4 Air

Do you know?

Carbon dioxide released in the atmosphere creates a green house effect by trapping the heat radiated from the earth. It is therefore called a **greenhouse** gas and without it the earth would have been too cold to live in. However, when its level in the atmosphere increases due to factory smoke or car fumes, the heat retained increases the temperature of the earth. This is called **global warming**. This rise in temperature causes the snow in coldest parts of the world to melt. As a result the sea level rises, causing floods in the coastal areas. There may be drastic changes in the climate of a place leading to extinction of some plants and animals in the long run.

Our earth is surrounded by a huge blanket of air called atmosphere. All living beings on this earth depend on the atmosphere for their survival. It provides us the air we breathe and protects us from the harmful effects of the sun's rays. Without this blanket of protection, we would be baked alive by the heat of the sun during day and get frozen during night. So it is this mass of air that has made the temperature on the earth liveable.

Composition of the Atmosphere

Do you know that the air we take in while breathing is actually a mixture of many gases? Nitrogen and oxygen are two gases which make up the bulk of the atmosphere. Carbon dioxide, helium, ozone, argon and hydrogen are found in lesser quantities. Apart from these gases, tiny dust particles are also present in the air. The pie chart gives you the percentage of different constituents of air (Fig. 4.1). Nitrogen is the most plentiful gas in the air. When we inhale, we take some amount of nitrogen into our lungs and exhale it. But plants need nitrogen for their survival. They can not take

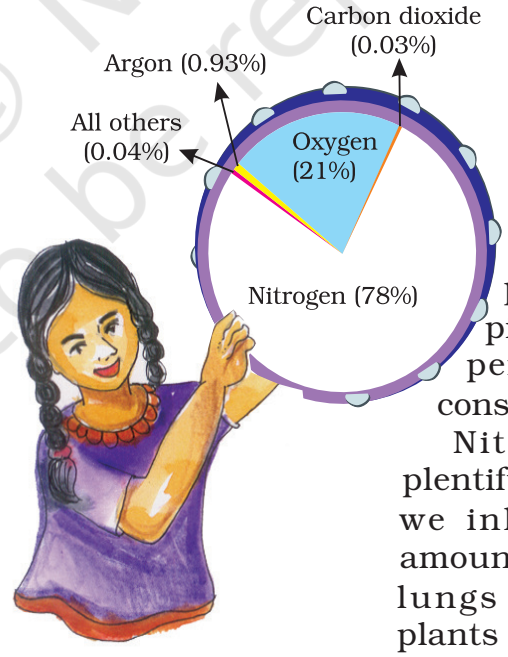


Fig. 4.1: Constituents of Air

© NCERT not to be republished

nitrogen directly from the air. Bacteria, that live in the soil and roots of some plants, take nitrogen from the air and change its form so that plants can use it.

Oxygen is the second most plentiful gas in the air. Humans and animals take oxygen from the air as they breathe. Green plants produce oxygen during photosynthesis. In this way oxygen content in the air remains constant. If we cut trees then this balance gets disturbed.

Carbon dioxide is another important gas. Green plants use carbon dioxide to make their food and release oxygen. Humans or animals release carbon dioxide. The amount of carbon dioxide released by humans or animals seems to be equal to the amount used by the plants which make a perfect balance. However, the balance is upset by burning of fuels, such as coal and oil. They add billions of tons of carbon dioxide into the atmosphere each year. As a result, the increased volume of carbon dioxide is affecting the earth's weather and climate.

Do you know?

When air is heated, it expands, becomes lighter and goes up. Cold air is denser and heavy. That is why it tends to sink down. When hot air rises, cold air from surrounding area rushes there to fill in the gap. That is how air circulation takes place.

© NCERT not to be republished

Read and Ponder: Is global warming a serious issue in today's world?

Structure of the Atmosphere

Our atmosphere is divided into five layers starting from the earth's surface. These are **Troposphere**, **Stratosphere**, **Mesosphere**, **Thermosphere and Exosphere** (Fig. 4.2).

Troposphere: This layer is the most important layer of the atmosphere. Its average height is 13 km. The air we breathe exists here. Almost all the weather phenomena like rainfall, fog and hailstorm occur in this layer.

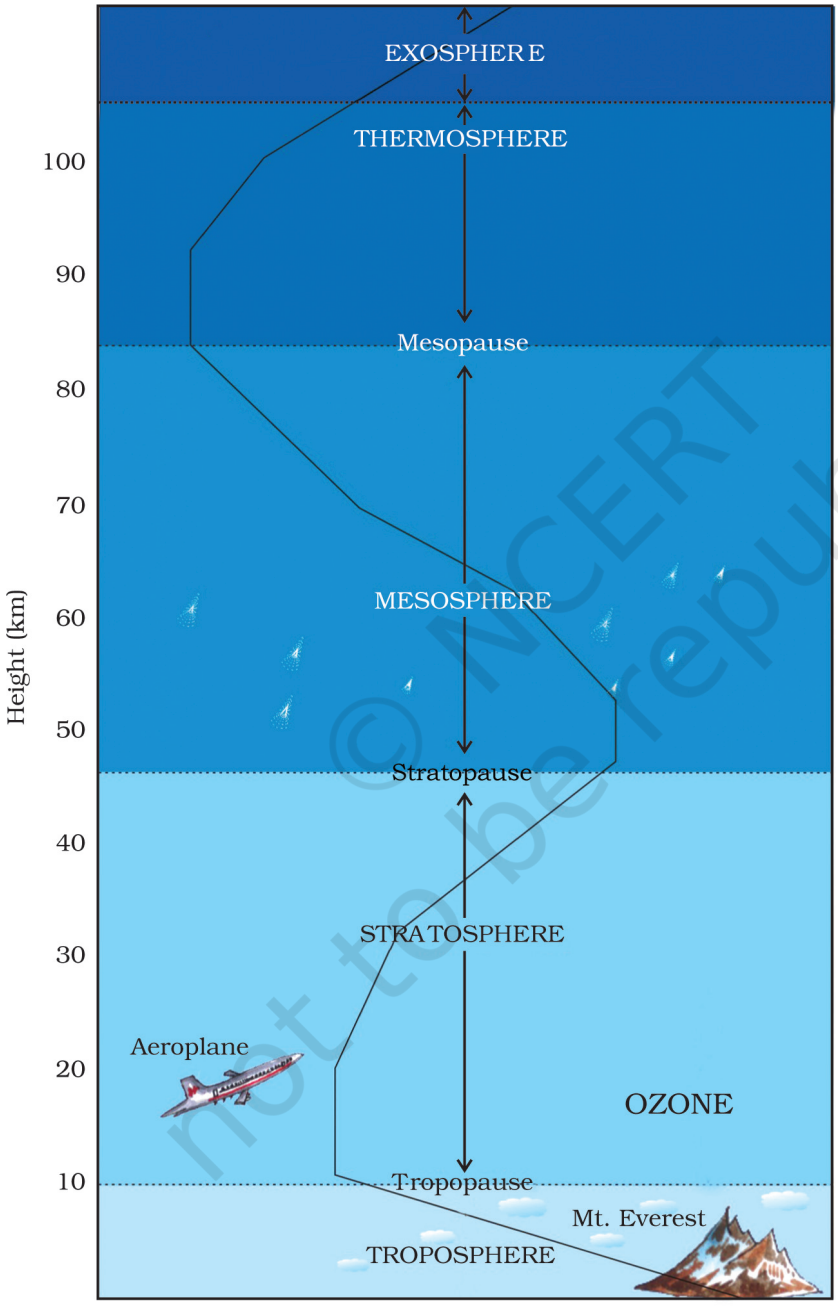


Fig. 4.2: Layers of the Atmosphere

Stratosphere: Above the troposphere lies the stratosphere. It extends up to a height of 50 km. This layer is almost free from clouds and associated weather phenomenon, making conditions most ideal for flying aeroplanes. One important feature of stratosphere is that it contains a layer of ozone gas. We have just learnt how it protects us from the harmful effect of the sun rays.

Mesosphere: This is the third layer of the atmosphere. It lies above the stratosphere. It extends up to the height of 80 km. Meteorites burn up in this layer on entering from the space.

Thermosphere: In thermosphere temperature rises very rapidly with increasing height. Ionosphere is a part of this layer. It extends between

© NCERT not to be republished

80-400 km. This layer helps in radio transmission. In fact, radio waves transmitted from the earth are reflected back to the earth by this layer.

Exosphere: The upper most layer of the atmosphere is known as exosphere. This layer has very thin air. Light gases like helium and hydrogen float into the space from here.

Let's do

For ten days note down weather report from a local newspaper and observe the changes occurring in the weather.

Weather and Climate

"Is it going to rain today?" "Will it be bright and sunny today?" How many times have we heard this from anxious cricket fans speculating the fate of a One Day match? If we imagine our body to be a radio and the mind its speaker, weather is something that fiddles with its control knobs. Weather is this hour-to-hour, day to day condition of the atmosphere. A hot or humid weather may make one irritable. A pleasant, breezy weather may make one cheerful and even plan for an outing. Weather can change dramatically from day to day. However, the average weather condition of a place for a longer period of time represents the **climate** of a place. Now do you understand why we have daily weather forecasts.

Do you know?

You will be surprised to know that the earth receives only 1 in 2,000,000,000 parts of the sun's energy.

Temperature

The temperature you feel everyday is the temperature of the atmosphere. The degree of hotness and coldness of the air is known as temperature.

The temperature of the atmosphere changes not only between day and night but also from season to season. Summers are hotter than winters.

An important factor that influences the distribution of temperature is ***insolation***. ***Insolation*** is the incoming solar energy intercepted by the earth.

The amount of insolation decreases from the equator towards the poles. Therefore, the

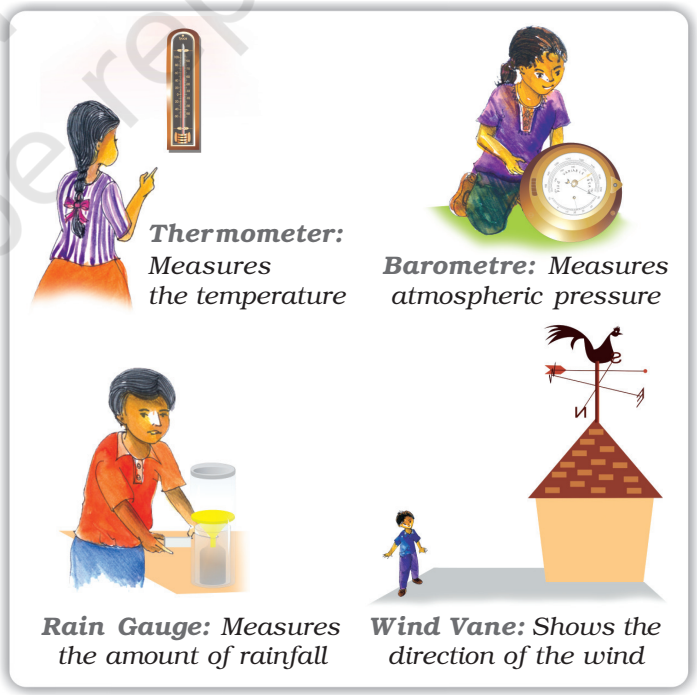


Fig. 4.3: Weather Instruments

© NCERT not to be republished

The standard unit of measuring temperature is degree Celsius. It was invented by Anders Celsius. On the Celsius scale the water freezes at 0°C and boils at 100°C.

temperature decreases in the same manner. Now do you understand why poles are covered with snow? If the earth's temperature rises too high, it would become too warm for some crops to grow. Temperature in cities is much higher than that of villages. The concrete and metals in buildings and the asphalt of roads get heated up during the day. This heat is released during the night.

Also, the crowded high rise buildings of the cities trap the warm air and thus raise the temperature of the cities.

Air Pressure

On the moon there is no air and hence no air pressure.

Astronauts have to wear special protective space suits filled with air when they go to the moon. If they did not wear these space suits, the counter pressure exerted by the body of the astronauts would make the blood vessels burst. The astronauts would bleed.

You will be surprised to know that air above us presses us with a great force on our bodies. However, we don't even feel it. This is because the air presses us from all directions and our body exerts a counter pressure.

Air pressure is defined as the pressure exerted by the weight of air on the earth's surface. As we go up the layers of atmosphere, the pressure falls rapidly. The air pressure is highest at sea level and decreases with height. Horizontally the distribution of air pressure is influenced by temperature of air at a given place. In areas where temperature is high the air gets heated and rises. This creates a low-pressure area. Low pressure is associated with cloudy skies and wet weather.

In areas having lower temperature, the air is cold. It is therefore heavy. Heavy air sinks and creates a high pressure area. High pressure is associated with clear and sunny skies.

The air always moves from high pressure areas to low pressure areas.

Wind

A wind is named after the direction ***from*** which it blows, e.g. the wind blowing ***from*** the west is called westerly.

The movement of air from high pressure area to low pressure areas is called wind. You can see wind at work as it blows dry leaves down the pavement or uproots trees during a storm. Sometimes when the wind blows gently you can even see it blowing away smoke or fine dust. At times wind can be so strong that it is difficult to walk against it. You must have experienced it is not easy to hold an umbrella on a windy day. Think of some other examples when strong winds have created

© NCERT not to be republished

problems for you. Winds can be broadly divided into three types.

1. *Permanent winds* – The trade winds, westerlies and easterlies are the permanent winds. These blow constantly throughout the year in a particular direction.
2. *Seasonal winds* – These winds change their direction in different seasons. For example monsoons in India.
3. *Local winds* – These blow only during a particular period of the day or year in a small area. For example, land and sea breeze. Do you recall the hot and dry local wind of northern planes of India? It is called *loo*.

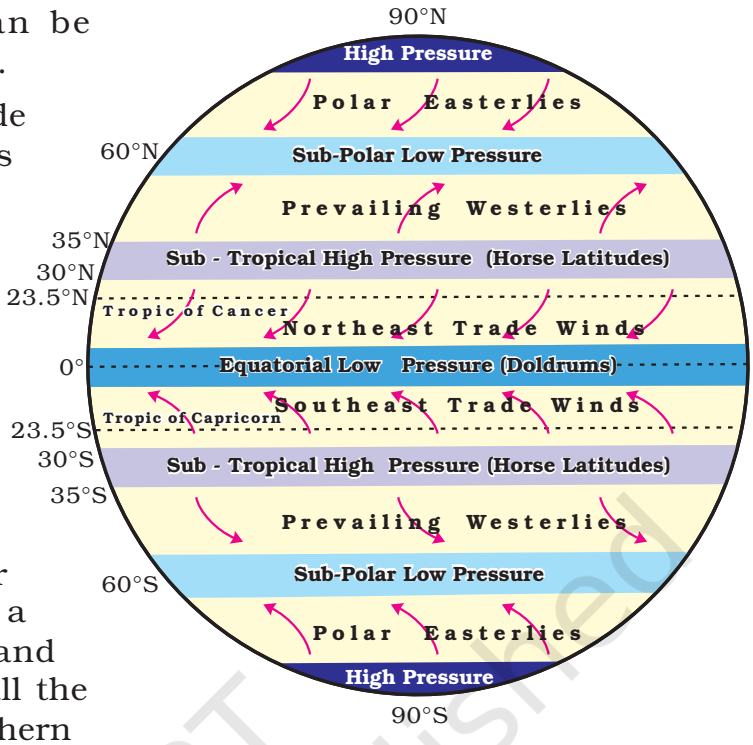


Fig. 4.4: *Major Pressure Belts and Wind System*

© NCERT not to be republished

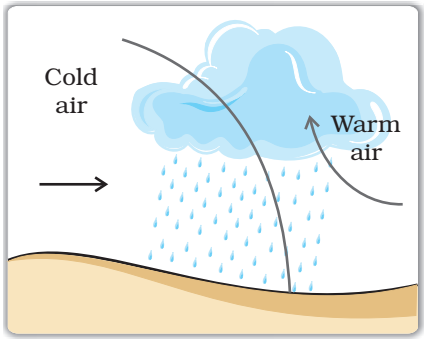
CYCLONE – NATURE'S FURY

Destruction caused by a cyclone

Odisha, located on the eastern seacoast of India is prone to cyclones that originate in the Bay of Bengal. On 17-18 October 1999, cyclone hit five districts of the state. Another supercyclone occurred on the 29 October 1999, that devastated large portions of the state. The damages caused were mainly due to three factors: wind velocity, rain and tidal surge. The winds of upto 260 km. per hour lasted for over 36 hours. These high velocity winds uprooted trees and damaged the *kutcha* houses. Roof tops of several industrial sheds and other houses were also blown away. Power supply and telecom lines snapped completely. Heavy rain occurred under the influence of the cyclone for three days continuously. These rains led to flooding in the major rivers of Odisha. The cyclonic winds caused tidal waves that swept 20 km. inland and brought massive destruction to the coastal areas. The 7 to 10 m high tidal wave intruded suddenly and caused massive damage to the standing paddy crops.

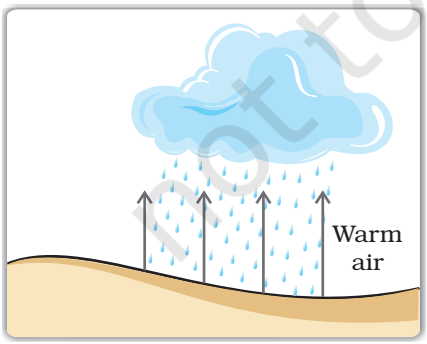
The cyclone originated as a "depression" in the Gulf of Thailand, near east of Port Blair, on 25 October 1999 and gradually moved in a northwestward direction. It intensified into a supercyclone and hit the area between Erasama and Balikuda in Odisha on 29 October at 10.30 a.m.

The supercyclone swept the entire coast of Odisha including the cities of Bhubaneshwar and Cuttack and 28 coastal towns. About 13 million people were affected. A large number of livestock were killed. Standing crops of paddy, vegetables and fruits were heavily damaged. Due to salinisation caused by tidal surge, large tracts of agricultural land have turned infertile. Large tracts of sal, teak and bamboo plantations have disappeared. The mangrove forests between Paradeep and Konark vanished.



Cyclonic Rainfall

Relief (Orographic) Rainfall



Convectional Rainfall

Fig. 4.5: *Types of Rainfall*

Moisture

When water evaporates from land and different water bodies, it becomes water vapour. Moisture in the air at any time, is known as humidity. When the air is full of water vapour we call it a humid day. As the air gets warmer, its capacity to hold the water vapour increases and so it becomes more and more humid. On a humid day, clothes take longer to dry and sweat from our body does not evaporate easily, making us feel very uncomfortable.

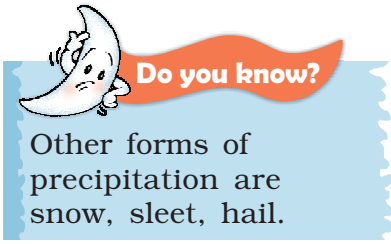
When the water vapour rises, it starts cooling. The water vapour condenses causing formation of droplets of water. Clouds are just masses of such water droplets. When these droplets of water become too heavy to float in air, then they come down as precipitation.

Jet planes flying in the sky leave a white trail behind them. The moisture from their engines condenses. We see trails of this condensed moisture for some time when there is no air movement to disturb it.

Precipitation that comes down to the earth in liquid form is called rain. Most of the ground water comes from rainwater. Plants help preserve water. When trees on hill sides are cut, rainwater flows down the bare mountains and can cause flooding of low lying areas. On the basis of mechanism, there are three types of rainfall: the convectional rainfall, the orographic rainfall and the cyclonic rainfall (Fig. 4.5).

© NCERT not to be republished

Rainfall is very important for the survival of plants and animals. It brings fresh water to the earth's surface. If rainfall is less – water scacity and drought occur. On the other hand if it is more, floods take place.



1. Answer the following questions.

(i) What is atmosphere?

(ii) Which two gases make the bulk of the atmosphere?

(iii) Which gas creates green house effect in the atmosphere?

(iv) What is weather?

(v) Name three types of rainfall?

(vi) What is air pressure?

2. Tick the correct answer.

(i) Which of the following gases protects us from harmful sun vays?
(a) Carbon dioxide (b) Nitrogen (c) Ozone

(ii) The most important layer of the atmosphere is
(a) Troposphere (b) Thermosphere (c) Mesosphere

(iii) Which of the following layers of the atmosphere is free from clouds?
(a) Troposphere (b) Stratosphere (c) Mesosphere

(iv) As we go up the layers of the atmosphere, the pressure
(a) Increases (b) Decreases (c) Remains the same

(v) When precipitation comes down to the earth in the liquid form, it is called
(a) Cloud (b) Rain (c) Snow

3. Match the following.

(i) Trade Winds	(a) Incoming solar energy
(ii) Loo	(b) Seasonal wind
(iii) Monsoon	(c) Horizontal movement of Air
(iv) Wind	(d) Layer of ozone gas
	(e) Permanent wind
	(f) Local wind

4. Give reasons.

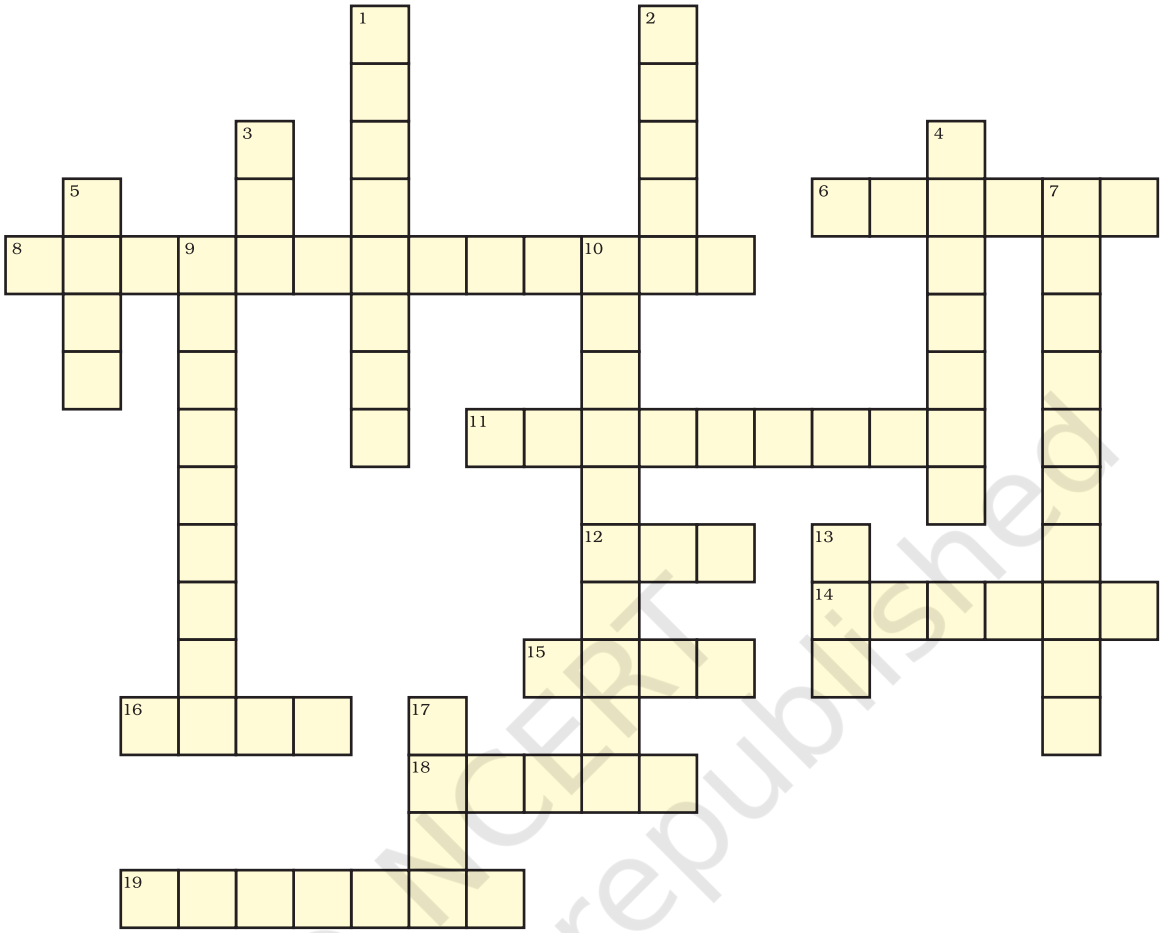
(i) Wet clothes take longer time to dry on a humid day?

(ii) Amount of insolation decreases from equator towards poles?

© NCERT not to be republished

5. For fun.

(i) Solve this Crossword puzzle with the help of given clues:



Across

6. An Indian tree having extraordinary quality of providing oxygen round the clock
8. Gas present in atmosphere occupying only 0.03% by volume
11. Outermost layer of atmosphere
12. Mixture of many gases
14. Life giving gas
15. Air in motion
16. An indian tree valued highly for medicinal properties
18. Gas protecting us from harmful sunrays
19. Low pressure area

Down

1. Amount of water vapour in air
2. Condensation of water vapours around dust particles in atmosphere
3. Example of local wind blowing in summer in northern india
4. Short term changes in atmosphere
5. Precipitation in liquid form
7. Blanket of air around the earth
9. Instrument to measure pressure
10. Incoming solar radiation
13. Reduces visibility in winters
17. It is ..... time when sun is overhead

© NCERT not to be republished

(ii) Make a weather calendar for one week. Use pictures or symbols to show different types of weather. You can use more than one symbol in a day, if the weather changes. For example, the sun comes out when rain stops. An example is given below:

Day	Weather
1. 	Sunny day
2.	
3.	
4.	
5.	
6.	
7.	

© NCERT not to be republished