

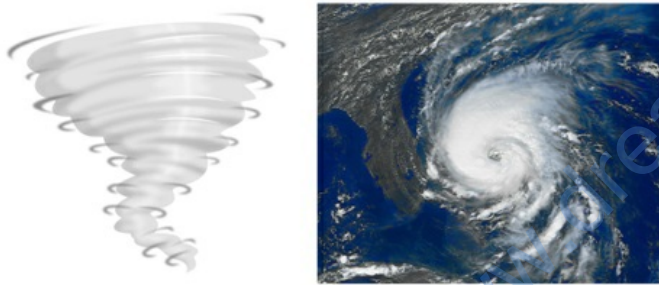
Class 7 Physics Winds, Storms and Cyclones

Wind

Wind

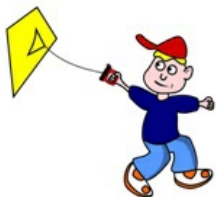
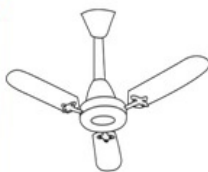
Moving air is called Wind.

- Since air is a mixture of gases, wind is the flow of gases on a large scale.
- Winds are caused by heating difference between different parts of the world and the movement of the earth.
- Winds can be of classified on the basis of:
 - **Duration:** Long and Short
 - **Strength:** High, medium and low
 - **Speed:** Slow and Fast
- High strength winds for longer duration, like cyclone or hurricanes, may cause hazardous effects.



Twister/Tornado/Cyclone/Storm

- Applications of wind include Windmills (to generate electricity), fan, flying kite, Hair Dryer etc.



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Pressure exerted by Air

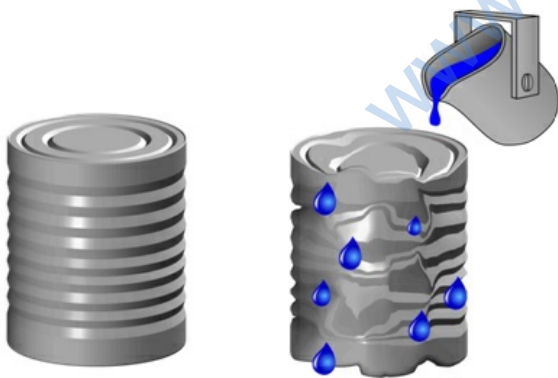
Pressure exerted by Air

Atmospheric pressure is the pressure exerted by the weight of air in the atmosphere of Earth (or that of another planet).

- All gases in the atmosphere exert pressure on each other, the earth and the objects on earth including humans.
- The pressure exerted on a human body by atmosphere is compensated by the pressure exerted by the gases inside human body.
- The force or the pressure exerted by air/wind makes loose paper, hair, flags, leaves of trees
- Manual tasks like riding bicycle or rowing boat against the wind requires more muscular energy, than normal, due to the opposing pressure exerted by wind. Similarly, If riding and rowing are being done in the direction of wind, then these tasks require less muscular energy than normal.

Examples of pressure being exerted by Air

- Distortion of tin can or bottle
 - Closed Tin can half filled with boiling water.
 - The can will have hot water as well as steam.
 - Now, pouring cold water will make the steam condense and become water.
 - This reduces air inside the can.
 - Since the pressure of air inside can becomes lower than air outside, the can's shape will become distorted.



Tin can with hot water inside

Distorted Tin can poured with cold/normal water

- Sucking a straw decreases pressure inside it, this makes the outside atmospheric pressure become higher and the fluid thus goes up through the straw.
- Tyre tube bursts when over filled with air due to the fact that the pressure inside the tube becomes higher than the outer atmospheric pressure.



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Air Pressure concepts

Air Pressure concepts

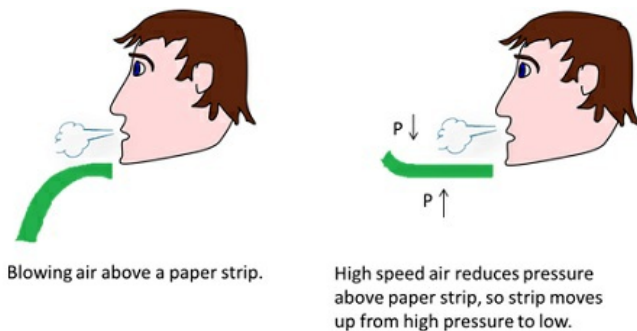
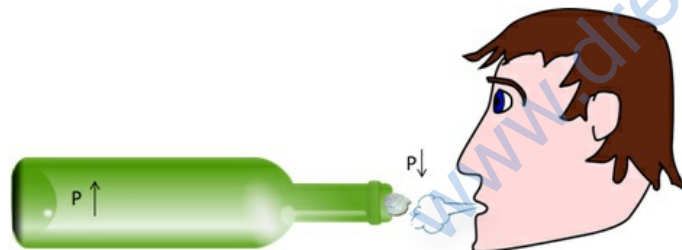
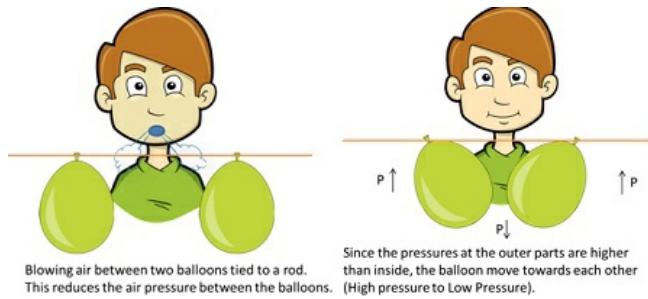
As the **pressure** of an area **reduces**, **wind speed increases** and vice versa. Higher the pressure difference, higher the speed of wind.

Thus, the two major concepts are:

High speed winds are accompanied by reduced air pressure.

Air travels from high pressure areas to low pressure areas.

Examples



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Air Expands on Heating

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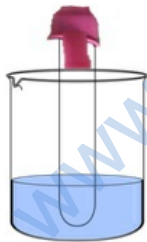
- Air molecules expand on heating and contract on cooling.
- Hot air molecules take more space than cold air molecules.
- Warm or Hot air is lighter than cool air.
- Warm air, like smoke, rises up and cool air settles down.
- When warm air rises up, it creates low pressure in the area, so surrounding cooler air, from relatively higher pressure, then comes to take up its place.

Examples

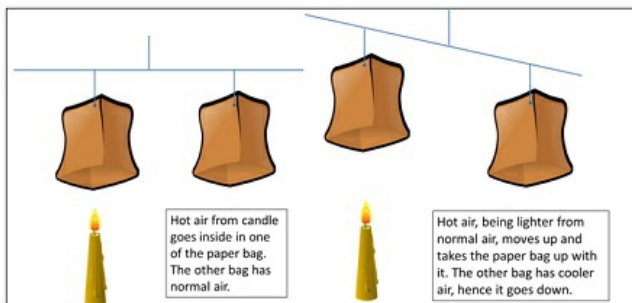
- When a test tube is immersed in hot water, the air inside it expands and tries to take more space. On the other hand, when immersed in cold water, the air inside the tube contracts a little and tries to take up lesser space than normal.



A balloon gets a little blown up when attached to a tube under hot water



A balloon gets sucked inside when attached to a tube under cold water



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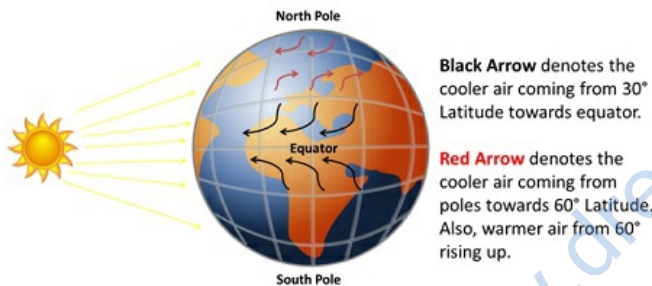
Causes of Wind Generation

Causes of Wind Generation

Winds or wind currents are generated by two factors:

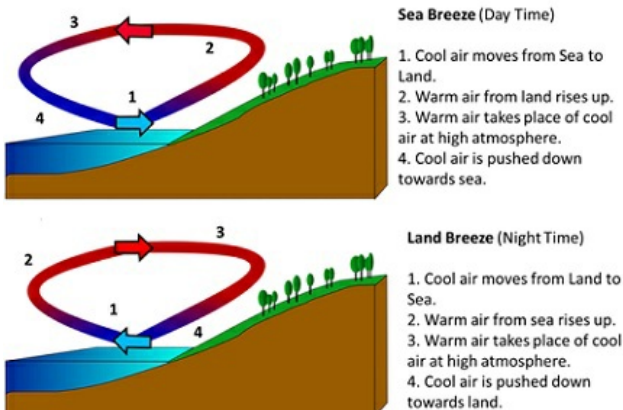
Uneven heating between Poles and Equator

- Centre of the earth is called **Equator** and the two extreme positions are **Poles**.
- **Poles are cooler than equator** as highest intensity of the sun's heat and light falls on the equator and it reduces as we go either side of equator towards the poles.
- **Cooler air from surrounding areas of the equator** comes towards the equator to fill the place of warm air which rises up due to sun's heating.
- Similarly, **cooler air from poles comes towards the surrounding areas** as the surrounding areas have air warmer than the poles.
- These winds from north to equator and south to equator are not straight as their direction change due to **earth's rotation on its axis**



Uneven heating between Land and Water

- This occurs in the coastal areas.
- Sea Breeze: This causes the wind to move from Sea towards Land and the process continues during the day. These are also called **Monsoon winds**.
- Land Breeze: This causes the wind to move from Land towards Sea and the process continues during the night.

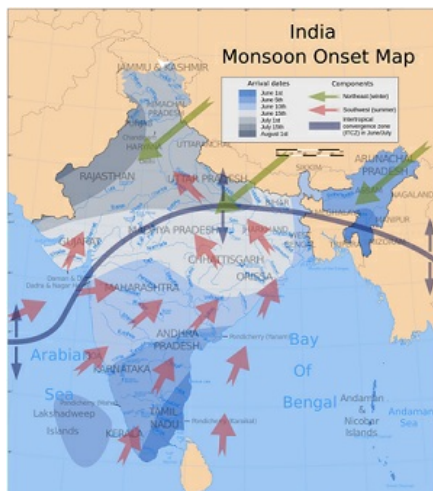


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Summer and Winter Winds

Summer and Winter Winds

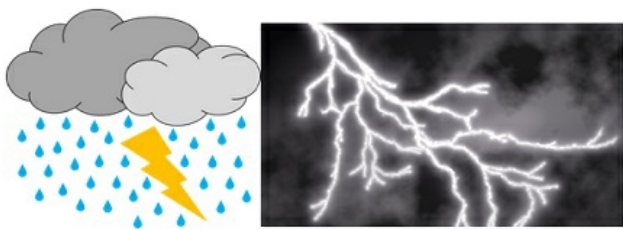
- During summer season, winds blow from sea towards land on a large scale.
- These winds carry water droplets with them and form clouds.
- During monsoon season, these clouds rain as they become heavier.
- Rain is useful for farmers for irrigation but excessive rain causes floods and diseases.
- During winter season, the winds blow from land to sea and they do not carry any water droplets with them. Hence, Monsoon season occurs only after summer season.



Thunderstorms

A **storm** is a disturbed state of environment creating severe weather conditions mainly high speed winds. A **thunderstorm** is a storm with sound and lightning and typically also heavy rain or hail.

- Thunderstorms develop in hot and humid areas.
- High temperature in this areas cause hot humid (with water vapours) air to rise up. So, strong upward rising winds with water droplets are generated.
- At high altitude, these water drops freeze and fall again towards earth.
- Upward movement of air and downward movement of water drops, together, cause lightning and sound.



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Cyclones

Cyclones

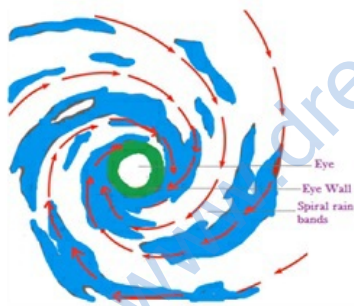
A **Cyclone** is a large scale air mass that rotates around strong centers of low pressure.

- Water vapors are formed when water is heated.
- This heat is released to atmosphere when water vapors convert to water during rains.
- The heat released, warms the air around and makes it to move up. This also results in decreased air pressure.
- Hence, cooler air from surrounding rushes to take the warm air's place.
- This repeats till a low pressure system with surrounding high speed winds is created. This is called a Cyclone.
- Cyclone depends on wind speed, direction, temperature and humidity.

Cyclones are also called **Hurricane** in USA and **Typhoon** in Japan and Philippines



Cyclone formation over Sea



Structure of a Cyclone

Structure of Cyclone The structure of cyclone contains:

- Eye – Low pressure and area of sinking air. Its diameter ranges from 10-100 kms.
- Eye Wall – Dense cloud surrounding eye having maximum wind speed. It causes maximum destruction.

Spiral rain bands – Band of clouds spiraling into eye wall and it contains heavy rains

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Destruction by Cyclones

Destruction by Cyclones

- East coastline of India (Mainly Orissa) is prone to Cyclones being a coastal area.
- Cyclone hit areas result in loss of life, property, communication and transportation systems.
- Cyclones cause a wall of water to move from sea towards shores resulting in destruction.
- Cyclones also bring heavy rainfalls which could lead to flood situations.
- Damages agricultural land and reduces soil fertility.

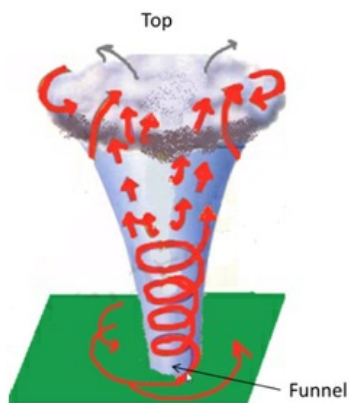


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Tornado

A **tornado** is a violently rotating dark funnel shaped cloud that reaches from sky towards ground.

- Diameter of a tornado ranges from few meters to a km.
- It grows bigger by taking dust and anything else near it. Smaller tornadoes can only make dust rotate with itself whereas a bigger tornado can take vehicles or even houses.
- It sucks everything from bottom and throws them out from the top.
- Tornadoes can attain a speed of 300km/hr.
- They can form within cyclones.



Structure of a Tornado



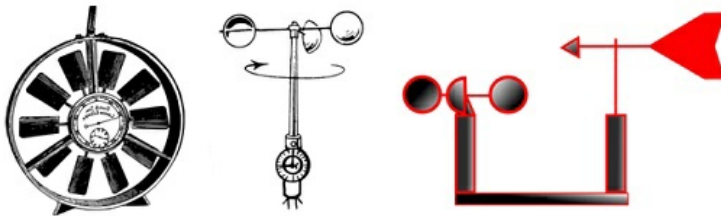
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Anemometer

Anemometer

An **anemometer** is a device used for measuring wind speed.

- It consists of cup like structures to measure wind speed based on their movement.
- It can also show the direction of the wind.



Different types of Anemometers

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Safety Measures and Precautions

Safety Measures and Precautions

In case of a Cyclone or a Tornado, following are the safety measures to be taken on behalf of government and people:

- Government should forecast cyclones 24 hours in advance with the help of satellites and radars.
- Cyclone and Tornado shelters should be made for people living in cyclone prone areas. These are rooms made underground and away from shores having no windows.
- Quick communication to government agencies, fishermen, ports to make necessary arrangements and minimize destruction.
- As an individual, when cyclone or a tornado strikes, take shelter under tables, bow down and protect head and neck using arms.
- Keep away from water in cyclone-hit areas as the water might be contaminated.
- Stay inside houses.
- Should not ignore warnings from meteorological department.
- Should have all emergency numbers.
- Avoid driving on roads full of water as the roads might be damaged or the vehicle may get stuck with water going inside the machinery.
- Cyclone/Tornado can cause damage to electric poles and it may cause short circuit and electric shocks.
- Cooperate and help others.

