal areas like Chennai and Mumbai have higher concentration levels of water vapours than the other areas like Rajasthan and Madhya Pradesh.

Dust and Smoke

- Air contains dust. For example, the corners of the room of the house and you may have observed something that is uncleaned have dust on it. The construction sites have more dust as compared to the well-furnished rooms.
- When we burn anything, the smokes come out and mix with the particles of air. The production of products in the factories and burning woods in the house release smokes that goes out through the chimneys (Figure 2).

Figure 2: Smokes coming out of the factories through chimneys.

Oxygen Cycle

- The maintenance of the amount of oxygen present in the atmosphere is done by plants by the process of photosynthesis.
- The process of respiration in animals required oxygen all day and night. Most probably, photosynthesis takes place in the daytime. During respiration in plants, the amount of oxygen released is sufficient to maintain the level of oxygen in the atmosphere.
- The two main processes that maintain the amount of oxygen in the atmosphere are photosynthesis and respiration.
- The consumption and releasing of the oxygen form a cycle called the oxygen cycle (Figure 3).
- The continuation of cutting trees and plants disturb the level of O_2 present in the atmosphere. Meanwhile, the level of CO_2 is increasing rapidly.
- Due to the continuation of cutting trees and urbanization, global warming takes place.

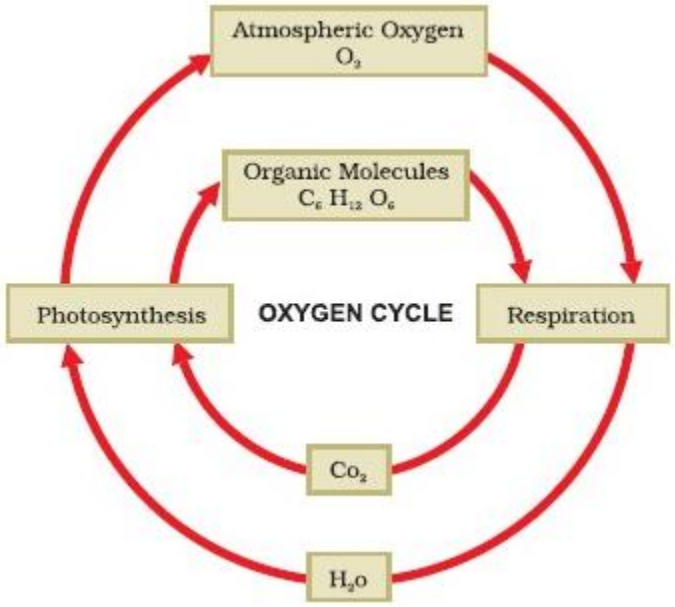


Figure 3: Oxygen Cycle.

Ozone Layer

The main work of the ozone layer is the absorption of UV rays by the sun. It absorbs 93-99% of the UV rays. The ozone gas is present 10 to 50 kilometres high up in the earth's atmosphere. The UV rays can cause eye problems and skin cancer. The ozone layer is depleting due to the use of chlorofluorocarbons.

Uses Of Air

- Air is one of the dispersal agents of pollen grains and seeds.
- Air is used to generating electricity by windmills and aerogenerators (Figure 4).
- Air is compressed to inflate tyres of vehicles.
- The important processes of living things such as respiration and photosynthesis required air.

- Flying objects like aeroplanes, helicopters and parachutes also required air to fly.

Figure 4: Windmill

AIR POLLUTION

The involvement of harmful materials in the air molecules pollute the atmosphere. The substances that pollute the air are called pollutants such as smokes come out from chimneys of the factories

The major causes of air pollution are:

i. The emissions from factories.

ii. Burning of coal and fuel.

iii. Volcanic eruptions.

iv. Forest fires.

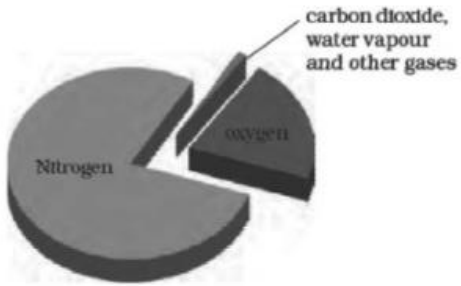
v. Decay processes of vegetation.

Air pollution causes several lungs disorders and eye problems.

CHAPTER - 15 AIR AROUND US

Air Around Us

- **Air**
  - Occupies space
  - Present in water & soil
  - in motion
    - wind
- **Windmill**
  - Converts wind energy into rotational energy
  - Uses
    - To draw water from tubewells
    - to generate electricity
- **Air Composition**

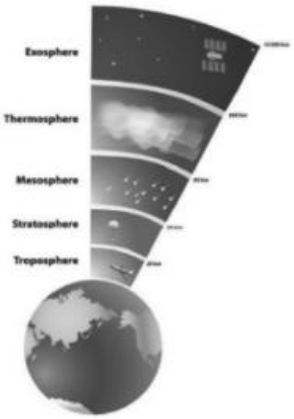


Gases	Approx%
Nitrogen	78%
Oxygen	21%
Argon	0.93%
Carbon dioxide	0.04%
Traces of hydrogen, helium & water vapour, dust, smoke	

- **Oxygen availability**
  - Aquatic Animals
    - use air dissolved in water
  - **Plants**
    - use air present **in soil**
- **Atmosphere**
  - Layers

Troposphere
Stratosphere
Mesosphere
Thermosphere
Exosphere

  - **Meaning**
    - **Air envelope surrounding earth**



Important Questions

Multiple Choice Questions:

Question 1. Major part of the air is constituted by

(a) nitrogen

(b) oxygen

(c) carbon dioxide

(d) inert gases

Question 2. Which of the following gas helps in burning?

(a) Nitrogen

(b) Oxygen

(c) Carbon dioxide

(d) Carbon monoxide

Question 3. Which of the following gas we use in breathing?

(a) Carbon dioxide

(b) Nitrogen

(c) Oxygen

(d) None of these

Question 4. Wind is

(a) air around us

(b) rising hot air

(c) air in motion

(d) none of these

Question 5. Air is present in

(a) atmosphere

(b) soil

(c) water of ponds, lakes and seas

(d) everywhere

Question 6. Air is

(a) a mixture

(b) a pure substance

(c) an element

(d) anything, that depends on the place where it is found

Question 7. Envelope of air that surrounds the earth is known as

(a) biosphere

(b) atmosphere

(c) environment

(d) ecosystem

Question 8. Which is not a property of air?

(a) It occupies space.

(b) It is transparent,

(c) It is a solution.

(d) It is a compound.

Question 9. The ratio of nitrogen to oxygen in the air is

(a) 1:4

(b) 4:1

(c) 3:1

(d) 1:2

Question 10. The main constituent of the air is.

(a) nitrogen

(b) oxygen

(c) carbon dioxide

(d) hydrogen

Very Short Question:

1. Name the main component of air.

2. What is the source of oxygen gas in air?

3. What is the percentage of nitrogen in air?

4. What is the percentage of oxygen in air?

5. What is the source of carbon dioxide in air?

6. Mention one necessary condition for the combustion to take place.

Short Questions:

1. Why is air considered as a mixture?
2. Name the major gas present in the (a) inhaled air (b) exhaled air.
3. Write the necessary conditions for rusting of iron to take place.
4. Name a device which uses wind energy to generate electricity.
5. What is wind energy? Mention its two advantages.
6. Mention two uses of air.
7. Describe balance of oxygen in the air.
8. What happens if the percentage of oxygen in the air reaches to 70%?

Long Questions:

1. What is air? Name the major constituents of air. Also give their volume proportions in air.
2. Demonstrate through a simple experiment that the air mainly contains nitrogen and oxygen in the volume ratio of 4: 1.
3. Air is a mixture. Prove this statement.

Answer Key-

Multiple Choice Answers:

1. (a) nitrogen
2. (b) Oxygen
3. (c) Oxygen
4. (c) air in motion
5. (d) everywhere
6. (a) a mixture
7. (b) atmosphere
8. (d) It is a compound.
9. (b) 4:1
10. (a) nitrogen

Very Short Answers:

1. Answer: Nitrogen gas
2. Answer: Photosynthesis by green plants is source of oxygen gas in air.

3. Answer: 78.1%
4. Answer: 20.9%
5. Answer: Respiration by animals and plants and burning of fuel.
6. Answer: Presence of air.

Short Answer:

1. Answer: Air contains oxygen and nitrogen as its major constituents of air. These gases retain their properties in air. So, the air is called a mixture.
2. Answer: (a) Oxygen (b) Carbon dioxide.
3. Answer: Rusting of iron takes place in the presence of moisture and air. So the presence of air and water vapour in air are two necessary conditions for rusting of iron.
4. Answer: Windmills use the wind energy to convert wind energy into electrical energy
5. Answer: Blowing air is called wind. Wind possesses kinetic energy. The kinetic energy possessed by wind is called wind energy.

   Uses of Wind Energy are:

   (i) Wind energy is used to pump the ground water.

   (ii) Wind energy is used to generate electricity with the help of windmills.
6. Answer: The two uses of air are as below:

   (a) For respiration all organisms need air.

   (b) For burning of any substance air is needed.
7. Answer: The oxygen in air is used by the organisms present in air, water or soil or on earth for their respiration. During respiration carbon dioxide gas is released to air. But green plants during photosynthesis use carbon dioxide of air for preparing food and they release oxygen gas in the air. Thus the balance of oxygen in air is maintained.
8. Answer: If any substance catches fire it will become difficult to extinguish the fire, as oxygen supports combustion.

Long Answer:

1. Answer: Air is a mixture of gases. The major constituents of air are nitrogen, oxygen, carbon dioxide and argon. The percentage composition of constituents of air are as given below:

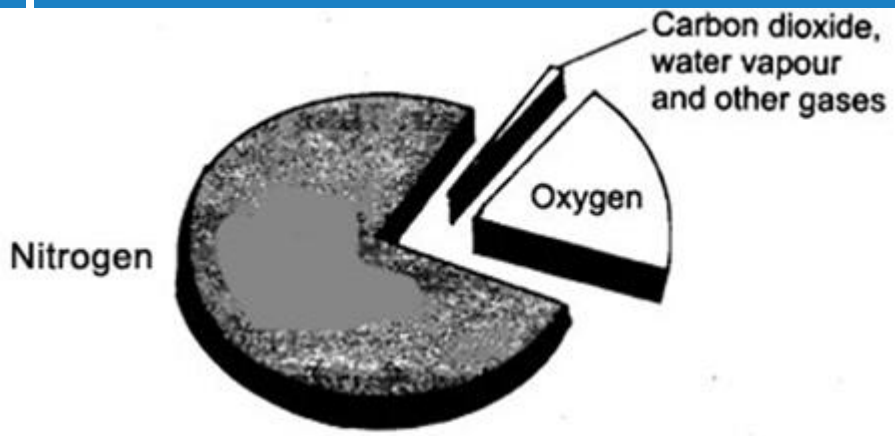


Fig. 15.8 Composition of air.

Name of Constituents	% Composition
Nitrogen gas	78.1%
Oxygen gas	20.9%
Carbon dioxide gas	0.03%
Argon	0.9%

Other components of air are water vapour and dust particles.

2. Answer: Aim of experiment: To show that air contains nitrogen and oxygen in the ratio 4 : 1 by volume:

Procedure: Take a glass container and fix a candle at its centre. Put some quantity of water in the container. Place an empty, dry gas jar over it. Mark five marks above water surface on the jar at equal distances shown in the figure given below.

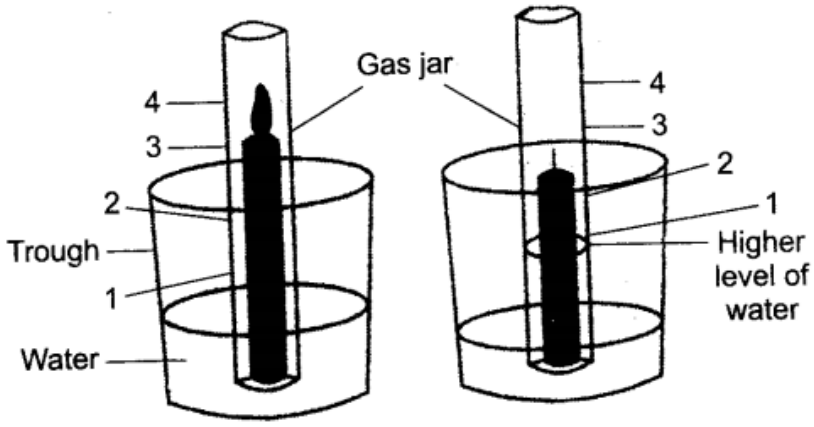
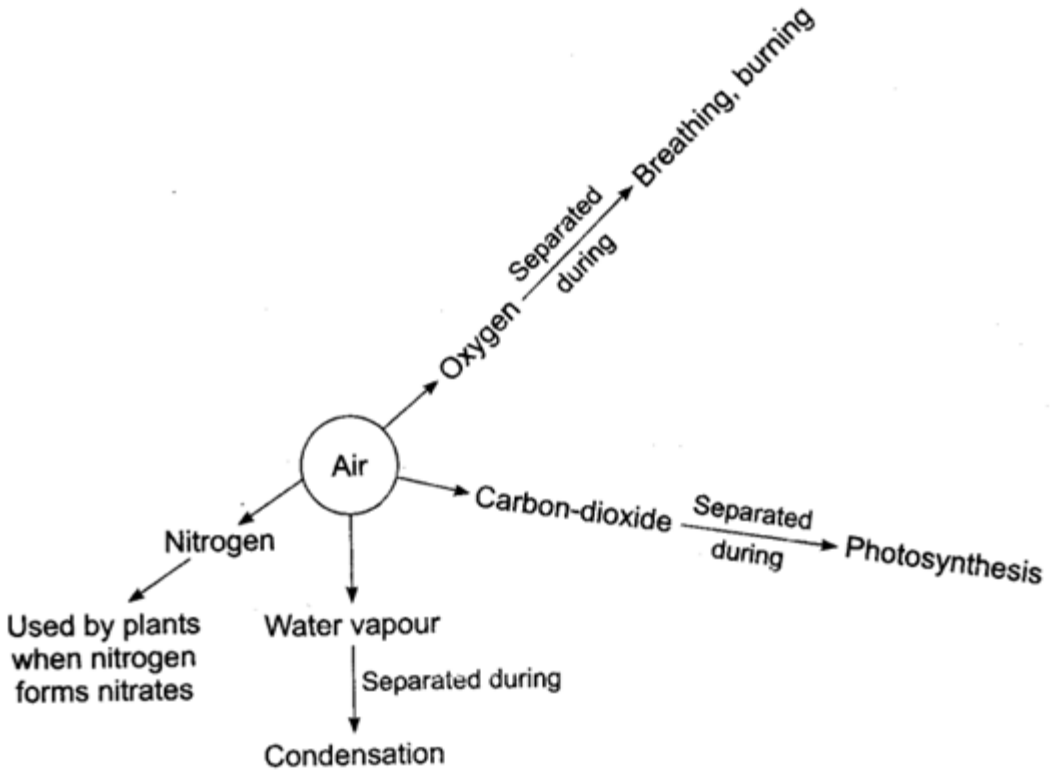


Fig. 15.9 Experiment with a candle

The candle is lightened and is covered with the gas jar. After some time the candle is extinguished and the water level is raised in gas jar. The raised level in water is 1 / 5 of the volume of air in the gas jar.

This proves that one part of the air of the jar is a gas which supports combustion, i.e., oxygen. Hence, 1/5 by volume is oxygen in air.

3. Answer: The components of mixture can be easily separated and they retain their properties.



The components of air are: oxygen, nitrogen, water vapour and carbon-dioxide, all these gases can be easily separated and they retain their properties.