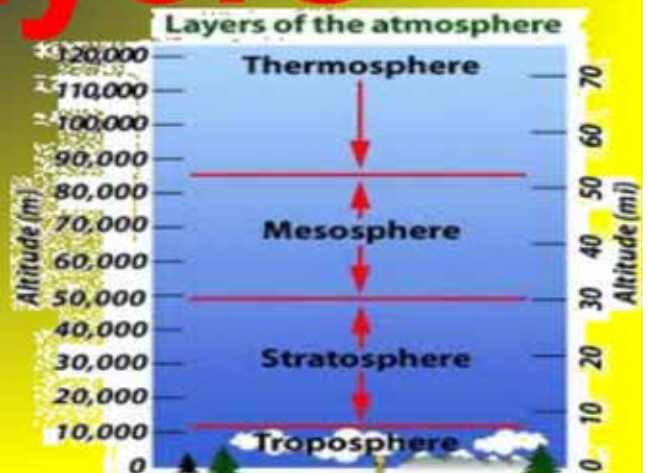
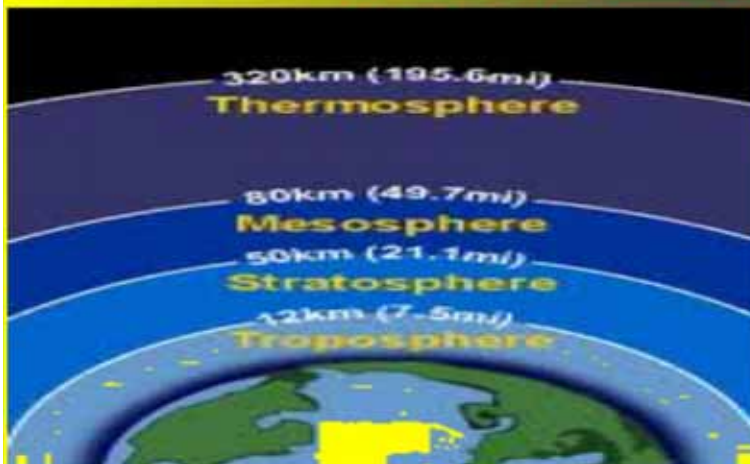


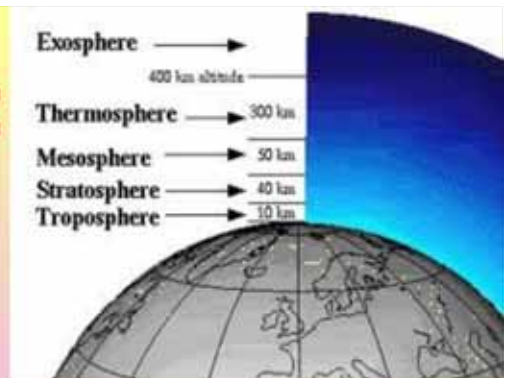
# Atmosphere and Its Layers



# Learning Outcomes:

Students will be able to:

1. define environmental chemistry;
2. define atmosphere;
3. explain environmental spheres;
4. explain composition of atmosphere;
5. differentiate between stratosphere and troposphere;
6. summarize the components of stratosphere and troposphere.



## **Environmental Chemistry:**

*"The branch of chemistry that deals with the chemicals and other pollutants in the environment is called environmental chemistry".*

**Environmental chemistry helps to study sources, reactions, transportation of chemicals and other toxic substances that are created by human activities in the environment and their adverse effects on human beings.**



## **Environmental Spheres:**

Environment consists of the following four segments.

1. Lithosphere
2. Hydrosphere
3. Biosphere
4. Atmosphere

### **1. Lithosphere:**

The soil covering the rocks which constitute earth's crust is called lithosphere. The soil has come into existence as a

result of weathering of rocks. The main elements of the earth's crust are *oxygen (50%)*, *silicon (26%)* and *aluminium (7%)*.

## **2. Hydrosphere:**

This sphere of environment includes all natural resources of water e.g. oceans, lakes, rivers, rain, glaciers and ground water. More than 70% of the surface of the earth comprises of hydrosphere. Unfortunately, only 1% of the earth's water resources are available as fresh water. This water is being used by agriculture, industry and for domestic purposes.

### **3. Biosphere:**

Biosphere is the region of earth capable of supporting life. It includes lower atmosphere, the oceans, rivers, lakes and soils. Biosphere exhibits an interaction of organisms with lithosphere, hydrosphere and atmosphere.

### **4. Atmosphere:**

This segment of environment comprises of a mixture of gases which are essential for sustaining life on earth i.e. oxygen is required for breathing, Carbon dioxide is required for plant photosynthesis

and  $N_2$  is used by nitrogen fixing bacteria.  
Atmosphere also maintains the heat balance of  
the earth.



## **Atmosphere:**

*"The layer of gases surrounding the earth is called atmosphere".*

### **Composition of atmosphere:**

It consists of various gases in different proportions, such as

$\text{N}_2$  (78%)

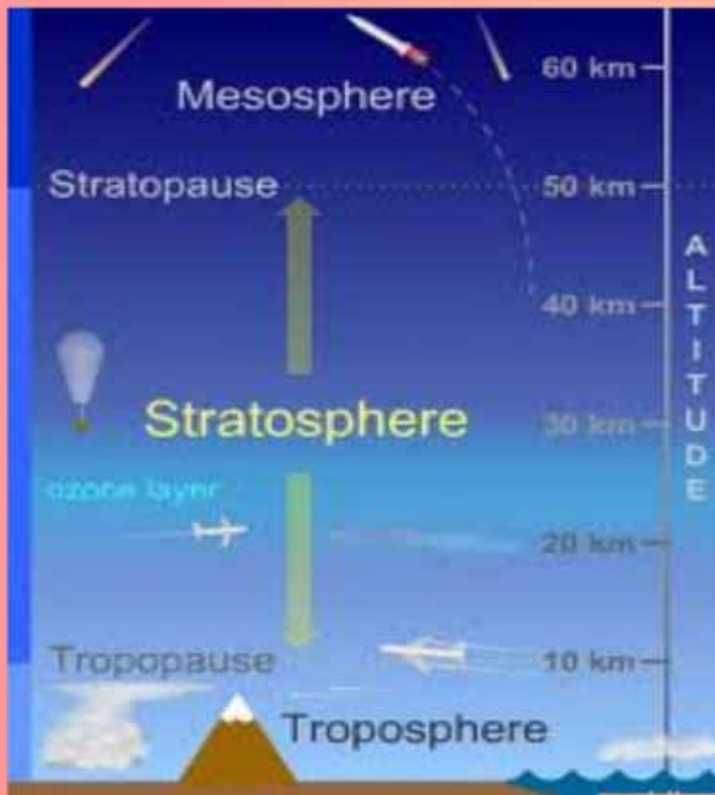
$\text{O}_2$  (21%)

Ar (0.9%)

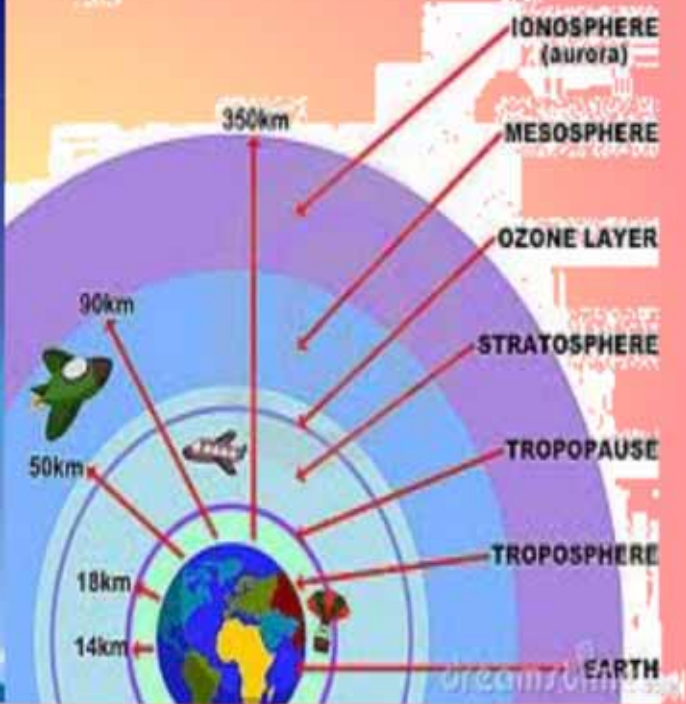
$\text{CO}_2$  (0.03%)

and trace amounts of  $\text{H}_2$ ,  $\text{CH}_4$ ,  $\text{O}_3$ , CO, He, Ne, Kr, Xe and water vapours.





## Layers of the Atmosphere



*animation*

## **Layers of the Atmosphere:**

Atmosphere is divided into following four major regions.

1. Troposphere
2. Stratosphere
3. Mesosphere
4. Thermosphere

### **1. Troposphere:**

The first 10 km layer of air above earth's surface is called troposphere. Temperature in this region falls between 290 K to 220 K. This portion contains 70% of atmospheric mass with

nitrogen, oxygen, carbondioxide and water vapours. Weather phenomenon such as clouds and rainfall are characteristic of this region.

## **2. Stratosphere:**

The region of atmosphere extending from 10 km to 40 km is known as stratosphere. The temperature in this layer of atmosphere increases slowly from about 220 K to 270 K. The air in this region is very dry and clouds from troposphere cannot penetrate into it. The presence of ozone layer in this region protects life on earth from UV radiations.



### 3. Mesosphere:

The layer of atmosphere that extends from 40 km to 80 km is called mesosphere. The temperature continues to rise to about 300 K and then falls to a minimum i.e. about 180 K near 80 km.

### 4. Thermosphere:

The layer of atmosphere extending from 80 km to 500 km is termed as thermosphere. The temperature rises continuously to 1500 K. This region is characterised by low pressure and low density. The gaseous species in this layer are present as cations, anions, free electrons, neutral atoms and molecules. This region is also termed as "*ionosphere*" due to ionization of gases at high temperature.



## Differentiation between Troposphere and Stratosphere:

### Troposphere

1. This layer extends up to 10 km above the surface of earth.
2. Temperature remains between 220 K to 290 K.
3. Most of the weather phenomenon such as clouds and rainfall occur in this region.
4. This is rich in oxygen for breathing.

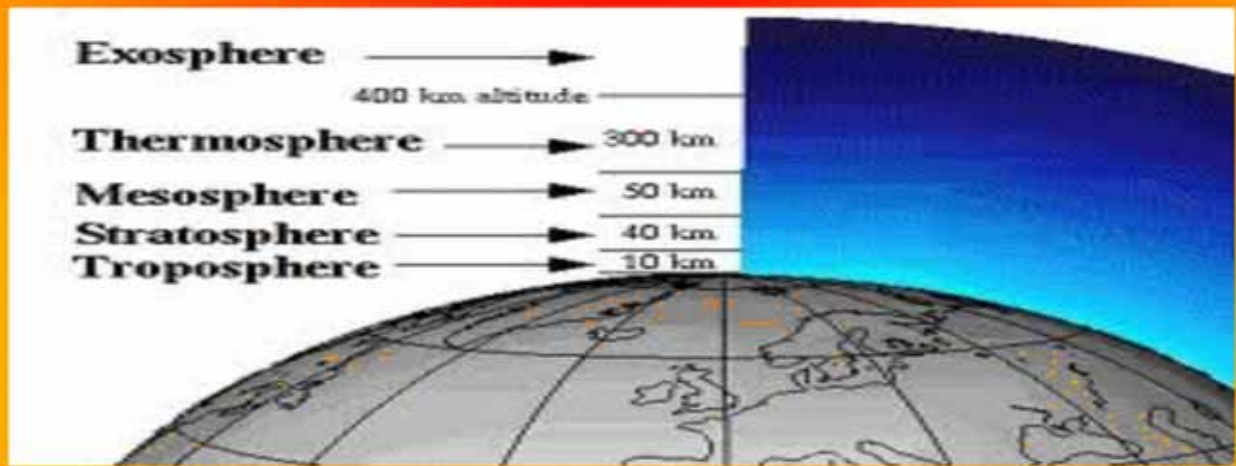
### Stratosphere

1. This layer extends from 10 to 40 km above the surface of the earth.
2. Temperature remains between 220 K to 270 K.
3. The air in this region is very dry therefore clouds from troposphere cannot penetrate in this region.
4. This is rich in ozone to protect life on earth.

## **Summary of the Components of Troposphere and Stratosphere:**

1. Both spheres of atmosphere are generally called homospheres, because the composition of gases is uniform throughout.
2. The temperature of the homosphere falls between 220K to 290K.
3. The larger concentration of oxygen is present in troposphere while stratosphere is rich in ozone.
4. All the weather changes of atmosphere take place in troposphere while the clouds cannot penetrate into stratosphere because of its dryness.

# Multiple Choice Questions





1. Which of the following segments of environment is expected to be the kingdom of living organisms?

- A. Hydrosphere
- B. Lithosphere
- C. Biosphere
- D. Atmosphere



2. Which of the following segments of atmosphere contain ozone?

- A. Thermosphere
- B. Stratosphere
- C. Mesosphere
- D. Troposphere

3. Which of the following layers of atmosphere is called ionosphere?

- A. Thermosphere
- B. Mesosphere
- C. Stratosphere
- D. Troposphere