



316en09

# ATMOSPHERE COMPOSITION AND STRUCTURE

Earth is a unique planet because the life is found only on this planet. The air has a special place among the conditions necessary for life. The air is a mixture of several gases. The air encompasses the earth from all sides. The air surrounding the Earth is called the atmosphere. The atmosphere is an integral part of our Earth. It is connected with the earth due to the gravitational force of the earth. It helps in stopping the ultra violet rays harmful for the life and maintain the suitable temperature necessary for life.

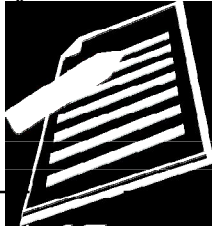
The air is essential for the survival of all forms of life on the earth. You cannot imagine any kind of life in the absence of it. The atmosphere is like a large protective cover. Besides many gases, water vapour and dust particles are also found in the atmosphere. Due to these all kinds of changes take place in the atmosphere you will study in this lesson. The composition and structure of the atmosphere and the cyclic process of main gases.



## OBJECTIVES

After studying this lesson, you will be able to :-

- explain the composition of atmosphere.
- tell the characteristics of different layers of the atmosphere.
- explain the importance of atmosphere.
- explain the cyclic process of main gases of the atmosphere – nitrogen, oxygen and Carbon dioxide.
- describe the importance of cyclic process of important gases of the atmosphere such as nitrogen, oxygen and carbon dioxide.



**9.1 COMPOSITION OF ATMOSPHERE**

The atmosphere is made up of different types of gases, water vapour and dust particles. The composition of the atmosphere is not static. It changes according to the time and place.

**(A) Gases of the atmosphere:**

The atmosphere is the mixture of different types of gases, including water vapour and dust particles. Nitrogen and Oxygen are the two main gases of the atmosphere. 99 percent part of it is made up of these two gases. Other gases like organ, carbon dioxide, hydrogen, nion, helium etc. form the remaining part of atmosphere. The details of different gases of the atmosphere are given in the table No. 9.1 and Fig. No. 9.1

**Table 9.1 : Amount of gases in the dry and air of the atmosphere.**

Serial No.	Gas	Amount (in percentage)
<b>A.</b>	<b>Main</b>	
1.	Nitrogen	78.1
2.	Oxygen	20.9
		} 99%
<b>B.</b>	<b>Secondary</b>	
1.	Organ	0.9
2.	Carbon Dioxide	0.03
3.	Hydrogen	0.01
4.	Nion	0.0018
5.	Helium	0.0005
6.	Ozone	0.00006
7.	Others	
		} 0.99%

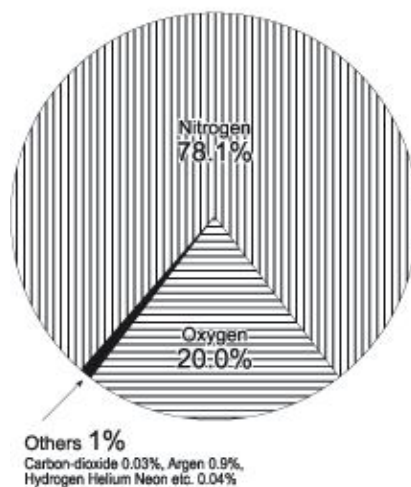


Fig. 9.1 Composition of Atmosphere

Notes

*The domain of Air on the Earth*



**Notes**

**Ozone Gas**

The amount of ozone gas in the atmosphere is very little. It is limited to the ozone layer but it is very important. It protects the living beings by absorbing the ultra-violet rays of the sun. If there was no ozone gas in the atmosphere, there would not have been existence of living beings and plants on the earth surface.

**(B) Water vapour**

Gaseous form of water present in the atmosphere is called water vapour. Water vapour present in the atmosphere has made life possible on the earth. Water vapour is the source of all kinds of precipitation. Its maximum amount in the atmosphere could be up to 4 percent. Maximum amount of water vapour is found in hot-wet regions and its least amount is found in the dry regions. Generally, the amount of water vapour goes on decreasing from low latitudes to high latitudes.

In the same way, its amount goes on decreasing with increasing altitude. Water vapour reaches in the atmosphere through evaporation and transpiration. Evaporation takes place in the oceans, seas, rivers, ponds and lakes while transpiration takes place from the plants, trees and living beings.

**(c) Dust Particles**

Dust particles are generally found in the lower layers of the atmosphere. These particles are found in the form of sand, smoke and oceanic salt. Sand particles have an important place in the atmosphere. These dust particles help in the condensation of water vapour. During condensation water vapour gets condensed in the form of droplets around these dust particles. Due to this process the clouds are formed and precipitation is made possible.

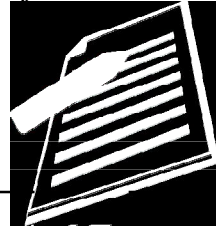
**Importance of the Atmosphere:**

- (i) Oxygen is very important for the living beings.
- (ii) Carbon dioxide is very useful for the plants.
- (iii) Dust particles present in the atmosphere create suitable conditions for the precipitation.
- (iv) The amount of water vapour in the atmosphere goes on changing and directly affects the plants and living beings.
- (v) Ozone protects all kinds of life on the earth from the harmful ultra violet rays of the sun.



**INTEXT QUESTIONS 9.1**

- (i) Which are the two main gases of the atmosphere?  
 (a) \_\_\_\_\_ (b) \_\_\_\_\_



(ii) In which region the maximum amount of water vapour is found?

\_\_\_\_\_

(iii) What is the main function of ozone gas?

\_\_\_\_\_

**9.2 STRUCTURE OF THE ATMOSPHERE**

The atmosphere is an integral part of the earth. It surrounds the earth from all sides. Generally it extends upto about 1600 kilometres from the earth's surface. 97 percent of the total amount of weight of the atmosphere is limited upto the height of about 30 kilometres. The atmosphere can be divided into five layers according to the diversity of temperature and density.

- (a) Troposphere
- (b) Stratosphere
- (c) Mesosphere
- (d) Ionosphere
- (e) Exosphere

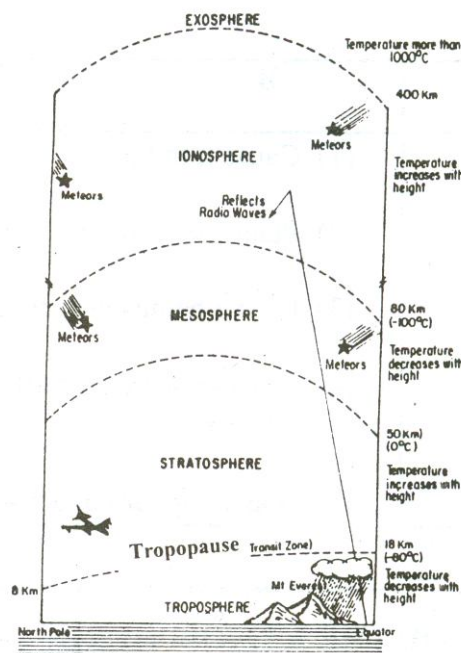


Fig. 9.2 Structure of the atmosphere

**(a) TROPOSPHERE :-**

- (i) This is the lowest layer of the atmosphere.
- (ii) The height of this layer is about 18 kms on the equator and 8 kms on the poles. The main reason of higher height at the equator is due to presence of hot convection currents that push the gases upward.



**Notes**

- (iii) This is the most important layer of the atmosphere because all kinds of weather changes take place only in this layer. Due to these changes development of living world take place on the earth. The air never remains static in this layer. Therefore this layer is called changing sphere or troposphere.
- (iv) The environmental temperature decreases with increasing height of atmosphere. It decreases at the rate of  $1^{\circ}\text{C}$  at the height of 165 metre. This is called Normal lapse rate.
- (v) The upper limit of the troposphere is called tropopause. This is a transitional zone. In this zone characteristics of both the troposphere and ionosphere are found.

**(b) STRATOSPHERE**

- (i) This layer is above the troposphere.
- (ii) This layer is spread upto the height of 50 kms from the Earth's surface. Its average extent 40 kms.
- (iii) The temperature remains almost the same in the lower part of this layer upto the height of 20 kms. After this the temperature increases slowly with the increase in the height. The temperature increases due to the presence of ozone gas in the upper part of this layer.
- (iv) Weather related incidents do not take place in this layer. The air blows horizontally here. Therefore this layer is considered ideal for flying of aircrafts.

**(c) MESOSPHERE**

- (i) It is the third layer of the atmosphere spreading over stratosphere.
- (ii) It spreads upto the height of 80 kms. from the surface of the earth. It's extent is 30 kms.
- (iii) Temperature goes on decreasing and drops upto  $-100^{\circ}\text{C}$ .
- (iv) 'Meteors' or falling stars occur in this layer.

**(d) IONOSPHERE**

- (i) This is the fourth layer of the atmosphere. It is located above the mesosphere.
- (ii) This layer spreads upto the height of 400 kms. from the surface of the earth. The width of this layer is about 300 kms.
- (iii) The temperature starts increasing again with increasing height in this layer.
- (iv) Electrically charged currents flows in the air in this sphere. Radio waves are reflected back on the earth from this sphere and due to this radio broadcasting has become possible.

**(e) EXOSPHERE**

- (i) This is the last layer of the atmosphere located above ionosphere and extends to beyond 400 km above the earth.
- (ii) Gases are very sparse in this sphere due to the lack of gravitational force. Therefore, the density of air is very less here.

- Change of weather take place only in troposphere.
- Change of weather conditions donot take polace in stratosphere. This is an ideal layer for flying aeroplanes.
- Ions are found in abundance in ionosphere. Ionosphere reflects back the radio waves to the earth and make possible the communication system.
- Density of air is the least in the exosphere.



### INTEXT QUESTIONS 9.2

1. Define tropopause.  
\_\_\_\_\_
2. Why is there a difference in the height of troposphere?  
\_\_\_\_\_
3. In which two spheres the temperature increases with the height?  
\_\_\_\_\_
4. From which sphere are the radio waves reflected?  
\_\_\_\_\_
5. In which layer of the atmosphere, the density of the air is the least?  
\_\_\_\_\_
6. In which layer of the atmosphere is the ozone gas found?  
\_\_\_\_\_

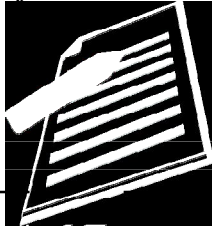
### 9.3 CYCLIC PROCESS OF THE ATMOSPHERIC GASES

The cycle of main gases found in the atmosphere is given below:-

- (a) Carbon cycle
- (b) Oxygen cycle
- (c) Carbon dioxide cycle

#### (a) CARBON CYCLE

1. The element of carbon is present in the atmosphere in the form of carbon dioxide. The source of carbon for all living beings is atmosphere.
2. Green plants receive carbon dioxide from the atmosphere which is used for making food with the help of the sun light. This is called photosynthesis. By this process the plants create 'carbohydrates' in the form of food. Carbohydrates thus, produced by plants are used as a food by all Living beings.

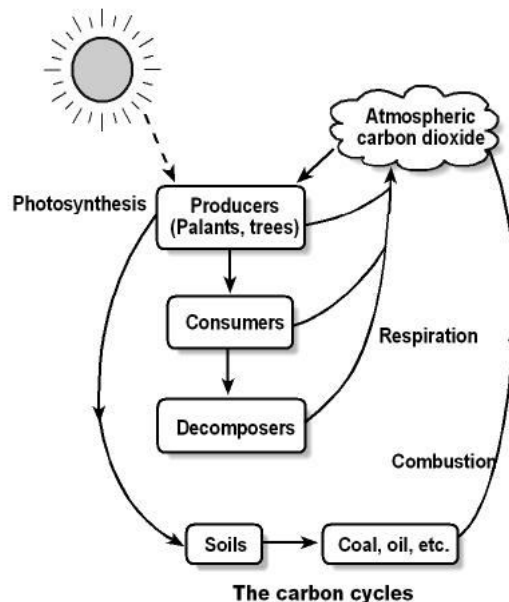




**Notes**

3. Carbon dioxide gets dissolved in the water bodies and gets collected in the form of lime on the earth. After dissolution of lime stone, carbon dioxide again reaches in the atmosphere. This process is called carbonization. In this way carbon dioxide goes on moving between the atmosphere and water-bodies of the earth.
4. Carbon dioxide produced by breathing of plants and animals, disintegration of plants and animals and by burning fossil fuels like coal, petroleum and natural gas again returns back to the atmosphere.

In this way, the process of receiving of carbon-dioxide from the atmosphere and going back to it from the surface of the earth keeps on going continuously. It keeps the balance between the carbon and biosphere.



*Fig. 9.3 : Carbon cycle*

**(b) OXYGEN CYCLE**

1. The amount of oxygen in the atmosphere is about 21% and all living beings use oxygen present in the atmosphere for breathing.
2. For the burning of fuels like wood, coal, gas etc. oxygen is essential and carbon dioxide gas is produced by their burning.
3. The main sources of oxygen in the atmosphere are plants and trees. Higher the number of trees and plants, the availability of oxygen will be more.
4. Oxygen produced through photosynthesis by the green plants goes back to the atmosphere. In this way the process of oxygen cycle goes on continuously.

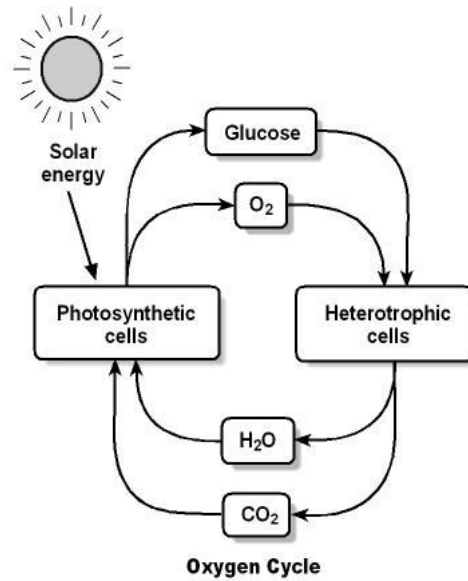
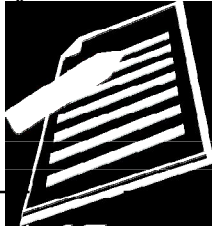


Fig. 9.4 Oxygen cycle

**(c) NITROGEN CYCLE**

Nitrogen is an important element for life. The amount of nitrogen gas in the atmosphere is 78%. The main source of nitrogen are nitrates present in the soil. From the atmosphere, nitrogen enters into bio components through the biological and industrial processes. Nitrogen compounds from the plants are transferred to the animals through food chain. The process of transformation of nitrogen gas of the atmosphere into nitrogen components is called nitrogen Fixation. Bacteria's decompose dried plants and dead animals. It produces nitrogen gas which goes back into the atmosphere. In this way the cycle of nitrogen gas is completed.

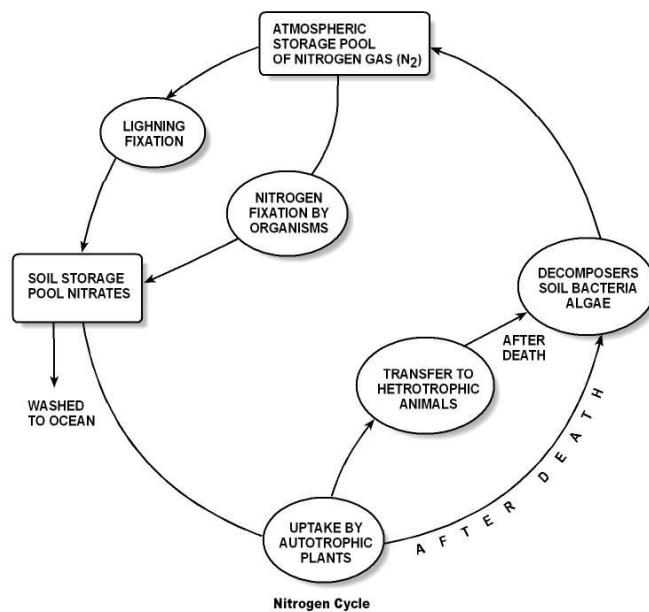


Fig. 9.5 Nitrogen cycle





- The main source of carbon is carbon dio-oxide gas found in the atmosphere.
- The main source of oxygen in the atmosphere are plants and trees.
- Oxygen is used for breathing and for burning fuels.
- Nitrogen is very essential for life on the earth. The main source of nitrogen in the plants are nitrates present in this soil.



**INTEXT QUESTIONS 9.3**

- (i) What is the main source of carbon?  
\_\_\_\_\_
- (ii) What is the main source of oxygen?  
\_\_\_\_\_
- (iii) What is the percentage of nitrogen in the atmosphere?  
\_\_\_\_\_



**WHAT YOU HAVE LEARNT**

The atmosphere is made up of different kinds of gases which surrounds the earth. Two important gases nitrogen and oxygen together are found on the 99% part of the atmosphere. The atmosphere is composed of troposphere, stratosphere, mesosphere, ionosphere and exosphere. All weather related incidents take place in the troposphere whereas stratosphere is considered to be ideal for flying of aeroplanes. Radio waves are reflected back on the earth from the ionosphere. This has made possible the radio broadcast.

The element of carbon in the atmosphere is found in the form of carbon dio-oxide gas. The main sources of carbon are petroleum, wood, coal and gases. The main sources of oxygen in the atmosphere are plants and trees. Oxygen is very important for breathing and for the burning of fuels. The main source of nitrogen for the plants is nitrate present in the soil. Nitrogen gas is produced by decomposition of plants and animals and goes back to the atmosphere.



**TERMINAL QUESTIONS**

- (1) Which is called atmosphere?
- (2) Distinguish between troposphere and stratosphere.
- (3) State the importance of ozone gas.
- (4) Explain the cycle process of nitrogen gas.
- (5) Explain the oxygen cycle with the help of a diagram.

- (6) Describe the structure of the atmosphere with the help of a diagram.
- (7) Write notes on the following.
  - (i) Carbon cycle.
  - (ii) Importance of atmospheric is gases.
  - (iii) Water vapour.
  - (iv) Dust particles.



## ANSWERS TO INTEXT QUESTIONS

### 9.1

- (i) Nitrogen and Oxygen
- (ii) Hot-wet region
- (iii) Absorption of harmful ultra-violet rays of the sun.

### 9.2

- (i) See para 9.1(a)
- (ii) See para 9.2(a)
- (iii) See para 9.3(c)
- (iv) Ionosphere
- (v) Exosphere
- (vi) Stratosphere

### 9.3

- (i) Fossil fuels – Coal, petroleum and natural gas
- (ii) Plants and trees
- (iii) 78 percent

## HINTS TO TERMINAL QUESTIONS

- 1. See 9.1
- 2. See 9.2 (a and b)
- 3. See ozone gas under 9.1(A)
- 4. See 9.3(c)
- 5. See 9.3(b)
- 6. See 9.2
- 7.
  - (i) See 9.3(a)
  - (ii) See 9.1
  - (iii) See 9.1(b)
  - (iv) See 9.1(c)

