

Lesson - 11

Atmosphere: Composition and Structure

The atmosphere is the enclosure of the air which extensively surrounds our Earth. This enclosure of air is in a form of an envelope which has become an integral part of the our earth due to earth's gravity. This air is colourless, tasteless and odourless. We can feel wind because of the movement of air.

The gaseous cover around the earth is called atmosphere which is thousands of kilometres in height. The atmosphere can not be separated from the Earth like the lithosphere and the hydrosphere. No human being or organism can live without the air. Air is the basis of all living creatures on earth.

Importance of atmosphere

The gases like oxygen, nitrogen, carbon dioxide, hydrogen and many other useful gases are found in atmosphere. Atmosphere as our cover protects us against harmful effects of ultraviolet rays.

This may be the reason why the atmosphere has been a matter of curiosity for all of us, since the beginning of mankind. The temperature and humidity present in the atmosphere influences human life. Atmosphere presents us with its natural scenes and its composition keeps us alive.

Composition of Atmosphere

Atmosphere is the mixture of gases. Apart from gases, water vapour and dust particles are also found in atmosphere. There are 9 different types of gases in our atmosphere, of which Oxygen,

Nitrogen, Argon, Carbon dioxide, Hydrogen, Helium Neon, Krypton and Ozone are the major gases.

The most important gas for all the living organisms is Oxygen in our atmosphere. No one on the earth can survive without oxygen. The highest amount of gas in our atmosphere is Nitrogen, which contributes about 78.8% of the total atmosphere. Oxygen is next that contributes about 20.95%. In this way both these gases contribute about 99% of the total volume of the entire atmosphere.

Important characteristics of some gases

1. Nitrogen -

This gas is maximum in our atmosphere. We are aware of air pressure, force of wind and the reflection of light due to presence of Nitrogen in our atmosphere. This gas is colourless, odourless and tasteless. This gas controls combustion. This gas helps the plants to prepare proteins which is an important part of food. If Nitrogen gas would have not been there in the atmosphere, it would have been very difficult to control fire. This entire process is called Nitrogen cycle. (Table & Fig 11.1)

2. Oxygen -

It is considered vital for life on the earth. Oxygen gas easily combines with other chemical elements and creates different types of compounds. This gas is important for combustion. Therefore it is an important source of energy. It also plays an important role in the formation of carbohydrates.

Table - 11.1
Percentage of Gases in the Atmosphere

Sr. No.	Name of Gas	Formula	Percentage
1	Nitrogen	N ₂	78.8
2	Oxygen	O ₂	20.95
3	Argon	Ar	0.93
4	Carbon dioxide	CO ₂	0.03
5	Neon	Ne	0.0018
6	Helium	He	0.0005
7	Ozone	O ₃	0.00006
8	Hydrogen	H ₂	0.00005

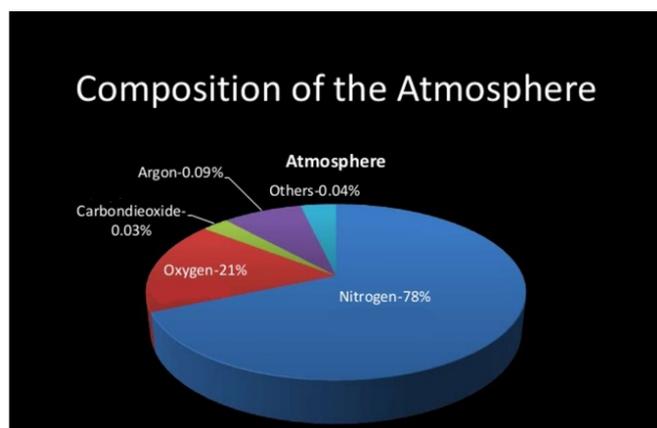


Fig. 11.1 : Composition of the Atmosphere

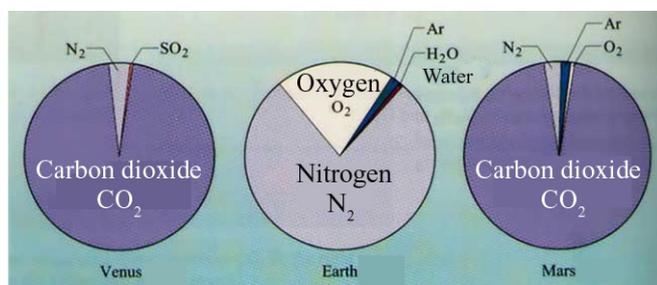


Fig. 11.2 : Status of Carbon dioxide on Venus, Earth and Mars

3. Carbon dioxide

It is a heavy gas. It is emitted during combustion. All type of vegetation dioxide during the process of photosynthesis. According to scientist, it is believed that the increase in the amount of carbon dioxide, causes increase in the temperature in the lower layers of the atmosphere. Global temperatures are rising and climate is also changing.

4. Ozone-

It is another important gas of the atmosphere .It is formed from three atoms of oxygen.This gas has special significance in terms of climate.It absorbs some part of the harmful ultraviolet radiation coming from the sun.Thus, only that proportion of solar radiation is allowed to reach the earth's surface that is necessary and useful.

5. Water vapour-

Water vapour is mostly concentrated near the lower layers of the atmosphere. With the increase in height there is decrease in the amount of water vapour in the atmosphere.90% of the entire water vapour in the atmosphere is found up to the height of 8 kilometres. Beyond this height , the amount of water vapour is very less in the higher layers of the atmosphere. The average amount of water vapour in the atmosphere is 2%.

Water vapour absorbs some percentage of solar radiation coming to the earth and retains the heat which is being reflected back into the atmosphere. Thus water vapour works as a blanket ,as it does not allow our earth to get extremely warm or to get extremely cold. Condensation of water vapours results in rainfall.

6. Dust particles -

The dust particles which are minute, also moves along with the movement of winds. There are many different sources of these dust particles. This include minute particles of dust, sand, sea salt, volcanic ash, meteoric dust. These dust particles mostly remain in the lower layers of the atmosphere.

Apart from gas and water vapour, whatever

is there in the atmosphere in a solid form, will be called as dust particle. Due to the presence of dust particles in the atmosphere, sky appears to be blue in colour.

In comparison to humid regions, relatively more dust particles are found in the industrial cities and in arid regions.

Structure of Atmosphere

Atmosphere is divided into many layers. Generally, on the basis of the vertical distribution of temperature in the atmosphere, it is divided into the following five major divisions-

1. Troposphere
2. Stratosphere
3. Mesosphere
4. Ionosphere
5. Exosphere

1. Troposphere

This is the lowest layer of the atmosphere, 75% of the total atmospheric volume is concentrated in this layer. The average height of this layer above the Earth's surface is 13 km, at equator it is 18 km and at poles it varies from 8 to 10 km. It is considered to be the most important layer of the atmosphere as most of the weather conditions occurs in this layer.

The decrease in temperature with the increase in height is the most important feature of this layer. There is a decrease of 6.5 degree Celsius per 1 km which is also called as 'Normal lapse rate of temperature.' Changes in the weather and climatic conditions that influence human beings occur in this layer. In this layer dust particles and water vapours are more in quantity, which when condenses, causes rainfall and other weather and climatic conditions. This layer is the area of intensive study for climatologists.

The uppermost layer of troposphere is called tropopause. It has a thickness of about 1.5 kms. Atmosphere is more stable above the layer. It is also called "Roof of the weather changes". The temperature does not decrease beyond 20 km from this layer.

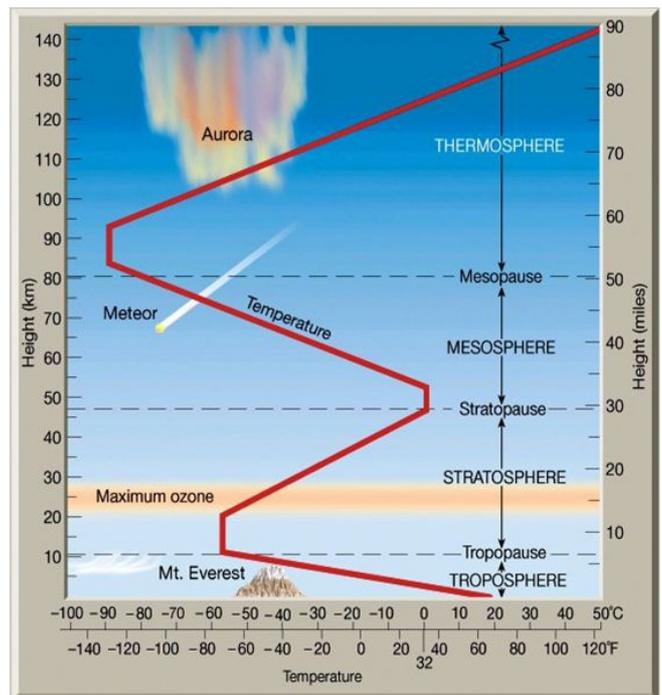


Fig. 11.3 : Structure of the Atmosphere

2. Stratosphere

The average height of this layer is approximately 50 kms from the earth's surface. This layer is thinner at the equator and thicker at the poles. Many scientists have considered Ozone Layer to be a part of stratosphere and because of this its estimated thickness of this layer ranges from 50 to 55 kms. Ozone Layer is found in this layer. It absorbs the harmful ultraviolet rays from the incoming solar radiation.

3. Mesosphere

This layer extends about 80 km beyond stratosphere. In this layer there is a gradual decrease in temperature with increase in height and decreases upto -80°C . The temperature again starts increasing beyond this. In this layer the pressure is extremely low. The upper most part of the mesosphere is called Mesopause Sphere.

4. Ionosphere

This layer extends from 80 to 400 km of height from Mesopause Sphere. The existence of

this layer was known because of the radio waves. The dust particles present in this layer are electrically charged. The electrically charged particles are called as ions. Thus this layer is called Ionosphere. The temperature of the upper limit of this layer is 1100 °C. Aurora is also visible in this region. This layer is also called as Thermosphere.

5. Exosphere

This is the outermost layer of the atmosphere. The availability of wind is rare in this layer and the outer margins of this layer merges with the space. There is no upper limit of this layer, but many scientist are of opinion that its height is up to 1000 kms.

Elements of Weather and climate

The atmospheric conditions of a particular place at a particular period of time is termed as weather. Therefore the atmospheric conditions are understood clearly with the help of weather.

The factors like temperature, pressure, rainfall, humidity helps to know more about weather. These factors are called elements of weather. The weather conditions keeps on changing. Therefore the weather of a place also keeps on changing. This change of weather from one day to the other, from one place to the other place are caused due to the differences in quantities, activity, and distribution of elements of weather. The factors that control this change of weather elements are called "Controls of weather". These include, latitude, uneven distribution of land and sea, pressure, height above sea level, mountains as barrier, nature of the earth surface, wind disturbances.

Important points

1. Atmosphere surrounds the earth from all sides.
2. Atmosphere works as a huge house made up of glass.
3. About 99% of atmosphere is made up of nitrogen and oxygen gases. Rest 1% is contributed by other gases like argon, carbon dioxide, hydrogen, helium, ozone, neon and xenon.

4. The other components of atmosphere also include water vapour, dust particles smoke and salt particles.
5. There are five layers of atmosphere- Troposphere, Stratosphere, Mesosphere Ionosphere, Exosphere.
6. The elements of the weather include temperature, pressure, rainfall and humidity etc.

Exercise Multiple choice-

1. The gas which is maximum in atmosphere is.....
A) Carbon dioxide
B) Nitrogen
C) Oxygen
D) Argon
2. The weather conditions occurs in which layer of the atmosphere?
A) Stratosphere
B) Troposphere
C) Ionosphere
D) Mesosphere
3. Which layer is called the "Roof of weather conditions"?
A) Troposphere
B) Ionosphere
C) Stratosphere
D) Mesosphere
4. The average amount of vapour present in atmosphere is...
A) 1 percent
B) 2 percent
C) 3 percent
D) 4 percent
5. The most extensive layer of atmosphere is..
A) Stratosphere
B) Troposphere
C) Ionosphere
D) Mesosphere

Very short type

6. How many types of gases are found in atmosphere?
7. What are dust particles?
8. What is stratosphere?
9. Where do we find ozone layer?
10. Which layer of the atmosphere has maximum concentration of helium gas?

Short type

11. What is atmosphere?
12. Which are the major gases that are found in atmosphere?
13. What is the importance of water vapour and dust particles in our atmosphere?
14. What are the major characteristics of troposphere?
15. Write the importance of atmosphere and describe its layers.

Essay type

16. Describe the concentration of atmosphere in detail.
17. Describe the layers of atmosphere in detail.
18. "The atmosphere is the core of life on the earth". Analyse scientifically.

Answer Key

- 1B. 2B. 3A. 4B. 5D.