

Chapter – 8

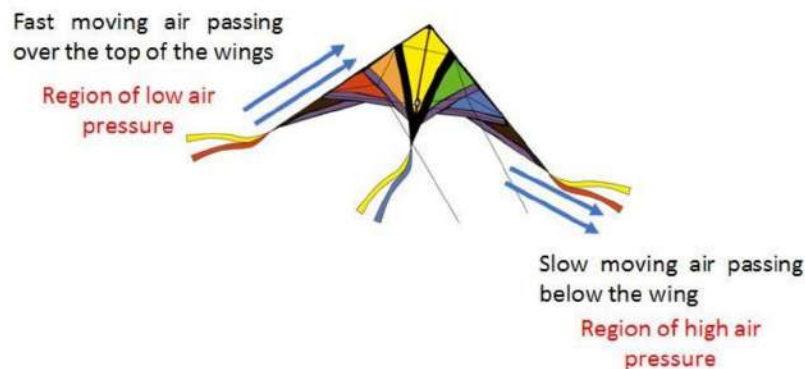
Winds, Storms and Cyclones

AIR EXERTS PRESSURE

Wind: The wind is moving air which is caused by the differences in air pressure within the atmosphere.

Atmospheric Pressure: The pressure exerted by air is called atmospheric pressure.

Example: The wind coming from our back help in flying kite.



While kite flying, the winds coming from our backside hits the kite and exert pressure on the kite. As a result of the force exerted by the wind on the kite, the kite rises upward and it flies higher in the air.

Example: Rahul is rowing a boat opposite to the direction of the wind. Does he have to exert less effort as compared to the effort he exerts in still water to row his boat forward?

Solution: No, it is difficult to row the boat in the direction opposite to the direction of the wind. In this case, wind exerts pressure opposite to the direction of the motion of the boat and because of this, the wind opposes the motion of a boat.



Therefore, Rahul has to apply much more effort to row the boat forward against the direction of the wind. Hence, he has to exert more effort in rowing the boat forward in this case.

Factors affecting atmospheric pressure:

(a) Altitude: As we move to the high altitudes, the number of air molecules decreases and the air pressure decreases. Because there are fewer molecules to put pressure on us.

So, the air pressure decreases when we move at a high altitude and vice – versa.

(b) Temperature: When temperature increases in the atmosphere. Air expands and air molecule moves apart and becomes less dense.

Therefore, the pressure exerted by the atmosphere becomes less when the temperature increases.

(c) Water vapour: The moist air is lighter or less dense than dry air in a fixed volume. The increase in moisture content makes the air lighter and decreases the density of molecules in the atmosphere. Hence the pressure decreases when moisture content increase in the atmosphere and vice – versa.

Temperature (Increase)	Pressure (Decrease)
Temperature (Decrease)	Pressure (Increase)
Altitude (Increase)	Pressure (Decrease)
Altitude (Decrease)	Pressure (Increase)
Water vapour (Increase)	Pressure (Decrease)
Water vapour (Decrease)	Pressure (Increase)

Tip: While answering questions based on atmospheric pressure we consider these three factors.

Example: Mountaineers moving toward the peak of the mountain as shown in the image below.

As they climb higher, the pressure exerted by the atmosphere on them _____.



Solution: As we move to the higher altitudes, the number of air molecules decreases and the air pressure decreases. This is because of the fewer molecules in the air which put pressure on us.

So, the air pressure decreases when mountaineers move towards the peak of the mountain i.e. at high altitudes.

Therefore, the pressure exerted by the atmosphere on mountaineers decreases.

HIGH SPEED WINDS ARE ACCOMPANIED BY REDUCED AIR PRESSURE

Wind: Wind is a moving air that is caused by the differences in air pressure within the atmosphere. The wind moves from the region of the high-pressure to the region of the low-pressure. Therefore, we can say that, as the speed of the wind increases, the air pressure decreases.

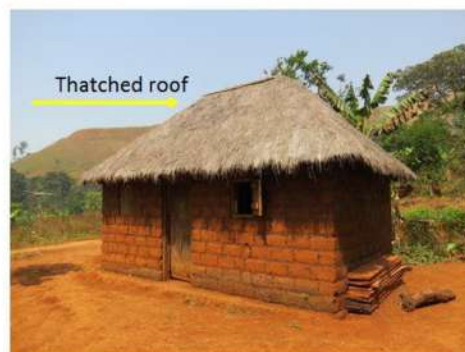
Therefore, the greater the difference in pressure of two regions, the faster the air moves.

Tip: The instrument that measures the wind speed is called an anemometer.



Example: During the rainy season, due to heavy rainfall and wind, the roof of the hut is blown off. Why does this happen?

Solution: The roof of the hut is blown off because of the high-speed winds. The high-speed winds during rainy seasons create an area of low pressure above the roof. While the air pressure below the roof i.e. inside the hut remains constant. Once, the outside pressure becomes less than the inside pressure, the roof is pushed upward and the roof is blown away.



AIR EXPANDS ON HEATING

Air expands on heating: Air expands on heating because as the particles of air become warm, they move away from each other and take up more space. So, we can say that the hot air occupies more space.

When the particles move away from each other, the air becomes light in weight as a result of which warm air rises up.

Example: A fire alarm is usually placed on the ceiling of the room. Why?

Solution: We know that air expands on heating as a result of which it occupies more space, becomes lighter and moves faster in an upward direction.

Therefore, the hot air from the fire will rise up towards the ceiling and will be easily detected by the fire alarm. Hence, the fire alarm should be placed on the ceiling of the room.

WIND CURRENTS ARE GENERATED DUE TO UNEVEN HEATING ON THE EARTH

Wind currents are generated due to uneven heating on the earth in two ways.

(i) Uneven heat distribution from the equator to pole: The regions which are close to the equator get maximum heat from the Sun. Therefore, the air in these region gets warm and rises, creating an area of low air pressure.

Similarly, at the poles, the air is colder than the equator.

As the warm air rises, the cooler air from the regions on either side of the equator rushes towards the equator and replaces the rising warm air. This makes the wind to blow from the north and the south towards the equator.

Tip: Remember the deflection of winds is due to the rotation of the earth.

(ii) Uneven heating of land and water: Land breeze and sea breeze are examples of this phenomenon.

Sea Breeze: During the day land gets heated faster than water. Due to this air over the land expand and rises, while cooler air moves from the sea to take its place. This is called sea breeze.

Land Breeze: During the night land cools faster than water. Due to this warmer air over the sea rises and the cooler air moves from land to sea to take its place. This is called land breeze.

Monsoon Winds: During summer, the land masses, especially in Asia become extremely hot. This causes the development of low-pressure areas. As the land mass of the Indian subcontinent gets heated a zone of low pressure develops over it. On the other hand, the Indian ocean remains relatively cold and a zone of high pressure exists over it. The wind blows from the zone of high pressure to the zone of low pressure. These winds carry a huge amount of moisture and create monsoon clouds over the Indian ocean which move over the Indian subcontinent.

Example: In the given figure



Where the atmospheric pressure is more during the daytime over land or over the sea?

Solution: During the daytime, an area of low pressure develops over the land because it gets heated faster than the sea.

And, when temperature increases in the atmosphere. Air expands and air molecules move apart and become less dense.

Therefore, the pressure exerted by the atmosphere becomes less when the temperature increases.

So, pressure over the sea is comparatively higher than land.

THUNDERSTORMS AND CYCLONES

Thunderstorm: The falling of water droplets along with the rising air creates lightning and sound, this event is called a thunderstorm.

Example: How does a thunderstorm form?

Solution: The rising temperature produces upward rising wind which carries water droplets upward where water droplets freeze and fall down.

Formation of Cyclone: Thunderstorms can be changed into cyclones. Factors like wind speed, wind direction, temperature and humidity contribute to the development of cyclones.

1. The sun heats the surface of the ocean water. The warm water heats the air above it. This causes low pressure on a vast area of the ocean. Due to the low pressure, the moist air from the ocean surface begins to rise rapidly. This creates a strong upward wind that rotates spirally.

2. As the warm and moist air rises high up in the atmosphere, it gets cooled and the water vapour present in it condenses to form clouds called thunderclouds. When water vapour condenses, it releases heat.

3. The heat released by the condensation of water vapour in the atmosphere warms the air all around. This warm air rises higher into the atmosphere causing low pressure. More air rushes to the centre of the storm. This cycle is repeated.

4. The chain of events ends with the formation of a very low-pressure system with very high-speed winds revolving around it. The weather condition consisting of a system of high-speed winds revolving around a central area of very low pressure is called a cyclone.

Tip: Remember the cyclones are called hurricanes in America, typhoons in Japan and the Philippines.

Example: High-speed wind can cause cyclones in the regions of _____ pressure.

Solution: High-speed wind can cause cyclones in the region of low pressure.

EFFECTIVE SAFETY MEASURES

Precautions should be taken in a cyclone:

1. Do not drink water that could be contaminated. Always store drinking water for emergencies.
2. Do not touch wet switches and fallen power lines.
3. Do not go out just for the sake of fun.
4. Do not pressurise the rescue force by making undue demands.
5. Cooperate and help your neighbours and friends.

Example: What are the ways of early-warning for cyclones?

Solution: Satellites and Radars plays an important role in the early-warning systems for cyclones. A cyclone alert or cyclone watch is issued 48 hours in advance of any expected storm and a cyclone warning is issued 24 hours in advance. The message is broadcast every hour or half-hour when a cyclone is nearer the coast.

To face these types of situations several national and international organizations cooperate to monitor the cyclone-related disasters.