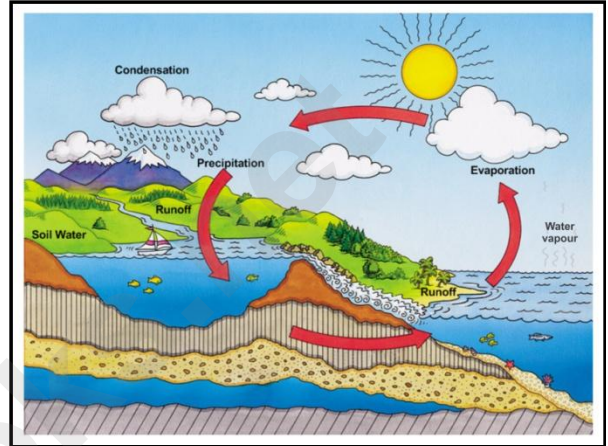


Precipitation - Its Types and Causes

Phenomena Associated with the Water Cycle

- The water cycle includes the process of evaporation, condensation and precipitation. The heat of the Sun evaporates the water resulting in the formation of water vapour. When water vapour cools down, it condenses and forms clouds.
- It is from clouds that the water precipitates in the form of rainfall, hail and snow. This process through which water keeps on changing its form and circulates between the oceans, atmosphere and land is known as the **water** cycle.

Many phenomena are associated with precipitation. Some important phenomena are



Evaporation: The process in which water gets heated and enters the atmosphere in the form of water vapour is known as evaporation. Heating of oceans, seas, lakes and rivers causes evaporation. Factors which lead to higher rate of evaporation:

- Humidity: Evaporation is maximum when the air is dry and less humid.
- Supply of Heat: High temperature or heat results in an increased pace of evaporation.
- Winds: Strong and dry winds cause quick evaporation of water. This is the reason that clothes dry quickly when the winds are strong.

Latent Heat: Hidden heat changes solid into liquid or water vapour or liquid into vapour without any change in the temperature.

Condensation: It is a process by which the water vapour gets converted to tiny droplets of water or ice. Condensation occurs only when water vapour is added to saturated air or when the temperature falls below the temperature at which the air saturates. Following conditions should exist for condensation to take place:

- Large amount of water vapour should be present in the atmosphere.
- Small particles of dust, salt and smoke should be present as water vapour condenses around these particles.
- The air temperature should be below the dew point.

Humidity

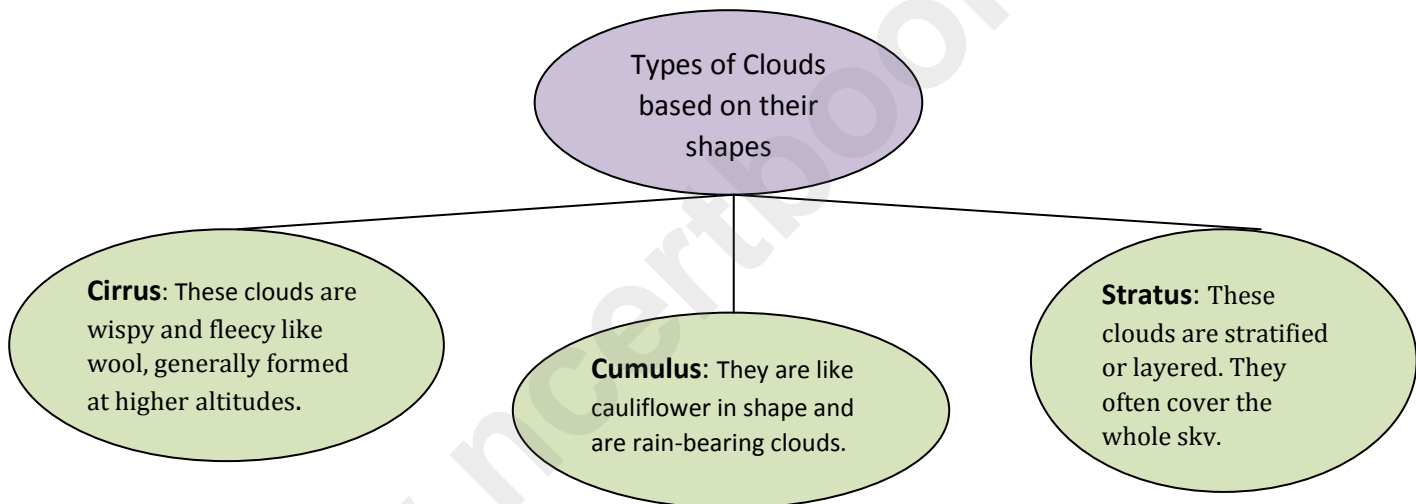
- The process of evaporation adds water to the atmosphere. This changes the water from the liquid form to the gaseous form. Water vapour which is present in the atmosphere is known as humidity.
- Absolute humidity is the content of water vapour present in the given volume of air. It is expressed in terms of grams per cubic metre (grams of water vapour present per cubic metre of air).
- Relative humidity is the ratio between the actual amount of water vapour present in the air and the maximum amount of water the air can hold at that temperature. It is expressed in percentage.
- It can be measured by applying the following formula:

- Relative Humidity = the actual amount of water vapour present in the air/the maximum amount of water vapour the air can hold at that temperature × 100
- Dew point is the temperature at which air gets fully saturated.
- Specific humidity is the actual amount of water vapour present in a given mass of air.
- Humidity is measured by a hygrometer which is also known as the Dry and Wet Bulb Thermometer.

Clouds

- **Clouds** are masses of small water droplets or small crystals of ice which float in the atmosphere away from the surface of the Earth.
- When warm air rises into the sky, it cools down and condenses into small droplets of water around dust particles floating in the air. When billions of droplets of water come together around dust particles, clouds are formed.

Based on their shapes, there are three different types of clouds.



- Clouds can also be classified on the basis of their height in the atmosphere. These are
 - **Low Clouds:** These are generally rain-bearing clouds. Their bases are less than 2 km above sea level. Example: Cumulus
 - **Middle Clouds:** These generally lie between 2 km and 6 km above the sea level. Example: Altocumulus
 - **High Clouds:** These lie more than 6 km above the sea level. They are generally made of ice crystals. Example: Cirrostratus

Precipitation

The process by which condensed water vapour falls on the surface of the Earth in various forms such as rainfall, snowfall and hail is known as **precipitation**. Various forms of precipitation are

Rain: It is the most common form of precipitation. The droplet of water which precipitates from clouds is known as rainfall.

Frost: When the temperature falls below the freezing point, i.e. 0°C, water vapour present on various surfaces such as leaves, rocks or grass freezes into crystals of ice known as frost.

Dew: The small droplets of water which are formed on cool surfaces during the nights or early morning when the water vapour in the atmosphere condenses is known as dew.

Mist: It is the small droplets of water suspended in the air near the surface of the Earth. It is not as dense as fog.

Fog: It is a thick cloud of small droplets of water suspended in the air near the surface of the Earth. Fog can also be a dense layer of mist.

Smog: It is a mixture of fog, smoke and dust particles. Smog is formed generally in the industrial regions.

Hail: When solid pieces of ice fall on to the surface of the Earth, it is known as hail.

Sleet: The mixture of rain and ice is known as sleet.

Rainfall is measured by an instrument known as **rain gauge**. It is a large metal cylinder. A funnel is fitted on the top of a glass bottle kept in the cylinder. The cylinder is placed above the level of the funnel to ensure that the rain is not splashed out of the funnel.

Snowfall is measured on the basis of the thickness of snow.

Factors which affect rainfall:

Land and Sea Contrast: Coastal areas receive more rainfall than the places which are located in the interiors of the continents.

Direction of Winds: Winds which blow from oceans to land bring more rainfall than the winds which blow from the interior of the land.

Presence of Mountains: When winds strike the mountains, it sheds its moisture on the windward side. Thus, places located on the windward side of the mountains receive more rainfall than places which are located on the leeward side.

Rainfall and its Types

There are three main types of rainfall—convectonal rainfall, orographic rainfall and cyclonic rainfall.

Convectonal Rainfall

- Convectonal rainfall mostly occurs in the equatorial regions. High temperature in the equatorial regions results in a high rate of evaporation.
- When the temperatures are high, the air gets heated. Warm air rises higher in the atmosphere; it then expands and spreads at the top. Ascending currents of hot and humid air result in condensation and the formation of cumulonimbus clouds of great vertical extent.
- Such clouds give heavy rainfall. This rainfall is associated with thunder and lightning.
- The Amazon river basin lies in the equatorial region, and hence, it rains almost every day.

Orographic or Relief Rainfall

- Relief rainfall is called so because it is affected by the relief or physical features of a place, i.e. mountains.
- This type of rainfall is also known as relief rainfall. When the moisture-bearing winds strike a mountain range, it is forced to ascend.
- Because the wind rises up the mountains, it cools down to its saturation point bringing rainfall on the windward side of the mountains. These winds are devoid of moisture when they reach the leeward side of mountains. Hence, places located on the leeward side of mountains get scanty rainfall.
- For example, Mumbai which lies on the windward side of the Western Ghats receives heavy rainfall, while Pune which lies on the leeward side receives scanty rainfall.



A rain gauge- for measuring the amount of rainfall, a rain gauge should be erected in an open space.

Cyclonic or Frontal Rainfall

- This type of rainfall occurs when the warm and the cold air meet each other. Because the warm air is lighter, it rises above the cold air. The rising air is then cooled beyond the saturation point resulting in heavy rainfall.
- Such rainfall lasts only for few hours. It is very heavy during tropical cyclones.

Thunderstorms are associated with heavy rainfall and **lightning**.

- Lightning is caused when raindrops move up and down because of convectional air currents.
- Because the temperature above the clouds is extremely low, small ice particles are formed.
- When these ice particles move against each other, they become electrically charged. While positively charged ions (which are lighter) settle at the top of the cloud, the negatively charged ions settle at the bottom of the clouds.
- When positively and negatively charged ions are attracted towards each other, a flash of lightning takes place.

Seasonal Distribution of Rainfall

The amount of rainfall changes gradually from season to season.

- Regions receiving rainfall throughout the year: The places located in the western margins of the continents in mid-latitudes like Western Europe receive rainfall throughout the year.
- Rainfall during summers: In the sub-tropical regions, convectional rainfall is limited to summer only.
- Rainfall in winters: Countries located in the Mediterranean regions such as France, Albania and Italy receive rainfall during winters.

World Patterns of Rainfall Distribution

- In May to October, as the Northern Hemisphere is tilted towards the Sun, the equatorial belt of Eastern Asia and the Eastern side of North and South America receive heavy rainfall from onshore winds.
- The western side of these regions and the Polar Regions do not receive any rainfall.
- From November to April, the rays of the Sun fall vertically over the Tropic of Capricorn in the Southern Hemisphere. The eastern coasts of Argentina, Africa, Brazil and Australia receive rainfall from the trade winds.

World Distribution of Rainfall

Regions of Heavy Rainfall

The following regions receive more than 200 cm of rainfall:

- Equatorial regions of Africa, South America and Southeast Asia
- Coastal areas of the monsoon regions of Asia
- West coastal regions in the westerly wind belt of middle latitudes in North America and Western Europe

Regions of Moderate Rainfall

- The areas which receive 100–200 cm of rainfall are the sub-tropical areas such as East China, Eastern Brazil and Southeast Asia.

Regions of Low Rainfall

Regions which receive less than 25 cm of rainfall:

- Tropical deserts located on the western margins of the continents and located in the interiors of the continents far away from the oceans.
- Cold deserts or Polar Regions.