

# 13 Atmosphere

## 13.1 Layers of atmosphere

What can you see when you look at the sky? If it is the afternoon you will see the clouds or the blue sky. If it is the night time you will see stars, planets and sometimes the moon. You see all these objects through the atmosphere. But you cannot see the atmosphere.

Atmosphere is a thin layer of gases that surrounds the earth. It spreads up nearly 700 km from the earth surface.

In grade six you have learnt that gases have a mass. The weight of the gases above us make a pressure on us and all the things around us. This pressure is known as **atmospheric pressure**. The atmospheric pressure is measured in milli bars (mb) to forecast the weather.

The height of a certain place from the sea level is known as **altitude**. According to the altitude the pressure and the temperature change in different levels of the atmosphere. Based on these differences the atmosphere is divided into five layers.

The five layers of the atmosphere, spread out from the earth surface respectively are;

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

The Figure 13.1 shows the layers of the atmosphere.

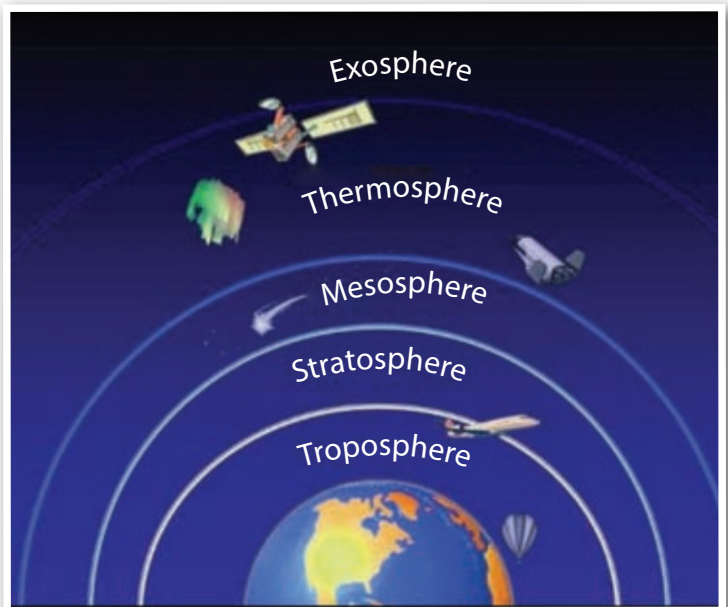


Figure 13.1 ▲ Layers of the atmosphere

## Troposphere

This is the lowest layer of the atmosphere. Near the equator it spreads up to about 15 km from the sea level, but near the poles the height of the troposphere is about 8 km.

Nearly 75% of the air in atmosphere is in the troposphere. Most of the water vapour and dust particles are found in this layer. All the weather changes take place in the troposphere.

Helicopters, parachutes and aeroplanes travel through this layer.

## Stratosphere

This layer is 15 - 50 km high above from the sea level. The air is dry as there is very little water vapour in this layer. There are no storms or turbulences in stratosphere. Therefore, jets fly through this layer.



Figure 13.2 ▲ Cumulo nimbus cloud shaped as an anvil

The ozone layer lies in the stratosphere. This is a special layer which prevents the ultra violet rays (UV rays) of the sun falling on the earth.

The Cumulo nimbus closer to the stratosphere takes the shape of an anvil. The reason for this shape is the blowing wind in one direction. Rain with thundering and lightning can be expected after forming these type of clouds.



### Activity 13.1

Go out on a day with a clear sky. Identify a Cumulo nimbus cloud. Continue looking at that cloud. You will see that the height of the cloud increases and the top of the cloud gets flat. Then, check whether the cloud has got a shape of an anvil.



Figure 13.3 ▲ Cumulo nimbus cloud

## Mesosphere

Mesosphere extends from 50-80 km up from the sea level. This is the coldest layer among the five layers of the atmosphere. In this layer water vapour gets frozen into ice clouds. When the sun sets the rays fall on these clouds and you can see these clouds during the night time.



Figure 13.4 ▲ Clouds in mesosphere

## Thermosphere

Thermosphere lies from 80-120 km up from the sea level. The air particles in this layer absorb the sun's rays. So, that the temperature in this layer is very high. International Space Station is situated in this layer.



Figure 13.5 ▲ Aurora borealis

Both the special sceneries called Aurora borealis and Aurora australis occur in the thermosphere. **Aurora borealis** can be seen near the northern pole and **Aurora australis** can be seen near the southern pole.

## Exosphere

The thinnest layer in the atmosphere is the exosphere. This layer is 120 km high above from the sea level. There is no certain border between the exosphere and the space.



### Activity 13.2

#### Building up a model of the layers in atmosphere

**You will need :-** A4 sheets, a pair of scissors, a drawing pin, a picture of the earth

### Method :-

- Cut a big circle from a A4 sheet, in maximum size.
- Cut another circle with a radius 2 cm less than the big circle.
- Cut three more circles and each circle should have a radius 2 cm less than the other circle.
- Paste the picture of the earth on the smallest circle and write the word troposphere on it.
- Keep the circles on the big circle and fix them together using the drawing pin as shown in the figure.
- Write the names of the layers on the circles.
- Show your model to the teacher.



Figure 13.6 ▲ Layers of the atmosphere

### Differences of temperature and pressure in layers of the atmosphere

We live in the troposphere. What happens to the temperature and the pressure when you go up the troposphere?

The Table 13.1 shows the altitude, annual average temperature and average atmospheric pressure in some cities of Sri Lanka.

Table 13.1 ▼ Weather report in some cities

City	Altitude (m)	Average temperature (°C)	Average pressure (mb)
Colombo	01 m	27.4	1110
Kandy	500 m	24.6	956
Nuwara Eliya	1868 m	15.9	813

(Source - Meteorological department)

According to the Table 13.1 it is clear that when the altitude is increased the temperature and the pressure are decreased.



## Assignment 13.1

Select some cities in Sri Lanka with different altitudes. Listen to the weather reports in media and record the temperature of those cities for a week. Show the collected details using a graph.

The Figure 13.7 shows the changes of temperature in different layers in the atmosphere.

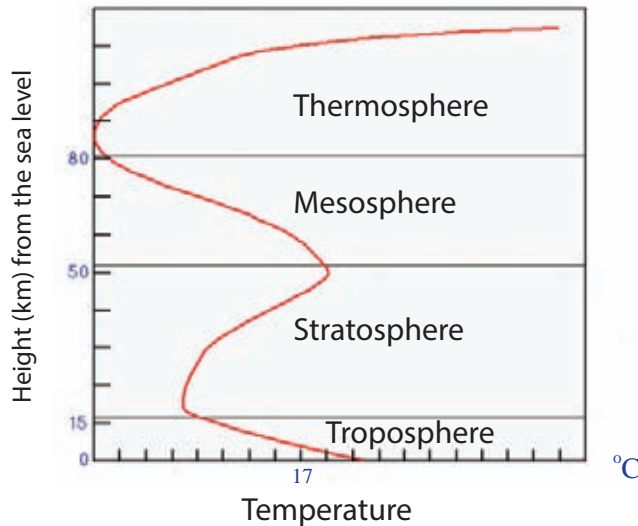


Figure 13.7 ▲ Changes of temperature in different layers

These are the details that can be taken from the Figure 13.7.

- Temperature decreases with increasing height up to the troposphere. This is how it happens. The land and the sea get heated from the sun's heat. So, the temperature near the land is high. The temperature of the troposphere gradually decreases away from the land.
- Temperature increases in the stratosphere when go up. The reason is the presence of the ozone layer which absorbs the ultra violet rays of the sun. Then, stratosphere gets heated and temperature increases.



### For extra knowledge

- Temperature in the mesosphere decreases from bottom to top. It is because there is very less amount of ozone gas to absorb sun's ultra violet rays. The lowest temperature is recorded in the top of the mesosphere. It is about  $-90\text{ }^{\circ}\text{C}$ . This temperature is less than the temperature in the Antarctic which has the lowest temperature on the earth.
- Temperature in the thermosphere increases from bottom to top again. The reason is the air particles in this layer highly absorb the sun's heat.
- Temperature increases more and more when it is close to the exosphere.

## 13.2 Air and its components

Troposphere is the most important atmospheric layer for the living beings on the earth. The Table 13.2 and the Figure 13.8 show the component of the troposphere.

Table 13.2 ▼ Gases in the troposphere

Gas	Volume as percentage
Nitrogen ( $\text{N}_2$ )	78%
Oxygen ( $\text{O}_2$ )	21%
Argon (Ar)	} 1%
Carbon dioxide ( $\text{CO}_2$ )	
Water vapour	
Other gases	

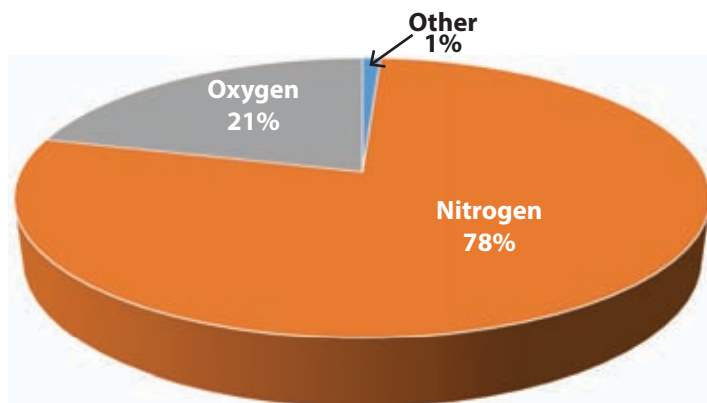


Figure 13.8 ▲ Percentage of gases in the troposphere

Nitrogen and Oxygen are the main components in the troposphere.



### For extra knowledge

#### **Nitrogen**

Nitrogen is the most abundant gas in the air. Under atmospheric conditions it has low reactivity.

#### **Oxygen**

The most important gas in the air. It is essential for respiration of organism. Oxygen is necessary for combustion. Therefore, it is introduced as a **supporter of combustion**. Oxygen gas can be separated from air. Oxygen gas has many uses;

- e.g.:-
- To aid patients with respiratory difficulties
  - For welding and cutting metals using oxy-acetylene flame
  - For divers and astronauts

#### **Argon**

Argon is the third most common atmospheric gas. This is an inert (noble) gas. It does not have any chemical reactions with any other elements. Therefore, it is used for many purposes.

- e.g.:-
- To fill filament bulbs
  - To produce electric lamps, which emit orange colour

#### **Carbon dioxide**

Carbon dioxide is essential for photosynthesis in green plants. This gas is used to extinguish fire and it helps to maintain the temperature on the earth. Carbon dioxide composition is higher in exhaled gas than in inhaled gas.

### **Functions of the atmosphere**

- Atmosphere provides oxygen needed for the respiration of all animals and plants.
- Plants get carbon dioxide from the atmosphere for photosynthesis.
- Nitrogen, which is a very important element for the growth of the plants is provided to soil by the atmosphere.

- Heat, light and ultra violet rays of the sun fall on earth through the atmosphere. The ozone layer protects the earth from expose to these harmful rays.
- Atmosphere prevent emission of heat of earth to the space. So atmosphere keep our earth in warmer condition. The moon has no atmosphere. Therefore, the moon is very hot during the day time and very cold during the night time.
- Hydrological cycle is very important for the existence of living beings. Water vapour in the atmosphere is very essential for the maintenance of the hydrological cycle.
- Atmosphere helps for birds and some insects to fly.
- It supports for communication among people.
- Atmosphere protects the earth from meteors. Meteors fallen on to the earth from the space get heated and burnt in the atmosphere. If meteors fall on to earth it will damage many lives.

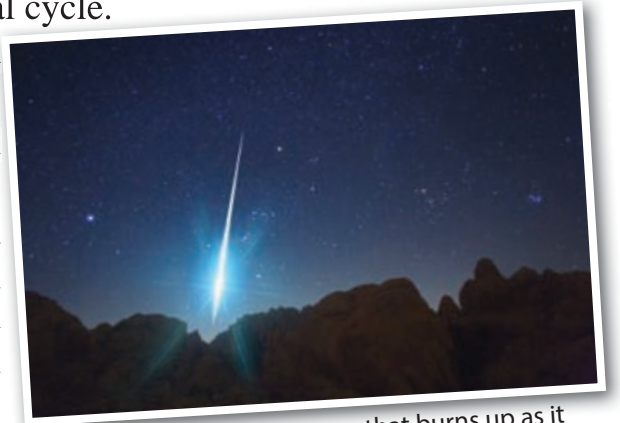


Figure 13.9 ▲ A meteor that burns up as it enters the atmosphere



### Assignment 13.2

Use the above facts and make a report of the problems that may occur on the earth "If the atmosphere is disappeared instantly".

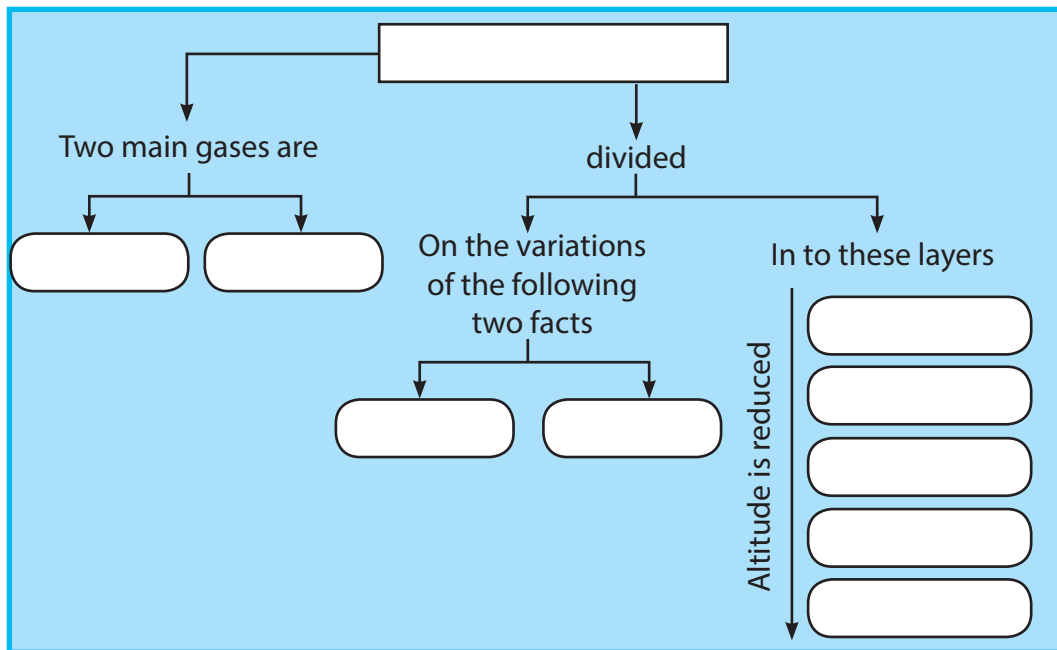


### Assignment 13.3

Following is a concept map prepared by some grade seven students about the atmosphere. Fill in the blanks using the given words.

**pressure, stratosphere, mesosphere, atmosphere, nitrogen, troposphere, oxygen, thermosphere, exosphere, temperature**





## Air pollution

Air pollution is "adding substance to the atmosphere, changing its composition and causing harmful effects on organism".

The substances that cause air pollution can be divided into two groups. They are;

1. Gaseous pollutants
2. Particulate pollutants

Some gaseous pollutants are carbon monoxide, sulphur dioxide, nitrogen dioxide etc.

Some particulate pollutants are carbon particles, lead particles, cement dust, insecticide droplets, unburnt fuel droplets and asbestos particles.



### Activity 13.3

After travelling in a bus clean your face with a white handkerchief. What can you see?

The reason for the things in the handkerchief is the particulate pollutants in the air.

Some ways of air pollution are given in Figure 13.10.



Combustion of fuel in vehicles



Combustion of fuel in factories



Exhaust from thermal power stations



Burning of waste materials



Volcanic eruptions



Destroying forests

Figure 13.10 ▲ Ways of air pollution



### Assignment 13.4

A green test must be done for a vehicle to get it licensed. In this test the particles in the emitted smoke of the vehicle is tested. Find out what are the particles tested in the green test and record your details.

Followings are some adverse effects of air pollution.

- Climatic changes on the earth
- Wide variety of health problems related to respiratory system
- Acid rain
- Increase of temperature in the atmosphere
- Reduction of the clarity and the transparency of the air

Here are some precautions that can be taken to minimize the air pollution.

- Tune the vehicle engines
- Minimize the combustion of fossil fuel
- Use eco-friendly energy sources
- Release the fumes of factories through a filter

- Re-cycle the waste without burning
- Protect the forests
- Re-forestation

There are artificial respiratory chambers in some cities to facilitate respiration, where there is an air pollution.

Therefore, it is our duty to protect the atmosphere.



## Summary

- The temperature and the pressure changes from the surface of the earth to the upper atmosphere. Depending on these changes the atmosphere is divided into five layers.
- Troposphere, stratosphere, mesosphere, thermosphere and exosphere are the five layers of the atmosphere.
- Atmosphere protects the earth and the living beings on it from the external dangers.
- Nitrogen and Oxygen are the main components in the troposphere.
- The gases in the atmosphere help man in many ways.
- Air pollution is a problem that affects all of us.

## Exercise

1. State whether the following statements are True ( $\checkmark$ ) or False (x).
  - i) Temperature decreases from bottom to top of the troposphere ( )
  - ii) The earth is the only planet with an atmosphere that can sustain life. ( )
  - iii) Oxygen comprises the highest percentage in the atmosphere. ( )
  - iv) Temperature increases from bottom to top of the stratosphere. ( )
  - v) Climatic changes take place in the troposphere. ( )
  - vi) Stratosphere contains the most amount of ozone gas. ( )
  - vii) Mesosphere has the lowest temperature. ( )

## Technical Terms

Atmosphere	- வாழ்வுக்குரிய	- வளிமண்டலம்
Altitude	- உயரம்	- குத்துயரம்
Pressure	- அழுத்தம்	- அழுக்கம்
Temperature	- வெப்பநிலை	- வெப்பநிலை
Cumulo nimbus clouds	- கருவி-வழி வலாகுழல்	- திரண்முகில்
Aurora borealis	- வடமுனைவுச் சோதி	- வடமுனைவுச் சோதி
Aurora australis	- தென்முனைவுச் சோதி	- தென்முனைவுச் சோதி
Recycling	- மீள் சுழற்சி	- மீள் சுழற்சி
Air pollution	- வளி மாசடைதல்	- வளி மாசடைதல்
Air pressure	- வளி அழுக்கம்	- வளி அழுக்கம்
Ozone layer	- ஓசோன் படை	- ஓசோன் படை
Ultraviolet rays	- கழியூதாக்கதிர்கள்	- கழியூதாக்கதிர்கள்