

Ch-8- Winds, Storms and Cyclones

Air Pressure

Wind

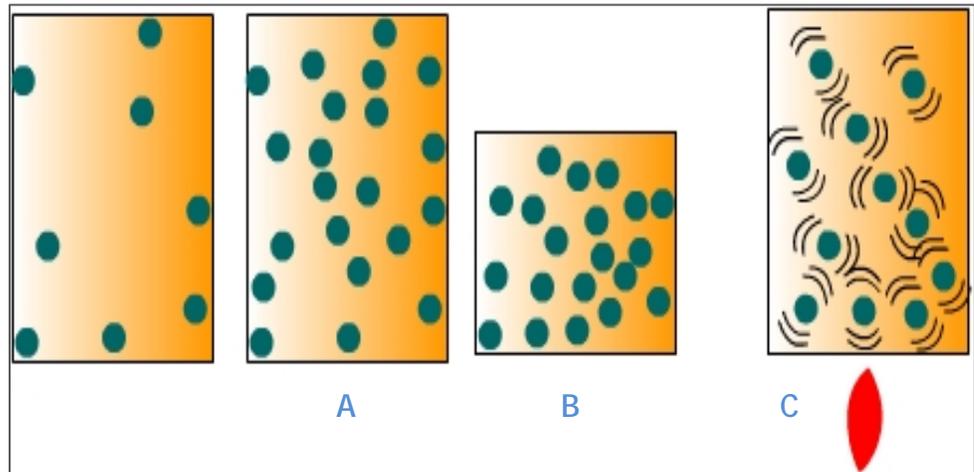
Thunderstorms and Cyclones

Air Pressure

Air pressure is the force exerted per unit area of surface by the air that is directly above that surface.

Imagine a sealed container full of air as shown below. When the molecules of air collide with the inside surfaces of the container they exert a pressure. The amount of pressure they exert depends on the number of collisions that occur between the molecules and the inside surface of the container. We can change the pressure in two ways. First, we can increase the density of the air by either putting more air molecules into the container (A) or reducing the volume of the container (B).

Secondly, we can increase the temperature of the air (C) to make the molecules move faster and thus collide with the sides more often. Therefore, changes in air pressure can come about by changes in air density or temperature.



Air pressure is measured using a *barometer*.

Some applications of Air Pressure:

- Cycling against the wind is difficult because of the pressure exerted by air.
- The tires of vehicles are filled with air, thereby exerting pressure. This makes it easy for them to hold and carry the weight.

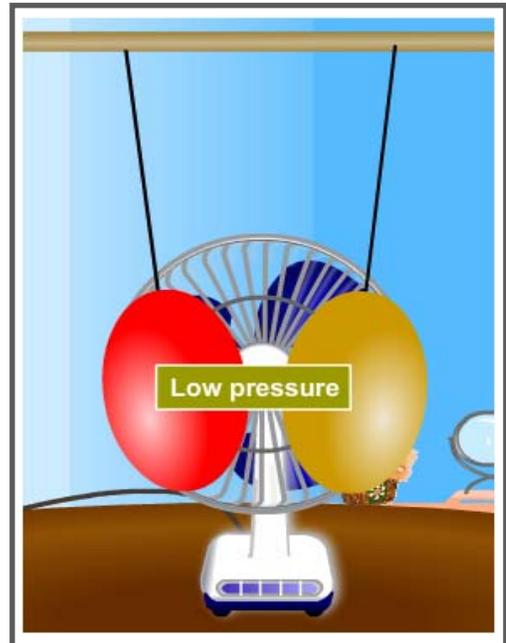
Wind

High Speed Winds are accompanied by Reduced Air Pressure

Changes in air pressure bring changes in the weather and make winds blow. Air usually moves from areas of high pressure to areas of low pressure and this produces winds. High air speed causes low pressure and low air speed causes high pressure.

Activity

Take two balloons and fill a part with water and rest with air. Place the balloons in front of the electric fan with some distance between them. Switch on the fan at lower speed. You will notice that the distance between balloon decreases slightly. Switch off the fan you will see that the balloons come back to their original place. Why did that happen? When air blew between the balloons the pressure between the balloons reduces and pressure outside the balloons is higher and it pushes them closer. Can you think what will happen if, speed of the fan is further increased? The balloons will come even closer to each other. We conclude that high air speed causes low pressure and low air speed causes high pressure.

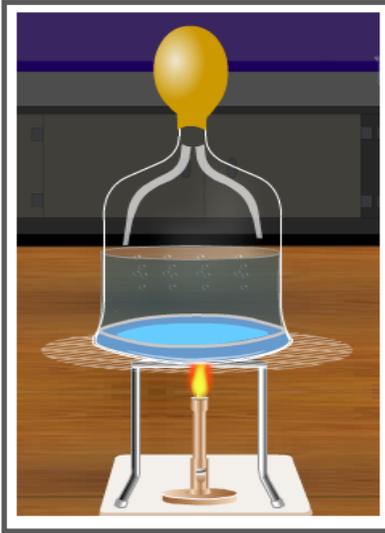


Air expands on Heating

Air condenses as it is cooled and hence requires less space. That means air contracts on cooling. Warm air therefore takes up more space than the same amount of cold air; it also weighs less than cold air occupying the same space. On heating, the molecules begin to move faster and move apart from each other leading to expansion.

Activity

Air expands on heating and contracts on cooling.



Take a glass bottle and a balloon. Now fill half the bottle with water and the balloon has to be fixed over the mouth of the water bottle, with the help of rubber band. Now place a flame under the bottle for heating the water. What do you see? The balloon expands. This is because when you heat the air inside the bottle, it expands. When it expands it needs more space to fill out. This expanding hot air finds empty space inside the balloon, so the air moves inside the balloon and hence the balloon expands. Let us put this bottle into a jar having ice cubes. What will you see? The air inside the balloon moves toward the bottle and the balloon contracts. Air condenses as it is cooled and hence requires

less space. That means air contracts on cooling. The continuous contraction of air inside the balloon will result in a completely deflated balloon.

Some applications

- Smoke from a fire moves upward. This is because fire heats the air above it, and this hot air moves up. The air carries the smoke along with it, thereby making it rise up.
- In a hot air balloon, there is a balloon fixed over a basket and a flame just below the balloon. As the air inside the balloon gets heated up, it becomes lighter and rises up.

Wind Currents Are Generated Due To Uneven Heating on the Earth

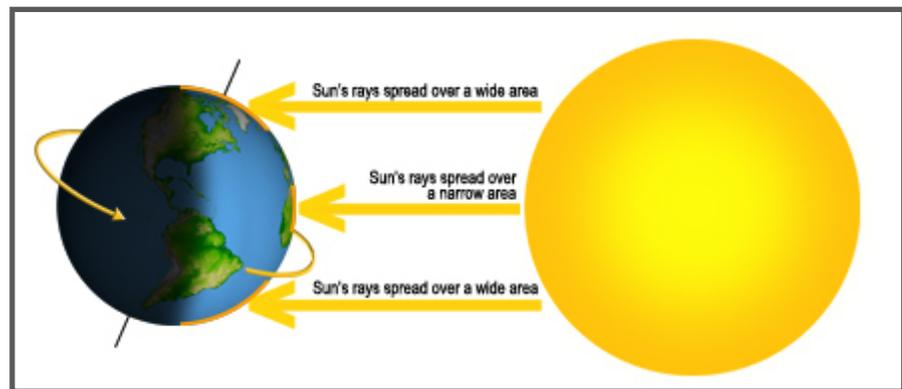
The winds blow from a region of low temperature to a region of high temperature because of a difference in the atmospheric pressures.

A region with a high temperature has a low-pressure condition because of low air density. That means when a place is hot, air above the place will also get heated up and hence will rise up thus decreasing the air density at that place whereas a region with a low temperature has a high-pressure condition because of high air density.

The pressure differences are caused due to following reasons:

(a) Uneven heating between the equator and the poles land and water.

Because of the tilt of the Earth, both the poles receive least amount of sunlight as compared to equator region and hence are very cold. Due to this air in these regions also remains cool forming a High-Pressure region.



The air between the 30° to 60° latitude belts is warmer in comparison to the air near the poles. Hence, this warm air rises up and cold air from the Polar Regions rush in to fill the empty space.

(b) Uneven heating of land and water.

Sea breeze



In day time, the surface of the land is warmer than the surface of sea. The warm air over the land moves upward. Once it does that. There is decrease in air pressure here. So, there is vacant space. The air from the sea blows toward the land to occupy the space. This blowing air is called a sea breeze. Now this sea breeze brings cold air from the sea. So, it reduces the temperature of

the surrounding area.

Land breeze

In night time, exactly the reverse happens. The land absorbs the heat in the day and releases it very quickly in the night as compared to water which absorbs the heat late and releases it late! The air over the land is cooler and denser than the air over the sea. So now the reverse is happening, the warm air over the sea moves upward. So there is a low pressure area here and it is waiting for the air from the land to rush in and take its space. This is known as the land breeze. That is the wind blowing from the land toward the sea. This is the reason that the temperature of the beach is neither too hot and nor too cold.



During the summer months, the land at equator absorbs heat and the temperature of the land becomes higher than that of the oceans. This makes the hot air from the land to rise up and the cold air from the oceans blow towards the land. This results in the formation of the **monsoon winds**.

During winter months, the temperature of the land becomes less than that of the oceans. As a result, winds start blowing from land to the oceans.

Monsoon rain

Monsoons are seasonal winds that change their direction with changing seasons. They blow from the oceans towards land in summer and from the land to oceans in winter. When blowing from oceans to land, these winds carry water droplets with them and are responsible for the rains in India.

Thunderstorms and Cyclones

A thunderstorm is a high-speed wind that is accompanied by heavy rain (or hail), lightning, and thunder.

What causes thunderstorms?



In hot, humid and tropical areas, the temperature of the air over the land is very high. This causes the air to move upward and forcefully carry the water vapour present in the air, to a higher altitude. At high altitudes water vapour freezes to form water drops or hail which falls on the Earth. This sudden rise and fall of hot air and cold-water droplets causes lightning and thunder, and results in what is commonly called as a thunderstorm.

Thunderstorms

Cyclones

Water on the surface of the Earth absorbs heat and changes to vapour. As water vapour moves up higher in the atmosphere, it carries this heat along with it. The higher regions of the atmosphere are cooler. This condenses the water vapour into water drops.

When vapour cools down, it releases the absorbed heat into the atmosphere. The heat thus released warms up the air, which once again causes it to rise up. A low-pressure area is thus formed and the air from the surrounding areas rushes in. This sequence of events is repeated continuously.



Thus, this cycle is the result of the formation of a very low-pressure system with high wind speeds revolving around it. This weather phenomenon is known as a Cyclone. The low-pressure centre of a cyclone is known as the eye of the cyclone. It is very calm i.e. the centre of the storm is actually free from storm and rain.

Formation of a cyclone depends on the factors like wind speed, wind direction, humidity and temperature.

Destruction Caused By Cyclones

Cyclones can cause a lot of destruction to our lives, property, communication systems, and facilities. They cause floods and make the soil infertile. The rainfall caused during a cyclone is so strong that a human cannot overcome it.

Safety Measures and precautions against these cyclones:

- 1 Never ignore the warning given by media against cyclones.
2. Avoid driving on a road filled it water, it might have got damaged because of cyclone.
3. Do not touch fallen and broken power lines.
4. Do not drink contaminated water in a cyclone hit area.

Advanced technologies like RADAR & satellites have helped a lot in giving early warning against cyclones, so that people can have enough time to evacuate their homes and shift to a safer place. Also we have Anemometer to measure the speed of the wind, so whenever there is a remarkable hike in the wind speed we get an Alert!

Tornadoes

In some countries Tornadoes are seen which are actually a dark cloud having a funnel shape and travelling at an average speed of 300 Km/Hour. But most of the tornadoes are weaker and sometimes these are formed within the Cyclones.



Tornadoes