7th Standard- Science

Winds, Storms and Cyclones

We live on the earth which is surrounded by air. The layer of air surrounding the earth is called atmosphere. The moving air is called wind. It is formed by the heat of the sun or it may be said that unequal heating of different parts of the earth forms wind.

Air Exerts Pressure

The continuous physical force exerted on an object or against an object when something comes in contact with it, is called pressure. Air exerts pressure in different ways under different situations and on all objects and in all directions. Air pressure helps the leaves of trees, banners or flags to flutter when the wind is blowing. It causes the tyres, balloons to inflate.

Importance of Air pressure

The importance of air pressure can be discussed as follows:

- It creates wind The difference in atmospheric pressure gives rise to the wind on the earth.
- It influences weather Air movement, i.e. downward or upward movement of air caused due to differences in pressure creates the cloudy and clear sky, brings rain or fine weather.
- Weather forecasting The changes in air pressure gives important clues for weather forecasting. The air pressure is measured by an instrument called barometer.

Similarly, when we ride a bicycle against the direction of the wind, boat against wind direction or flying of kite against the direction of the wind, we can feel the air pressure.

When we pump air or fill air into the bicycle tube, the air molecules inside the tube collide with the walls of the tube and exerts air pressure. The air pressure exerted from inside inflates the bicycle tube. The pressure exerted by air filled in a bicycle tube keeps the tube tight and makes the bicycle tyre feel hard. If we continuously fill more and more air into the bicycle tube, the air pressure in the bicycle tube will increase too much that tube may get burst. These observations also show that air exerts pressure.

High-Speed Winds

High-speed winds are accompanied by reduced air pressure.

Air moves from the region of higher pressure to the lower pressure. The greater the difference in pressure, the faster the air moves. It is due to the heat of the sun from which air becomes warm producing a low pressure. So, the warm air rises up and the cool air from the surroundings moves towards the sea.

The fast-moving air blowing over an object helps in lifting the object up by producing a region of low pressure above it. This can be shown by the following activity.

Air pressure is caused due to the constant bombardment by moving air molecules on the surface of the paper strip.

We have learnt that when high-speed air is blown over a strip of paper, it is lifted up. Similarly, if the high wind blows over the roof of houses, it will reduce the air pressure above the roofs and if the roofs of houses are weak then higher air pressure from below will lift up the roofs which can then be blown away by the fast winds. Therefore, weak roofs of houses can be lifted and blown away by the high-speed wind that is called a storm.

Air Expands on Heating

Gases or air expand more than solid and liquid on heating. Air is a mixture of gases. On heating, the molecules of air gain kinetic energy. It moves away from each other, thus occupying more space. Therefore, the air becomes lighter. Warm air rises up whereas comparatively cool air tends to sink towards the earth's surface.

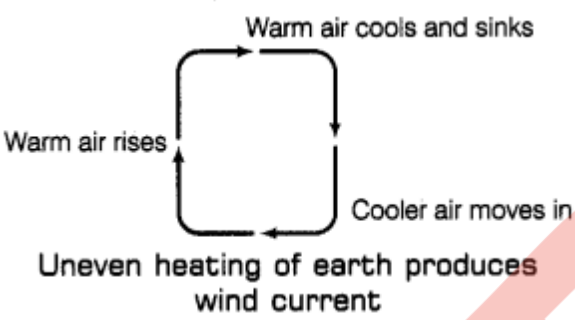
The term 'expansion of air' means the increase in the volume of air. When the air is heated, its volume increases and occupies a bigger space.

When the air is heated, it becomes lighter and rises up in the sky. This is the reason that when we burn woods, the smoke rises along with the hot air near the place of fire. This can be demonstrated by the following activities.

This fact of air is utilised in launching hot air balloons. In nature, there are several situations where warm air rises at a place. The air pressure at that place is lowered. The cold air from the surrounding areas rushes in to fill its place.

Wind Currents

The wind is the movement of air which depends on the difference in air pressure in two regions. Air moves from the region of high pressure to the region of low pressure in the atmosphere. This difference in air pressure is created by uneven heating or unequal heating on the earth. The region where the air rises, an area of low pressure is created while the region where the air sinks, an area of high pressure is created.



The uneven heating on the earth takes place in two situations:

1. Uneven Heating between the Equator and the Poles

The region of the earth which is closed to the equator of the earth gets the maximum heat from the sun. Therefore, the air in these regions gets warm and rises, creating an area of low air pressure. The cooler air from the region of upto 30 degrees latitudes belt on either side of the equator moves or rushes towards the equator and replaces the warm rising air. This makes the wind to blow from the North and South directions towards the equator.

At the poles, the air is colder than at latitudes about 60 degrees.

Therefore, the warmer air moves upward and colder air rushes in. This makes the wind blow from the poles of the earth towards the warmer region up to about 60-degree latitudes.

2. Uneven Heating of Land and Water

(i) During summer, the earth near the equator warms faster than the water in the oceans. The air above the land gets warmer and rises up in the sky creating a low-pressure area. Therefore, the winds flow from the oceans towards the land. These winds carry a lot of moisture with them and bring rain. It is a part of the water cycle. These rain-bearing winds are called the monsoon winds.

(ii) During winter, the direction of the wind gets reversed. The wind blows from the land to the sea due to the difference in air temperature between the land and sea. This happens so because during winter, the land cools down faster than the water in the oceans and the temperature of water in the ocean is higher than that of land. The warm air over the ocean rises up creating a region of low pressure and cooler air from the land rushes towards the ocean. Thus, the air flows from land to ocean carrying only a little water vapour. Hence, bring only a small amount of rain in the winter season.

Note: The word monsoon is taken from the Arabic word 'Mausam' which means 'season'

The summer monsoon which brings heavy rain is very important to the farmers because this annual rainfall helps in growing crops. Farmers depend on the rain for the irrigation of their crops. Sometimes, rain creates some problem also. In nature itself, there are certain situations that can sometimes create disasters and can pose a threat to humans, animals and plant life.

Wind speed and wind direction play an important role in the formation of storms, cyclone, thunderstorms, etc. The instrument used to measure the wind speed is called anemometer.

Thunderstorms

When air moves gently (low speed), it is called a breeze while when it moves violently (high speed), it is called a storm. When the pressure of air drops, it indicates the possibility of a storm.

The swift movement of the falling water along with the rising warm air producing sound, lightning, heavy rain and • strong wind is called thunderstorm. It develops in hot and humid tropical areas like India and is accompanied by heavy rains or hail. Thunderstorms are produced by the dark clouds which form at fairly low altitude in the atmosphere. In the tropical area, the air gets warmed up and makes it to rise, whereas humidity provides the water vapour for the formation of cloud.

Therefore, it can be said that to occur a thunderstorm, it requires moisture, rapidly rising warm air and sea breeze or mountains.

Precautions to be Taken During a Thunderstorm

A thunderstorm is accompanied by lightning which is a giant electric spark. It may kill people, animal and can damage buildings, etc. Therefore, you must take the following precautions during a thunderstorm to protect ourselves from the lightning.

When you are in open area

- Do not take shelter under an isolated tree or building. If you are in a forest, take shelter under a small tree. Do not lie on the ground.
- Do not take shelter under an umbrella having a metallic end.
- Never sit near a window, open garages, storage sheds, metal sheds, etc, to take shelter.
- One can take shelter in a car or a bus.
- Do not go in the water. If you are in the water, get out and go inside a building.

When you are inside

- Do not sit near an open window. Close the doors and windows properly.
- Do not touch/operate any electrical devices or telephone.
- Do not watch TV

Cyclones

A cyclone is a weather condition consisting of a system of high-speed winds revolving around a central area of very low pressure. Cyclones develop over tropical seas. It is a violent storm with a wind speed of 150-250 km/h. It is accompanied by strong winds and heavy rains.

Structure of a Cyclone

The centre of a cyclone is a calm area and is called the eye of the storm. The diameter of the eye varies from 10 to 30 km. It is a region free of clouds and has light winds. Around this calm and clear eye, there is a cloud region of about 150 km in size.

In this region, there are high speed winds (150-250 km/h) and thick clouds with heavy rains. Away from this region, the winds speed gradually decreases.

Note: Cyclones are developed over the Indian Ocean, Bay of Bengal and Arabian sea. The whole coastline of India is vulnerable to cyclones. Meteorologists study weather and give various names to the cyclones as Hugo, Katrina, Rita, Hud-Hud, Phailin, etc.

Formation of Cyclones

Factors like temperature, humidity, wind speed, wind direction and rotation of the earth, contribute to the development of a cyclone. The energy required to form and sustain a cyclone comes from the heat of condensation of water vapour present in moist air rising from the surface of hot seawater that condenses at altitudes to form a 0cloud. When the air above the seawater is heated, a region of low pressure is created because warm and moist air rises up. * The cool air rushes in forcing up more hot air.

The process of moving warm air up and its replacement by cool air is repeated again and again making or setting up a cycle or air current.

Once the cyclone is formed, it begins to move over the surface of the sea. The strongest wind and the heaviest rain occur in the towering thunder clouds about 20-30 kilometres from the centre of the cyclone. Cyclone comes to an end quickly if a cyclone moves over land because it no longer receives heat energy and moisture from warm seawater.

Note: A cyclone is known by different names in different parts of the world. It is called a hurricane in the American continent. In the Philippines and Japan, it is called a typhoon.

Destruction Caused by Cyclones

Cyclones are very destructive. These are the greatest storm on earth. Cyclones cause widespread destruction and loss of life in coastal areas. When the strong winds push water towards the shore even if the storm is hundreds of kilometre away, it gives the first indication of an approaching cyclone.

The high-speed wind accompanying cyclone produces a tremendous force of the high-speed wind. It causes damage by toppling trees, electric poles, telephone poles and vehicles, damage houses and even hurt people, thus causing a great loss of life and property.

The low pressure in the eye lifts the water surface in the centre. The rising water may be as high as 3-12 m and appears like a water-wall moving towards the shore. As a result, the seawater enters the low-lying coastal areas and can destroy roads and railway tracks, wash away vehicles, damage houses, drown people and animals, damage crops causing a great loss of life and property. The cyclone also reduces the fertility of the soil.

Continuous heavy rains caused by cyclones may further worsen the flood situation in the area and affect the people in coastal area. The flood may pollute drinking water and may cause several water-borne diseases.

Effective Safety Measures

On the part of the government

- Cyclone forecast and warning system must be installed.
- Information about cyclone should be given to the people in time through rapid communication system.
- Construction of cyclone-shelter in cyclone-prone areas.
- An administrative arrangement should be taken to move people faster to safer places.

On the part of the people

- People should follow the essential guidelines provided by the agencies through TV radio, phones, etc.
- A proper arrangement should be made to shift the essential household goods, domestic animals, etc. to the safer places.
- Avoid driving on a road which is underwater because flood might have damaged the road.
- Phone numbers of all the emergency services like police, fire brigade, hospitals, etc. should be kept ready.

Some other precautions to be taken when you are staying in a cyclone hit area

- Do not drink water that could be contaminated, store drinking water for emergencies.
- Do not touch wet switches and fallen power lines.
- Do not go out just for the sake of fun.

- Cooperate and help your neighbours and friends.
- Do not pressurise the rescue force by making under demands.
- Do not enter into damaged buildings.

Tornadoes

A tornado is a violent spinning storm in the shape of a dark funnel with a narrow end on the land.

These are formed over the sea and are called water spouts. Tornado develops from the thunderstorm and is formed mostly on the land. These are violent and can reach the speeds of more than 500 km/h destroying everything in their path. These are not very common in India but occurs in Canada and the USA.

Most of the tornadoes are weak. When the warm air from the earth's surface rises up, it whirls around it and causes very high-speed winds. These are much smaller than cyclones, i.e. from a few meters to a few hundred meters but the wind speed can rise as high as 500 km/h. The funnel of tornado sucks up everything at its bases like dust, debris, cars, trees and even houses.

Destruction Caused by Tornadoes

Tornado causes much damage due to the heavy force of its high-speed winds. A tornado causes considerable damage when it passes over land. Tornado causes the following destructions:

- It uproots trees, electric poles and telephone poles, it disrupts power supply and telecommunications.

- It lifts the people and vehicles off the ground and hurls them hundreds of metre away. This may lead to the death of people and damage to vehicles.
- Tornado causes extensive damage to buildings. It creates lower pressure outside the building much lesser than inside the building and the building can explode.

Protection from Tornado

The following precautions should be taken for protection during a tornado:

- One should take the shelter in a room situated deep inside the home having no windows or in a basement.
- Shut all the doors and windows and take shelter under the study table.
- Bend down on your knees and protect your head and neck using your arms. Stay indoors until it is safe to come out.
- If someone is in the vehicle and tornado begins, he should get out of the vehicle and take shelter in a ditch or low-lying area and lie flat in it.
- Keep distance from electric wires and damaged areas.

Protection of head and neck during tornado in bent position

Advanced Technology has Helped

During the early part of the last century, the people residing in coastal regions have less than a day for the preparations or to evacuate their homes from an overcoming cyclone. But, today's situation is very different. Today we are much protected.

We have satellites and radars which can issue the cyclone watch or cyclone alert before 48 hrs (in advance) of any expected storm and a cyclone warning is issued 24 hrs in advance.

Therefore, coastal residents have sufficient time to prepare and evacuate their homes. The message related to the cyclone is broadcasted over the ratio every hour or half hour when a cyclone is nearer the coast.

In this way, the advanced technology has helped us in giving better protection from cyclones. Several national and international organisations cooperate to monitor cyclone-related disasters.