Geography Notes Part 5

The Surface of the earth the changing face of the earth

The climatic elements such as temperature, rainfall and frost and also the natural agents like rivers, winds, glaciers and sea waves are responsible for changes in surface of the earth.

Weathering

Weathering is the process of disintegration or decomposition of rocks. Weathering is a complex interaction of physical, chemical and biological processes that alter the rocks of the crust. Weathering can be classified into **physical** (or mechanical), **chemical** and **biological** weathering.

A) Physical (or Mechanical) Weathering

Physical or Mechanical weathering is the process that causes the disintegration of rocks into smaller fragments without any chemical change. The primary process in physical weathering is abrasion. Physical weathering occurs by the following processes.

a) Thermal Stress

Rocks are made up of a combination of several minerals. The expansion and shrinking of each mineral due to changes in temperature vary from one another. The prolonged expansion and contraction of rocks cause stress which may develop into breaking of rocks.

b) Frost Weathering

The mountainous areas experience frost conditions and they have this type of weathering. Sometimes, the crocks found on the rocks are filled with water due to rain. It may freeze into ice during night due to very low temperature and melts during the day time. Since ice is a solid material, it creates more pressure in the cracks of the rocks and so the cracks widen.

The continuous freezing and melting of ice causes the rocks to break into pieces. This type of weathering is called **"Frost Weathering".**

The surface pattern on this pedestal rock is honeycomb weathering, caused by salt crystallisation.

Eg. Yehliu, Taiwan

c) Salt Crystal Growth

salt crystallization, otherwise known as **haloclasty,** causes disintegration of rocks when saline solutions seep through cracks and joints in the rocks and evaporate, leaving behind salt crystals.

B) Chemical Weathering

Chemical weathering refers to decomposition of rocks or the breaking of rocks due to the alterations made in the chemical composition of rocks. In this process of chemical weathering, oxidation and hydrolysis are the most common occurrences.

a) Dissolution

Rainfall becomes acidic if atmospheric carbon dioxide or sulphur dioxide or nitrogen oxide dissolve in the rainwater. When it occurs on a limestone or chalk region, the minerals are dissolved and results in the weathering of rocks.

The Government of India banned the tanneries around Taj Mahal due to acid rain caused by these industries which affects the marble stones of this wonder of the World.

b) Mineral Hydration

Hydration is often referred to as absorption of water. In this kind of Weathering, irons attach themselves to other minerals present in the rock. The attachment leads to an

increase in the volume of minerals, thus creating mechanical pressure, which leads to weathering.

c) Hydration

Hydrolysis is a process that affects the silicates present in the rocks. In such reactions, silicate is converted into clay minerals by the hydrogen and hydroxide ions.

d) Oxidation

This is the process where the iron present in the rock combine with oxygen and water to form oxides. These iron oxides make the rock weak and it consequently crumbles to form smaller rock particles. This process is better known as **rusting.**

C) Biological Weathering

The biological weathering is due to the growth of plants and trees in mines, quarries, buildings and roads.

The biological weathering is also caused by human beings and burrowing animals. This results in disintegration of rocks.

Agents of Gradation

Running Water (river)

A river is a natural water course, usually freshwater, originating on highlands and flowing towards an ocean, a lake, a sea or another river. River is one of the most important agents of erosion. Rivers do the work of erosion, transportation and deposition during the development of their courses.

Landforms Associated with Rivers

The Mountain Course

The source of a river is usually the top of glaciated mountains. The steep slope and high velocity of the river leads to vertical erosion. Gorges and canyons or 'V' shaped valleys are formed.

River Capture

This is also known as the **river piracy or river beheading.** Its development is dependent on the different rates of head ward erosion into a divide.

Rapids, Cataracts and Waterfalls

Due to unequal resistance of hard and soft rocks traversed by the river, the outcrop of a band of hard rock may cause a jump or fall downstream, leading to the formation of **rapids.** Similar falls of greater dimension are also referred to as **cataracts.** When rivers plunge down with a sudden fall from a great height they are called **waterfalls.**

The Valley Course

Here, lateral erosion tends to replace vertical erosion. Active erosion of the banks and the increased volume of water with load of sediments, widens the 'V' shaped valley.

Meanders

A meander in general is a bend in a sinuous watercourse. A meander is formed when the moving water in a river erodes the outer banks and widens its valley, over time. The irregularities of the slope and the load of silt forces the river to swing in loops, forming meanders.

River Cliff

When the river water enters the bend of a river, it dashes straight and erodes the outer bank to form a river cliff.

Interlocking Spurs

When a river flows through a young V- shaped valley, due to erosion projecting ridges or spurs are formed that extent alternately from opposite sides of the valley. It is called interlocking spur.

The Plain Course

Here, the work of a river is mainly deposition, building up of beds and forming extensive floodplains. The volume of water is greatly swelled by the additional tributaries that join the main stream. Coarse materials are dropped and the finer silt is carried down towards the mouth of the river. Large sheets of materials are deposited on the level plain and may split the river into several complicated channels, so that it can be described as a braided stream. Some of the major features are:

Floodplain

River in its lower course has large quantity of sediments. During annual floods, these materials are spread over low-lying and adjacent areas. A layer of sediment is thus deposited during each flood, gradually building up a fertile floodplain. When the river flows its bed in raised by accumulation of deposits. Materials are also dropped on the sides of the river, forming raised banks called levees.

Ox-bow Lake

In the lower course of the river, a meander becomes much more active. The outside bank or concave bank is so rapidly eroded that the river becomes almost a complete circle. At one point of time river cuts through the narrow neck of the loop, making an Ox-bow lake.

Delta

When the river reaches the sea, fine materials are deposited at its mouth, forming a fan shaped alluvial feature called **delta.** The different types of delta are: **bird foot delta, arculate delta, estuarine delta and cuspate delta.**

The Mississippi River is the largest river system in North America. About 3,730 km long, the river originates at Lake Itasca, Minnesota. It is the fourth longest river in the world and the tenth most powerful river in the world.

The Ganges is the largest river of the Indian subcontinent, flowing east through the Gangetic Plain of Northern India into Nangladesh. The 2,510 km river rises in the western Himalayas in the Uttarakhand. The Ganges Basin drains 1,000000 Km^2 and supports one of the world's highest densities of humans. The river has been declared as India's National River.

Waves

The most powerful agents of marine or coastal erosion are the waves. Along the coast, waves are agents of erosion, transportation and deposition.

Features Associated with Coastal Erosion

a) Bays

On exposed casts, the continual action of waves on rocks of varying resistance causes the coastline to be eroded irregularly. This is more pronounced where alternate bands of granite, limestone, sand and clay occur together.

b) Cliffs

generally, a very steep rock face adjoining the coast forms a cliff.

c) Cave, Arch, Stack and Stump

prolonged wave attack, on the base of a cliff, excavates holes called **caves.** When two caves approach one another, an **arch** is formed. Further erosion by waves will ultimately lead to the total collapse of the arch. The rest of the feature will remain as a pillar of rock known as **stack.** If it is further eroded, it then forms **stumps** which are only just visible above the sea level.

Features Associated with Coastal Deposition

a) Beaches

A beach is sand deposition along the coast. It usually consists of loose particles of sand.

World's longest beach is the Miami in the USA followed by the Marina beach in Chennai.

b) Spits and Bars

The debris eroded by waves is continually moved by long shore drift and may be deposited where there is some sort of indentation. As more materials are added, they will pile up into a ridge or embankment to form a **tongue** or **spit,** with one end attached to the land and the other end projecting into the sea. When a ridge of sand is formed across the mouth of a river or the entrance to a bay, it is called a **bar.**

Glaciers

The ice flow is called a glacier. Glaciers are widespread in the area where temperature is below freezing point. Glaciers are found in every continent except Australia. In regions lying above the snowline, the accumulation of snow solidifies under its own pressure, which then moves slowly down the valley due to gravity. Glacier plays a combined role of erosion, transportation and deposition throughout its course. They may be grouped as :

(i) Valley glaciers, **(ii) Continental glaciers** and **(iii) Piedmont glaciers.**

Valley Glaciers

These glaciers are formed on the mountains. They are also called as **valley** or **alpine glaciers.**

Continental Glaciers

The Polar Regions are vastly covered with ice. This extensive type of ice mass is called as continental glacier.

Piedmont Glaciers

When ice is accumulated along the foothills is known as piedmont glaciers.

Landforms Associated with Glaciers

Cirque

The glaciated Valley is a 'U' shaped Valley. The arm-chair shaped depression formed by plucking of glacier along the glaciated slope is called **cirque.**

Aretes and Pyramidal Peaks

A knife like elevated ridge formed between two consecutive cirques is known as an **'Arete'** when a series of cirques are formed along the glaciated slope, the top summit resembles a horn. This pointed Peak is called a Pyramidal Peak or nick named as 'Matter Horn' after the Swiss Peak.

U- Shaped Valley

A U-shaped valley is the shape left after a valley has been over deepened by a glacier. The original V-shaped valley is deepened after the ice has eroded the sides and bottom of the valley.

Hanging Valley

The main valley is eroded much more rapidly than the tributary valley. After the ice has melted it looks like the tributary valley hangs above the main valley. Such tributary valleys are called **hanging valleys.**

Glacial deposits

Moraines

Moraines are made up of pieces of rock, debris, boulders and clay transported by glaciers. Further, they may be classified as **ground Moraine, lateral Moraine, Medial Moraine and Terminal Moraine.**

Drumlins

They are the deposits of clay and debris and resembles like a half buried egg.

The other depositional features are **Outwash Plains** and Eskers.

Wind

Wind is a predominant agent of denudation in arid and semi-arid regions, because of scarce rainfall and sparse vegetation.

Erosional Works Done by Winds

In the desert regions, the wind forms different kinds of land forms by deflation and abrasion.

Pedestal Rock or Mushroom

a) Rock

The sand particles carried by the winds strike rock pillars made up of hard and soft rocks. When the soft rocks are found at the bottom, they are eroded faster than the hard rocks found at the top. The prolonged erosion carves the pillar to resemble like a mushroom. They are also called **rock pedestals.**

b) Inselbergs

These are isolated residual hills rising abruptly from the level ground. They are characterised by their very steep slopes and rounded tops.

Landforms Associated with Wind Deposition

The following are some of the major features of wind deposition.

a) Barchan

These are crescent-shaped dunes. They are mobile sand dunes as they move in the direction of wind. The windward side of the dune has a steep slope and the leeward side has a gentle slope.

b) Seif or Longitudinal Dunes

They are long, narrow ridges of sand and cover over a hundred miles, lying parallel to the direction of the 'Winds'.

Loess

The fine dust blown beyond the desert limits is deposited on neighbouring lands as loess. It is yellow, friable material and is usually very fertile. Eg. the Loess plains of China.

Geography Notes Part 6

6] Weather and Climate

Weather and Climate are two terms which everyone uses in day-to-day life. This is because our daily routine is based on the prevailing weather conditions. Human activity of any region is determined by weather and climate.

For example, in the tropical regions, paddy is cultivated as a major crop whereas, in the temperate regions, wheat is cultivated as a major crop. We wear cotton clothes in summer and woollen clothes in winter. Also our food habits, customs, traditional and even most of our common celebrations and festivals are associated with weather and climate.

Weather

Weather refers to the physical state of the atmosphere within 24 hours, described by weather elements such as temperature, atmospheric pressure, humidity, rainfall, cloudiness, wind speed and wind direction. Differences in these can occur due to the angle of the sun at any particular spot, which vary by latitude from the tropics.

Climate

The word climate is commonly defined as the weather averaged over a long period of time and over a large area. The standard averaging period is 30 years.

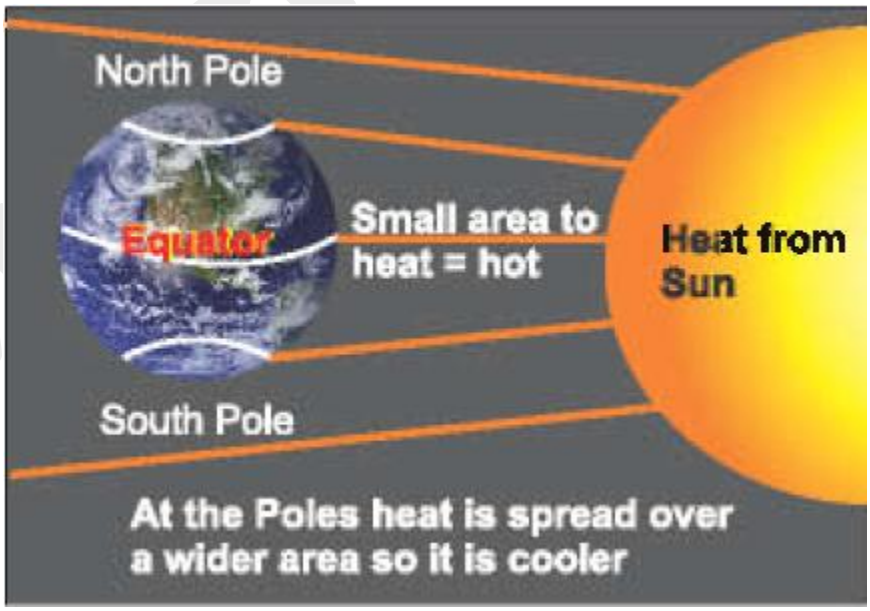
The word Climate is derived from the ancient Greek word **"Klima"** which means **inclination".**

Factors determining Weather and Climate

The weather elements are modified by various factors. The following factors affect the climate of a place.

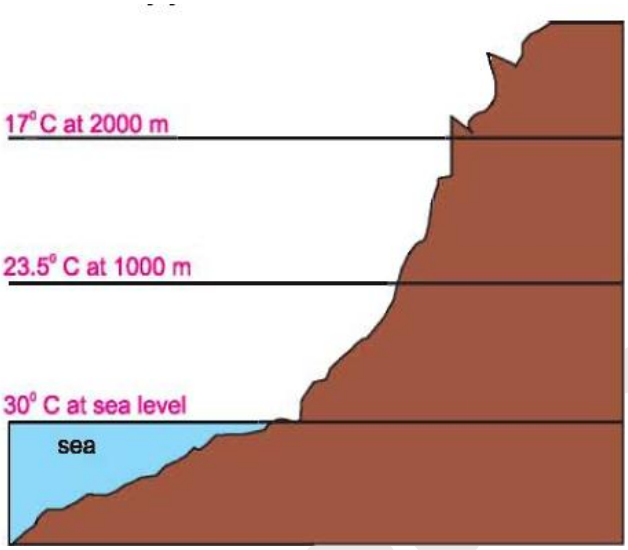
Latitude

The equator receives vertical sunrays which fall over a smaller area. In contrast, the polar regions receive slanting sunrays and they fall over a wider area. As a result of this, the places near the equator are hotter than the poles. For example, Madurai in Tamilnadu is hotter and Moscow in Russia is colder.



Altitude

The weather and climate are modified by the mountains and hills. The places located on higher altitudes are always cooler than that of lower places. It is because when the altitude increases, temperature decreases. For example Ooty and Kodaikanal are cooler than Trirchirappalli.



Temperature decreases at the rate of 6.5^{0}C for every 1000 metres high on the Earth's surface.

Distance from the Sea

To keep two vessels, one with water and another empty on the burning stove. Then you observe which one gets heated up faster.

The empty vessel is compared to the land and the other one to the sea. The sea absorbs and retains heat for long duration like the vessel with water. The coastal areas experience the cool, wet air from the sea throughout the year which modifies the weather along the coast to have uniform weather both in the winter and summer. This condition is said to be equable climate or maritime climate.

On the other hand, the land absorbs and loses heat quickly like an empty vessel. The interior land areas experience warm dry air. They are very hot in summer and very cold in winter. This condition is said to be extreme type of climate or continental climate.

Ocean Currents

Based on temperature the ocean currents are classified as **Warm Ocean Currents** and **Cold Ocean Currents.** Warm currents make coastal areas warm, wet and free from ice and cold currents make them cool, dry and form icebergs.

The meeting places of warm and cold ocean currents are the areas of major fishing grounds because the conditions are suitable for the growth of the fish food, plankton. At that same time, these areas are dangerous for shipping as they form dense fog and low clouds.

Direction of prevailing winds

The winds that blow from the sea contain more moisture so they are cool and wet. Example – Southwest Monsoon. Guess – which one can cause rainfall and why?

EI Nino Effect

EI Nino means **"The Christ Child",** in Spanish. It is formed around Christmas time and continues for a few months. During this period, once in five or six years, the temperature rises rapidly and a low pressure system is formed along the coast of Peru and Ecuador. It attracts winds from all directions. So, the trade winds become very weak over the Pacific Ocean and Indian Ocean and these winds are deflected causing a prolonged dry period in India. The other effects of EI Nino experienced in other areas are Bush fire and drought in Australia, famine in Indonesia and forest fires in Brazil and Southeast Asia.

Human influence

The industrial revolution brought changes in our lifestyle. As a result of this, forest areas were cleared and now we have many types of transport facilities, concrete buildings and many industries. All these developments made our life easy and comfortable. On the other hand, their effects are felt in the name of Global warming, Green house effect and pollution, which have increased the amount of CO_2. Creation of an urban heat island is also the result of human influence. The urban heat island occurs in metropolitan areas which are significantly warmer than their surrounding areas.

Temperature

Terrestrial radiation refers to the heat energy emitted from the Earth.

The sun is the source of light and heat to the earth. Earth receives only a small amount of solar radiation which takes eight minutes to reach the earth's surface. Incoming solar radiation is called insolation.

The difference between the maximum and minimum temperatures of a day is called the diurnal range of temperature.

Heat energy from solar radiation is received by the Earth through three mechanisms. They are:

(i) radiation in the atmosphere **(ii) Conduction over land** and

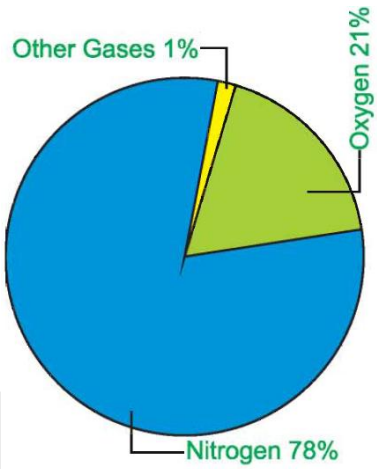
(iii) Convection in the water bodies. The Earth's atmosphere is heated more by terrestrial radiation than insolation.

The difference between the hottest and coldest months of the year is known as the annual range of temperature.

Earth's atmosphere

The atmosphere of the Earth's surrounded by gases which are retained by Earth's gravity. Earth's atmosphere is made up of a combination of gases. The major components of air are nitrogen and oxygen. Argon, Neon, Helium, Krypton, Carbon di-oxide, Ozone and so on are the other gases found in little quantities. Apart from these gases the water vapour and dust particles present in the atmosphere are responsible for weather changes.

The presence of all these gases varies with quantity in the atmosphere according to heights. The air is dense near the surface and becomes thinner and thinner with increasing height. Based on the characteristics of the atmosphere,



Components of Air

It is divided into four major layers, as troposphere, stratosphere, ionosphere and exosphere.

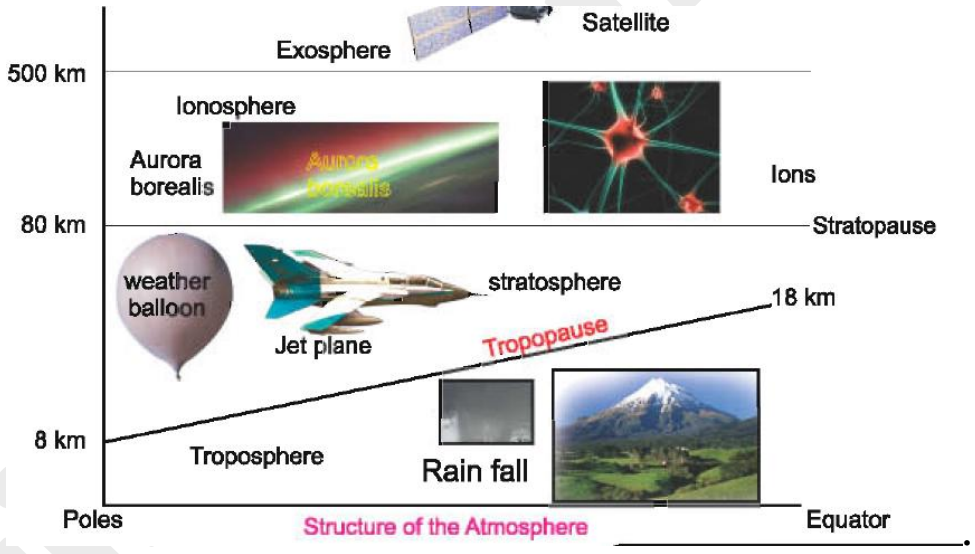
Troposphere

Troposphere begins at the surface of the earth and extends up to 8 km at the poles and 18 km at the equator. This layer is known for all kinds of weather changes such as temperature, pressure, winds, clouds formation and rainfall. In this layer alone, the temperature decreases with increasing altitude. The **tropopause** is a thin layer that lies between the troposphere and the stratosphere.

Meteorology is the scientific study of the atmosphere, focusing on weather processes for short term and it is the study of lower layer of the atmosphere.

Stratosphere

Stratosphere extends approximately for about 80 km. temperature increases with height. This is the layer where most jet planes fly. The top edge of the stratosphere is rich in ozone. It captures the ultraviolet rays of the sun and takes the harmful effects out. Since unfiltered radiation from the sun can destroy all animal tissues, Ozone is very important for all living begins on earth. This zone is also called **isothermal layer** or **ozonosphere.** Above the stratosphere, there is again a buffer layer called the **stratopause.**



Ionosphere

Ionosphere stretches from 80km to 500km. it is called ionosphere because, in this part of the atmosphere, the sun's radiation is ionized. It reflects the radio waves back to the earth's surface which are useful for modern communication. The colourful displays of auroasare called the **northern lights** or **aurora borealis** in the Northern Hemisphere, the **southern lights** or **Aurora Australia** in the Southern Hemisphere.

Exosphere

The exosphere is the uppermost layer of the atmosphere. The main gases within the Earth's exosphere are the lightest gases, mainly hydrogen and helium. The exosphere is sometimes considered a part of outer space.

Aerology is a branch of meteorology involves observation and research of the atmosphere using air balloons, radiosondes and airplanes. Aerology concerns the observation and research of ozone, radioactivity and some components of long wave radiation. Hence, it is the study of the upper layer of the atmosphere.

Heat Zones

You have already learnt that the temperature reduces with increasing latitude. Based on this, the Earth is divided into TORRID, TEMPERATE and FRIGID zones.

The instrument used to measure the temperature is called the thermometer. The imaginary lines that join different places with same temperature on the map is called Isotherms.

TORRID ZONE

The zone between the Tropic of Cancer (23 ½ ^{0} N) and the Tropic of Capricon (23 ½ ^{0} S) receive vertical sunrays all-round the year. So they are hotter than the other zones.

Temperate Zone

The zone between the Tropic of cancer(23 ½ ^{0} N)and the Arctic Circle(66 ½ ^{0} N) is known as the Northern Temperate Zone. Similarly, the zone between the Tropic of Capricon(23 ½ ^{0} S) and the Antarctic Circle (66 ½ ^{0} S) is known as the Southern Temperate Zone. These places always receive slanting sun rays. So the temperature he here is lower than that of the Torrid Zone.

FRIGID ZONE

The zone between the Arctic Circle(66 ½ ^{0} N) and the North Pole (90 ^{0} N), similarly between the Antarctic Circle(66 ½ ^{0} S), and the South Pole (90 ^{0} S), are called the Frigid Zones. They always receive the slanting sunrays so these zones are cooler than other two zones.

There are three scales to measure temperature. They are:

1) Celsius 2) Fahrenheit and 3) Kelvin

Air pressure is defined as the pressure thrust by the weight of the air on the earth's surface. The average air pressure at the sea level is 1,013 millibars. The horizontal distribution of the air pressure is highly influenced by the temperature of a given place.

Barometer is the instrument used to measure the atmospheric pressure.

The atmospheric pressure is always inversely related to the atmospheric temperature. The high pressure belts are formed in the areas of low temperature.

Equatorial Low Pressure Belt

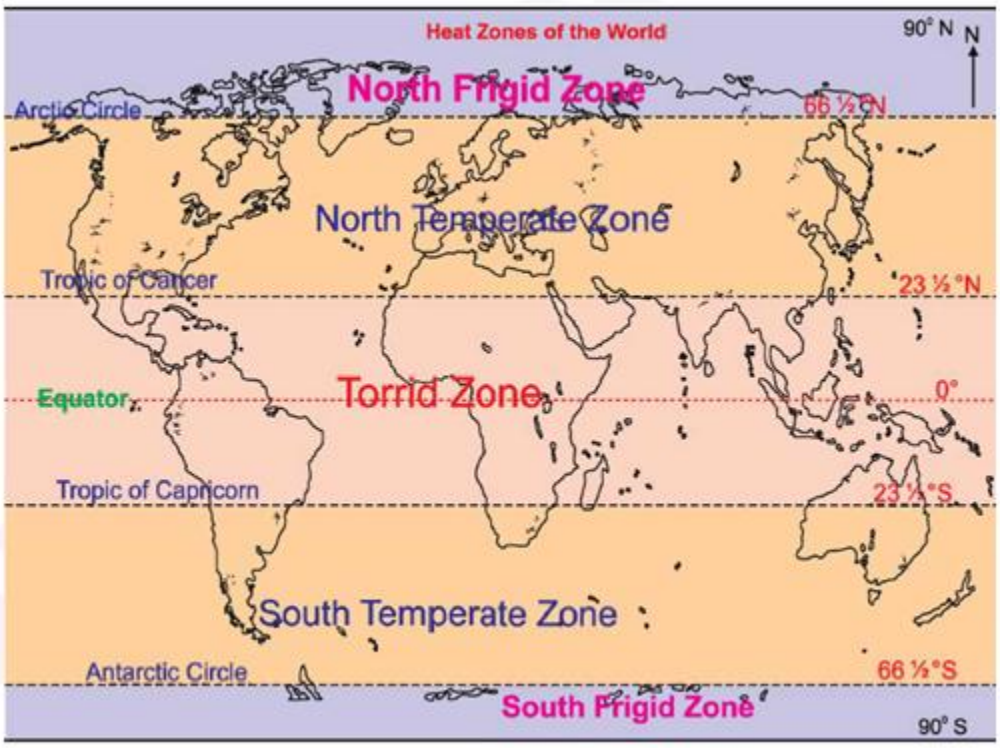
This belt lies between 5^0 N and 5^0 S. the sunrays are vertical over here throughout the year. Since temperature is high, the air becomes lighter and ascending. It causes low temperature conditions. This zone is otherwise called as "a belt of Calm" or "Doldrums".

Subtropical High Pressure Belt

This zone lies between 25^0 and 35^0 latitudes in both the hemispheres. The ascended air from the tropics is getting cooled due to low temperature so the air descends at about 25^0 - 35^0 latitudes.

In ancient times, the merchants carrying horses in their ships had to throw some of them out while passing through this zone of the calm in order to lighten the ship. Hence, this zone is called "horse latitudes".

The imaginary lines joining different places with the same pressure on a map are known as isobars.



Subpolar Low Pressure Belt

This belt lies between 60^0 - 65^0 latitudes in both the hemispheres and the air spreads outward from this zone due to the rotation of the earth so the low pressure is produced.

Polar High Pressure Belt

This pressure belt persists at the poles. The sunrays fall very slanting at the poles and as a result the temperature is low and heavy air accumulates and produces high pressure.

Winds

The air in horizontal motion is called wind. The air generally moves from high pressure area to the low pressure area. The speed of the wind is generally mentioned in kilometres or miles at land and in knots at sea.

All moving objects including winds and ocean currents tend to get deflected towards right in the Northern hemisphere and left in the Southern hemisphere due to the rotation of the earth. This changeless principle is called the Ferral's Law or Coriolis force.

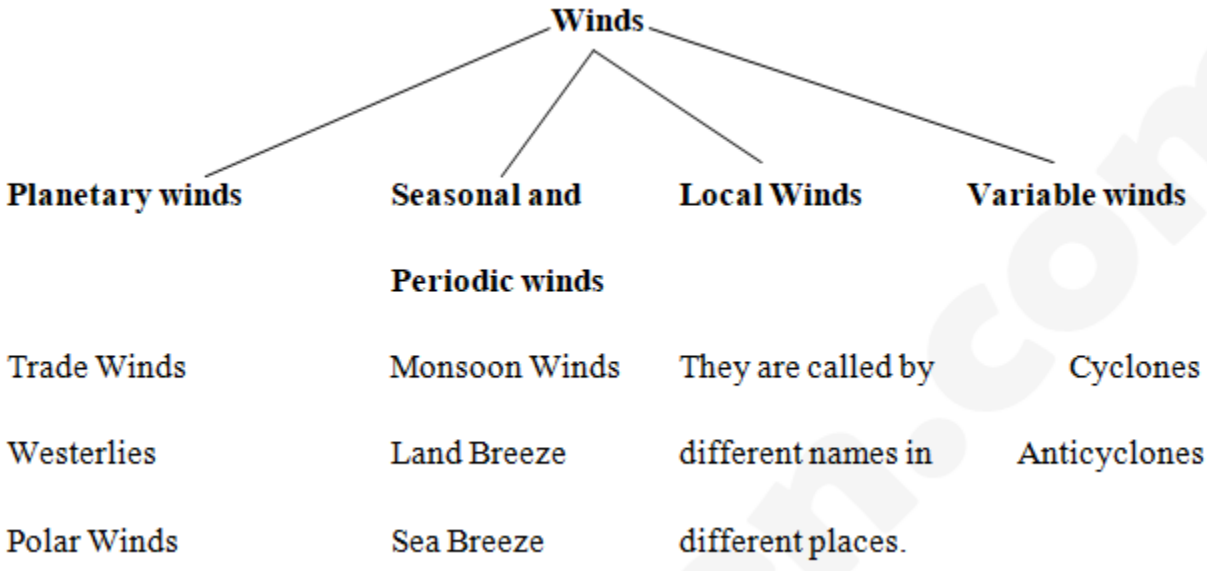
The Classification of Winds

The winds are classified on the basis of the duration of winds and place of origin. They are classified into the following:

Planetary Winds

The winds that blow from a particular direction throughout the year are known as the **Planetary winds.** The major trade winds are given below.

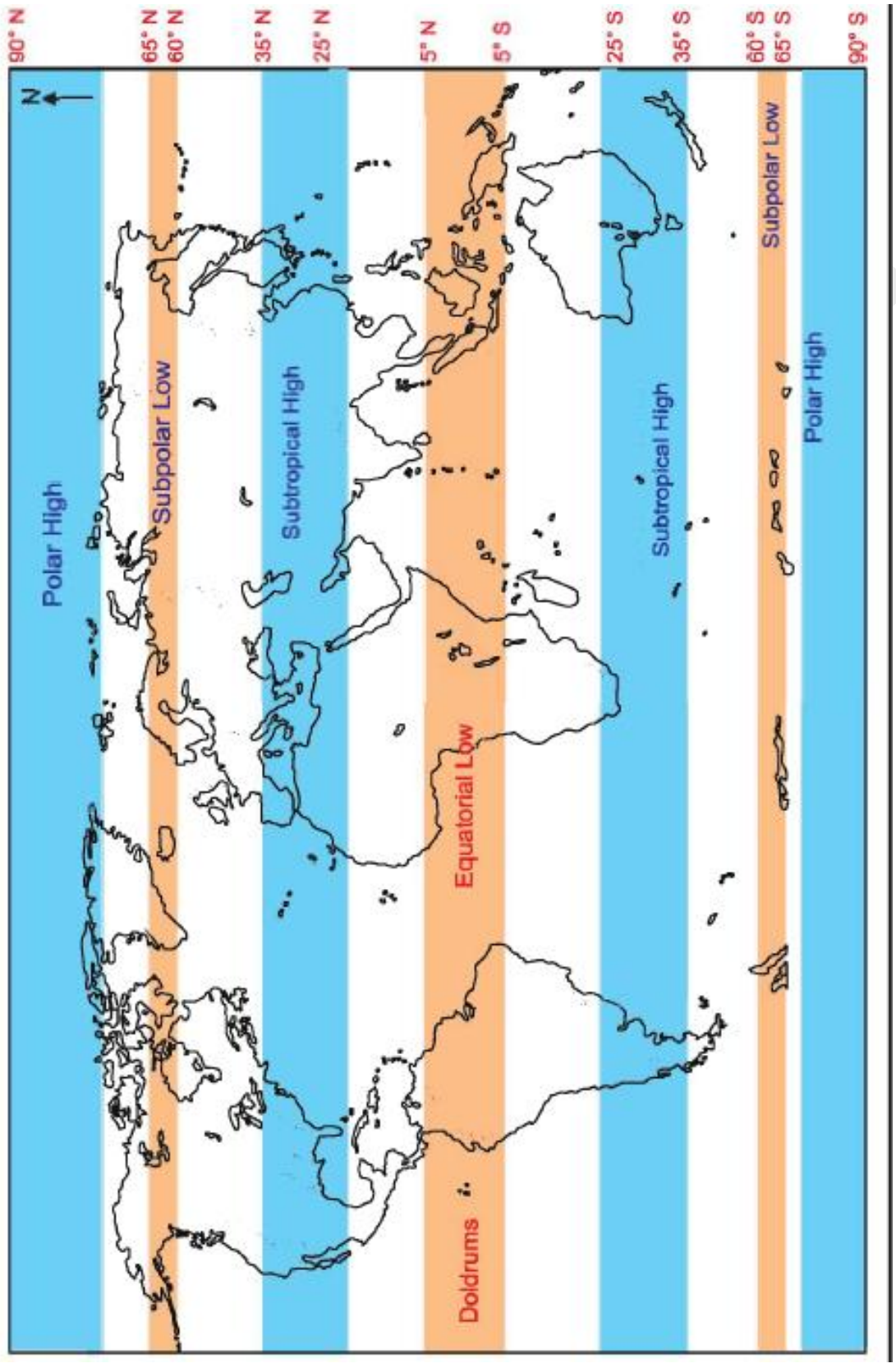
Anemometer is an instrument used to measure the velocity and direction of wind. Wind vane is used to indicate the direction of the wind.



The trade winds blow within the tropics, as Southeast trades and Northeast trades. They are called so because once it was favourable for sailors. They are regular and constant especially over the sea. These winds get deflected due to Ferrel's law.

The Westerlies blow from the subtropical high pressure belt to the subpolar low pressure belt in both the hemisphere, they blow as North westerlies and in the south it blows as the South westerlies. These winds blow along the Earth's rotation from west to east.

Major Pressure belts of the World



The Polar winds below as easterlies from polar high pressure belt to the subpolar low pressure belt. They are bitterly cold winds and they penetrate into many parts of the interior areas (Example, USA) but in India they are blocked by the Himalayas.

Seasonal and periodic winds

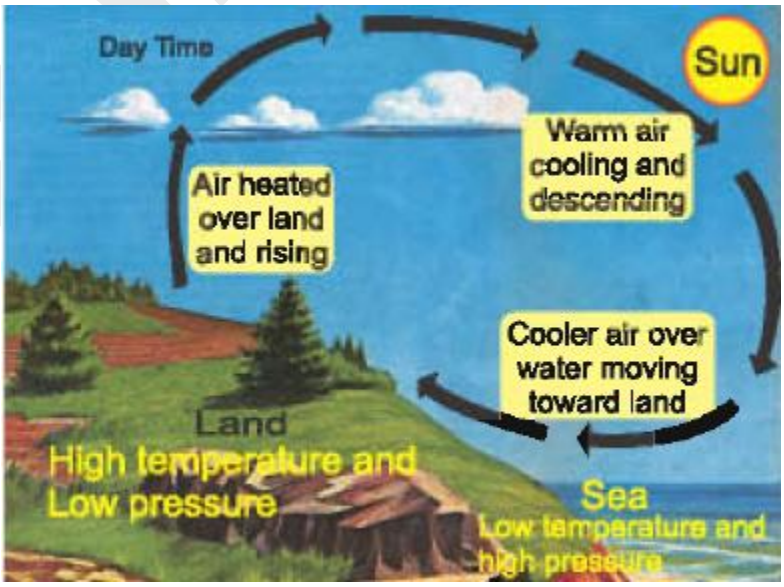
These winds are mainly caused due to the differences in heating and cooling of the surface of the earth. These winds blow only at specific time.

Monsoon winds

The monsoon is devined from the Arabic word **"Mausim",** which means further divided into Southwest Monsoon and Northeast Monsoon. The Southwest Monsoon winds blow from the south Indian Ocean and South Pacific Ocean towards Asia whereas the Northeast Monsoon winds below from the Asian high pressure areas to the Indian Ocean and Pacific Ocean. The details of these winds will be given in higher classes.

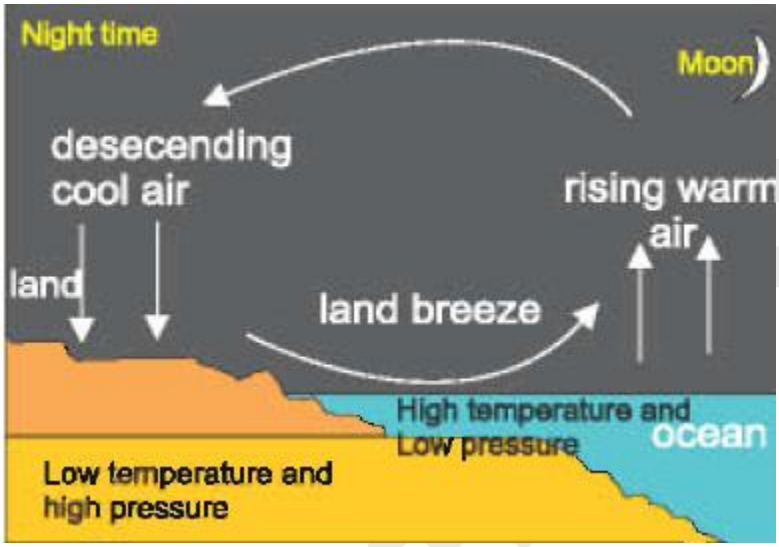
Sea breeze

During the daytime, the land becomes warmer than the adjoining water bodies. As a result, a low pressure on the land and a high pressure on the water body is formed; this leads to the cool wet breeze from the sea to blow towards land in the late evening.



Land breeze

During the night time the land becomes cooler than the adjoining water bodies. So there is a high pressure on the land and the low pressure on the water body. Hence cool dry breeze blows from the land towards the sea in the early morning.



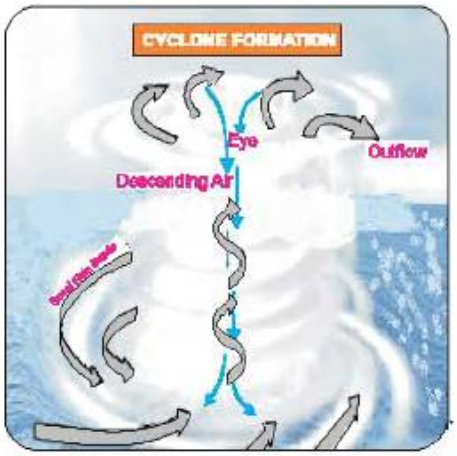
Variable winds

The variable winds have no definite location or direction. These winds get fluctuated in direction and speed.

Cyclones

The cyclones are the centres of a low pressure system. They attract winds from all directions.

Moreover, they are associated with heavy rain and high speed winds.



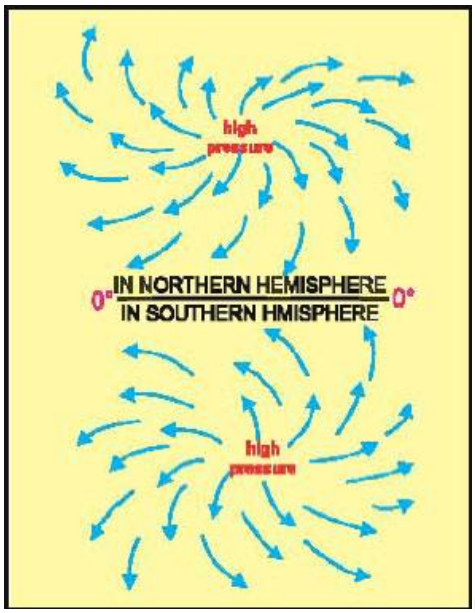
Cyclone formation

Eye of the cyclone

The centre of the cyclone is the vaccum area which is termed as **"the eye of the cyclone".** According to its origin and its location it is called by different names such as cyclones, typhoons and hurricanes. They move anti-clockwise in the northern hemisphere and clockwise in the southern hemisphere. When a low pressure system is formed over water bodies, it is violent and causes rainfall.

Anticyclones

The anticyclones are the centres of the high pressure systems from which the wind movement takes place outward. These winds are associated with clear weather



and no rainfall. The anti-cyclones move clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere. They are mostly formed over the land and so they are dry.

Local winds

These winds blow with some special characteristics over a small area and last for a short period. All these winds are mostly seasonal and are given local names. Some of the local names and the areas related to that are given below.

Warm local wind	**Location**
Brick fielder	Australia
Chinook	USA
Fohn	Northern Italy
Sirocco	Sahara desert
Loo	Thar desert in India

Cool local wind	**Location**

Harmattam	Central Africa
Mistral	Alps region
Purga	Russis
Norte	Gulf of Mexiico
Pampero	Argentina

Clouds

A cloud can be defined as a mass of small water droplets or ice crystals formed by the condensation of water vapour in the atmosphere. Clouds are formed by very minute suspended water particles present in the atmosphere. According to the shape and altitude, the clouds are classified as Cirrus, Stratus, Cumulus and Nimbus.

Cirrus clouds are high clouds because they are formed above 5,000 metres above sea level. They are naturally dry, consists of ice crystals and never bring rainfall. These clouds are long, fibrous, and curved, with no tufts or curls at the ends.

Cirrus clouds

Stratus clouds are low clouds because they are formed within 2,000 metres above the sea level. They have uniform base and look like a dark grey sheet. They may cause snow and drizzle.

Stratus clouds

Cumulus clouds are often described as “puffy” or “cotton-like” in appearance which are medium clouds. Cumulus clouds may appear alone, in lines or in clusters. These clouds are associated with rainfall, lightning and thunder. They are otherwise called thunder clouds. They extend up to 12,000 metres high above the sea level.

Cumulus clouds

Nimbus clouds are vertical clouds. They are thick dark or grey or black clouds. They cause continuous rainfall so they are known as storm or rain clouds.

Nimbus clouds

Rainfall

Rainfall may be defined as the water drops that fall from the clouds to the earth. The mechanism of rainfall begins from evaporation and it continues as condensation at considerable heights. Later on, the clouds are formed which may cause Rainfall.

Rainfall is classified into 3 types, namely:

a) Convectional Rainfall

b) Relief or orographic Rainfall

c) Cyclonic Rainfall

Raingauge is an instrument used to measure the amount of rainfall. The imaginary lines that join different places having same amount of rainfall on a map are known as Isohyets.

Convectional rainfall

The equatorial regions receive vertical sunrays, and hence become hot. The hot air expands and rises vertically upwards. As the temperature reduces gradually, the air gets cooled and forms clouds. When the clouds reach the dew point, they cause rainfall. This is known as convectional rainfall. This type of rainfall is accompanied with thunder and lightning. Usually, it occurs around 4'o clock, hence, it is called 4'o clock rainfall.

Relief or Orographic rainfall

The winds that blow from the sea contain a lot of moisture. When the moisture-laden winds from sea climb the hill slope, the winds become cool causing heavy rainfall on the windward side. Then these winds descend on the lee ward side of the mountains and cause low to no rainfall.

Though Kerala and Tamil Nadu lie on the same latitudes Kerala receives more rainfall because the state of Kerala lies on the windward side of the Western Ghats, but Tamil Nadu lies on the leeward side.

Cyclonic rainfall

The warm air from the hot area is further heated and moves upward. Hence, a low pressure area is developed and attracts air from the adjacent high pressure areas. Owing to Earth's rotation, the wind gets deflected and a circular motion of winds develop of winds develop. The air rises upward in the form of a funnel. The rising air gets cooled and condensation takes place. This

brings heavy rainfall in the low pressure centres. Example during October, November and December, the Northeast Monsoon period, there are a number of cyclones caused along the coast of Tamil Nadu, Andhra Pradesh and Odisha.

Lightning

Lightning can be defined as the atmospheric discharge of electricity. It is accompanied by thunder. It travels at a speed of 96,560 miles per second.

The study or the science of lightning is called Fulminology. The person who studies lightning is referred to as a Fulminologist.

There are 16 million lightnings every year. Generally, lightning is associated with convectional rainfall, cyclonic rainfall and also clouds formed from volcanic eruption. Lightning is formed by the meeting of the clouds containing ice. Researchers are hoping to generate electricity from lightning.

Find the reason for the cancellation of 23,000 aircrafts at the time of volcanic eruption in Iceland in April 2010.

Thunderstorm

Thunderstorms are produced by cumulonimbus clouds. They are usually of short duration. They are accompanied by lightning, thunder , strong wind gusts, heavy rain and sometimes hail. The presence of warm and humid air in the lower layers of the atmosphere, atmospheric instability and intense convective activity are the requirements for its origin.

Since the thunderstorms are accompanied by many weather elements, Meteorologists refer them to as weather factories. The formation of the thunderstorms ranges from 4 to 20 km.

In the tropical regions, they occur on the land in the rainy season usually in the afternoon or evening. But in the oceans, they occur during night. In the regions with a monsoon type of climate, they occur in the beginning and at the end of the summer monsoon.

Geography Notes Part 7

7] Disaster and Disaster Management

In recent times India has witnessed many natural calamities like floods, land slides, tsunami and earthquakes. These disasters leave a trail of destruction and sufferings. It takes lot of time and money to rebuild and rehabilitate the people who had been affected. In this chapter you will study about what disaster is and how these disasters can be managed so that sufferings can be mitigated.

Disaster:

Any event that negatively affects society or community or environment can be called as disaster.

According to UN a disaster is defined as : “a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of affected society to cope using oly its own resources”

Why do these disasters occur?

Some of these events happen due to natural causes over which we have no control. But other events occur due to the fact that we have, over a period of time, over exploited our natural resources. This has resulted in floods, land-slides, soil erosion, global warming, drought etc. since we are also responsible for the occurrence of disaster, it is our duty to learn the sustainable use of resources to overcome the adverse effects of the various disasters.

Hazard is an exposure to risk whereas disaster is a threat to life and property of a community. Cyclone is a hazard and it becomes a disaster when the same causes loss of life and property.

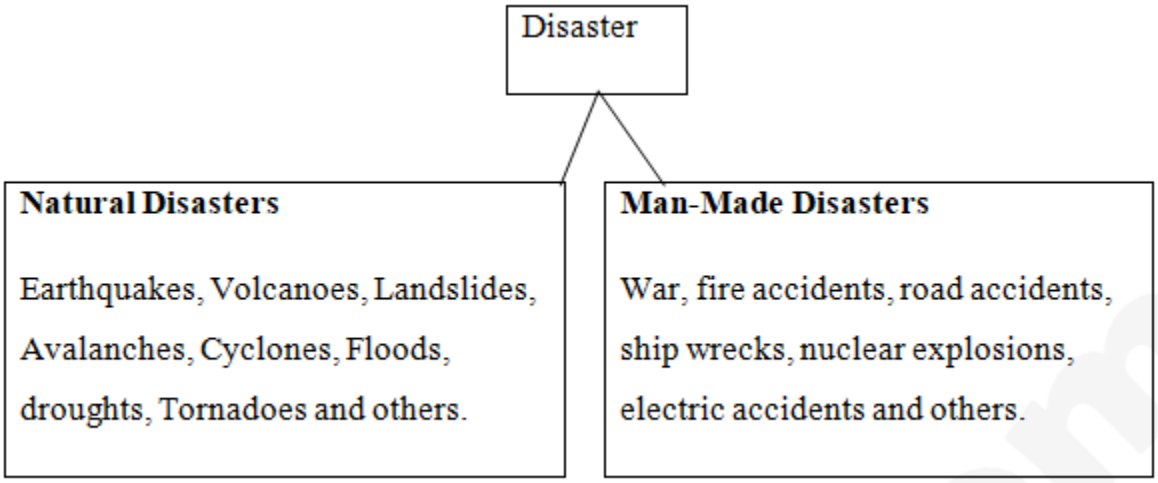
The disasters are broadly classified into Natural and Man-made. The natural disasters occur due to the natural forces whereas the man-made disasters occur due to human negligence.

Mitigation

The definition of Mitigation is "to make (something bad) less severe". Disaster due to natural forces like cyclones cannot be avoided but the sufferings can be mitigated by taking steps in advance.

Earthquake

A sudden movement or trembling of the earth's crust is called an earthquake.



The movement of the tectonic plates, volcanic eruptions, mass wasting, landslides, and surfaces fault line are the reasons for earthquake's occurrence.

Although hundreds of earth quakes occur in a year they are too weak to be detected except by an instrument called seismograph. One or two severe earthquakes do occur every year. The point where the earthquake originates is called **seismic focus** and the point directly above focus on the earth's surface is called the **epicentre.**

An earthquake is generally considered to be the most destructive and frightening of all forces of nature. The effect of an earthquake depends on its intensity and closeness to the

epicentre. Due to a strong earthquake, buildings, roads, bridges and dams may get damaged. It may cause floods, tsunamis, land-slides, avalanches, fires, breakdown of water supply and electrical lines, and loss of lives. An earthquake may even change the course of a river. A mild earthquake may cause cracks in buildings, roads and bridges.

On 26th, January, 2001, 51st Republic Day of India, there was an earthquake in Gujarat with the magnitudes ranging from 7.6 to 8.1 on the Richter scale. The shock waves spread to 700 km, 21 districts were affected, 6,00,000 were rendered homeless, 19,727 people died and 1,66,001 people were injured. The quake destroyed around 90% of homes, eight schools, two hospitals and a historic Swami Narayan Temple.

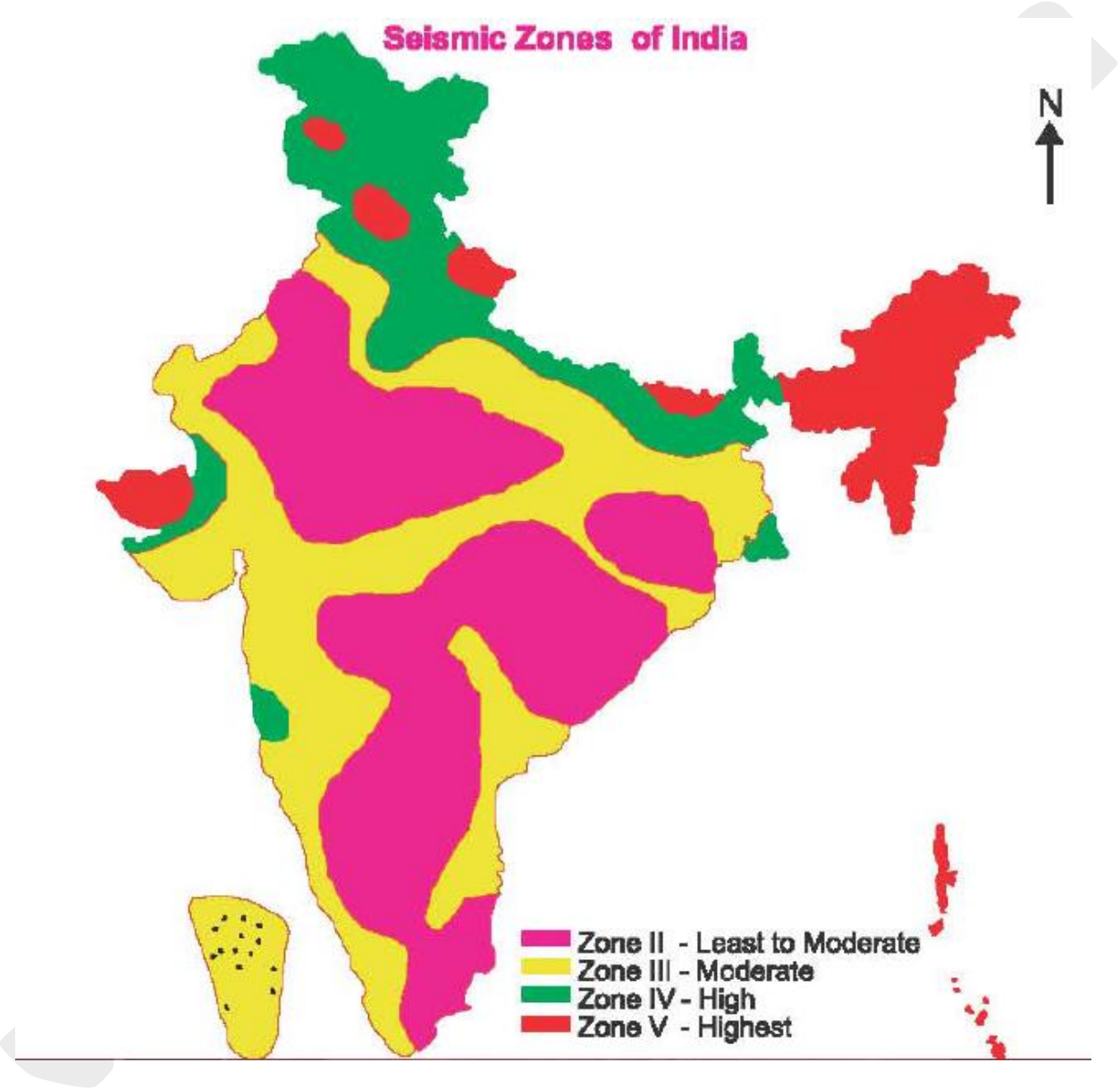
India is divided into four seismic zones. These are listed in the following table.

Sesmic Zones	Regions	Types
V	Kashmir, Punjab, Western and Central Himalayas, Northeast Indian Region and Rann of Kutch.	Very High Damage Risk Zone.
IV	Indo-Gangetic basin, Delhi, Jammu and Bihar.	High Damage Risk Zone.
III	Andaman and Nicobar Islands, Western Himalayas.	Moderate Damage Risk Zone.
II	Deccan Plateau, Tamil Nadu.	Low Damage Risk Zone.

Mitigation

In order to minimise the damages to life and property due to an earthquake an awareness has to be created in the public especially people living in the earthquake prone areas. People should be encouraged to build earthquake resistant homes. They should be helped to check the

quality of soil before building their homes. The people should be made aware of the steps they should take during an earthquake. Awareness campaigns have to be made in schools so that right from an early age they learn how to protect themselves during an earthquake.



Volcanic Eruptions

Unlike earth quakes volcanic eruptions can be predicted because before a volcanic eruption there is always slight tremors, smoke and evolution of gas.

Due to volcanic eruptions' **lava 'flows** and **'lahars'** can destroy settlements and destroy forest and agricultural lands.

Mud and ash from volcanoes when mixed with rain water or melted snow form mud flows which are called as Lahars.

The ash cloud and the smoke evolved affect visibility, thereby affecting air traffic and may also affect agricultural and other economic activities.

Though volcanic eruptions cause great havoc there are some positive effects also. The ash and mud deposited provide nutrients to the soil there by improving the fertility of the soil. The volcanic materials are used for industrial purposes. Rocks formed by lava are used for building roads. The steam and hot water released can be used to generate geo thermal energy.

The eruption of Nevado del Ruiz of Columbia in November 13, 1985 killed 40,000 people. It wiped out the entire city of Armero. Likewise, the most recent volcanic eruption in Iceland occurred on April 14, 2010, which erupted with a large ash plume(due to megma spewed from below the Ice). More than 20 countries had to shut down their airports because of the ash plume.

Mitigation

- ✓ Volcanoes rarely kill people, still people should stay away from volcanoes.
- ✓ All transport facilities are to be avoided, especially air transport near volcanic regions.
- ✓ Volcanic eruptions may cause earthquakes. So people should take precautionary measures.
- ✓ From the snow covered mountains, the volcanic eruptions may cause melting and flooding and therefore embankments must be built.
- ✓ People should be aware of the results of tilt meter which measures the expansion of a volcano.

Tsunamis

They are killer waves or Glant waves generated by earthquakes, volcanic eruptions or underwater landsides. It can raise to 15 metres or more in height. When earthquakes occur in the

sea or ocean, the sea waves rise to several meters and may reach the coast within a few minutes. The danger period of Tsunami can continue for many hours after a major earthquake.

The term **"Tsunami"** has been coined from the Japanese word. **"Tsu"** means harbour and **"nami"** means waves.

Tsunami waves travel at a speed of 500 kilometre per hour and speed increases when it approaches the continents.

A killer Tsunami hit South East Asian Countries on the 26th December of 2004 killing more than 150000 lives.

In India Tsunami warning centres has been set up at Hydrabad.

The emotional, economic and ecological toll of the disaster cannot be calculated. Many villages have lost entire generation. This was the biggest Tsunami to hit the world in 40 years. No one could have thought that its effects would ripple worldwide overnight.

Mitigation

- ✓ People should be aware of the information given by the Tsunami Warning Centre located at Hyderabad in India.
- ✓ People should vacate the coastal area as soon as the tsunami warming is released.
- ✓ Seriously injured persons should be given immediately First Aid.
- ✓ Fishermen should not go for fishing.
- ✓ We should not assume only the first wave is dangerous whereas the successive waves could be more dangerous.

Landslide

Land-slides may be defined as the movement of rock and debris down a slope. Debris mixed with rain water is called as mudflow or mud slide.

Landsides are caused due to instability of the slope, heavy rainfall, earthquake, volcanic eruption, deforestation and also indiscriminate construction activity.

Landslides affect agricultural production, destroy settlements, damage roads and railways and change the direction of surface run off.

Mitigation

If houses are built on soft soil and slide prone areas, an alternative path for sliding soil should be provided.

When there is a chance of the roads being affected by landslides or mud slide alternate routes should be planned for quick evacuation.

Avalanche

An avalanche can be defined as a large mass of snow or ice, descending down the mountain slope. It occurs in the high mountains and at the polar regions.

Avalanches are provoked by earthquakes, extreme precipitation, man-made disturbances such as loud noise, heavy movement of the skiers and use of explosives. The Avalanches become severe when more accumulation of snow takes place at the time of avalanches.

The effects of Avalanches are destruction and blockage of the roads, destroying a small hamlet, vegetation and wild life.

Mitigation

- ✓ It is difficult to check or stop the avalanches but the power of avalanches can be reduced to minimize its effects.
- ✓ Hill resorts, mountain towns, roads and railways are to be avoided in the areas of avalanches.
- ✓ People should be instructed not to use explosives.
- ✓ People who live on hill slopes should be encouraged to plant trees around their houses.

Cyclones

South Indian coastal areas are affected more by cyclones than by any other disaster. Every year, the cyclones cause a few deaths along the coromandel coast, especially in Andhra Pradesh and Odisha.

The Indian Coastal regions are among the six major cyclone prone regions of the world.

The cyclones are the strongest winds generated by the meeting of the cold and warm fronts in the centre of low-pressure systems. When they are all formed over the sea and oceans they become violent due to the fact that there are no barriers to check these winds.

The cyclone is always associated with strong winds and torrential rains. Strong winds may uproot trees and electrical poles thereby blocking roads, damaging buildings and disrupting electricity supply. Torrential rains will lead to water logging and floods affecting normal lives of people. Heavy rains will result in Soil erosion and destruction of standing crops. There also may be loss of lives due to falling of trees, collapsing of buildings and washing away of homes. Water logging for a longer period will cause the spread of water borne diseases like cholera and typhoid.

On October 29, 1999 Super-cyclone winds with a speed of 260-300 km/hour hit the 144 km coast of Odisha with a storm surge. It caused the water of the Bay of Bengal to rise 8 metre high. The super storm entered inland beyond 250 km from shore and within 36 hrs ravaged more than 20 million hectares of land, devouring trees leaving behind at huge trail of destruction. The violent cyclone was like a merciless giant and broke the backbone of odisha state and killed thousands and devastated millions of hectares of land.

Mitigation

- ✓ In water logged areas temporary channels should be built to drain the water.
- ✓ People living in old buildings may have to temporarily shift their residence.

- ✓ People should keep their important documents and jewels in a safe and secure place.
- ✓ Fishermen are advised by the government not to venture intothe sea for fishing.
- ✓ There is always the danger of electrocution from damaged electrical wires and poles. Hence people have to be careful.
- ✓ People are advised to drink boiled water to avoid spread of water borne diseases.
- ✓ People should listen to ratio or watch television news to know about the cyclone warnings and follow the instructions announced by the government.

Floods

Floods are a temporary inundation or overflow of water. They are caused due to very heavy rainfall, cyclones, melting of snow, tsunami or a dam burst. Floods are common features in Tamil Nadu, Andhra Pradesh, and Odisha due to very heavy rainfall during the Northeast Monsoon season and in Mumbai during the Southwest Monsoon season.

Floods destroy sewage system, pollute water, cause soil erosion, silt deposition, water logging, destruction to agricultural fields, livestock, damage to the fishing equipments, building structures and to the loss of life.

Why do floods occur more frequently in the north Indian rivers than in the south Indian rivers.

Floods and droughts are the two problems caused due to the vagaries of monsoon.

Mitigation

People in low lying area should move out to safer places as advised by their governments. To avoid overflow of water, Channels have to be dug to drain out water from agricultural fields and low lying areas. Sand bags are to be placed in front of the houses so that water does not enter the homes.

Ponds and lakes should be desilted, river embankments have to be raised and the drainage system de-blocked before the onset of monsoon.

For a long term solution to repeated floods afforestation is to be encouraged and rainwater harvesting methods to be implemented.

Older students may volunteer by collecting and distributing clothes and food packets to help people who have been affected by floods.

Drought

Drought refers to the prolonged dryness of weather due to lack of rainfall. It is difficult to indicate the time of its onset and end. According to the Indian Meteorological Department, the country is declared as drought-affected when overall rainfall deficiency is more than 10% over a long period.

The major reason for the drought is the scarcity of rainfall. Scarcity of rain can be listed due to failure of monsoons, vagaries of monsoons, deforestation, environmental degradation, high rate of evaporation poor land management, overgrazing and soil erosion.

The rainfed crops are mostly affected due to droughts. Other effects are:

(i) scarce drinking water supply, (ii) shortage of food (iii) lack of water to the livestock, (iv) nutrition deficiency diseases and (v) soil erosion.

Mitigation

- ✓ The following are the ways by which loss and suffering can be minimised.
- ✓ Planned land development, alternate cropping for optimal use of land, and drip irrigation method will help in increasing the farm output.
- ✓ Better storage facility to store grains, proper utilisation of rain water will help in mitigating drought condition.
- ✓ Fodder and drinking water for the cattle has to be ensured during drought period.
- ✓ Food grains and fodder should be transported to needy areas.
- ✓ Drought relief planning at village level has to be undertaken to provide quick relief to the affected people.

Tornadoes

A tornado is a violently rotating column of air that is in contact with the surface of earth and the cumulonimbus cloud(thunder cloud base). Tornadoes occur in many different shapes and sizes but the typical tornado is funnel shaped with the narrow end touching the surface of the earth.

They are caused due to extreme low pressure. They originate in land, generating a rapid whirl wind. They are formed when hot air and cold air are mixed. They cause heavy destruction to both life and property like a cyclone.

On March 24, 1998: Violent tornado or tornadoes killed 160 people and injured 2000 when they streaked through 20 coastal villages on the eastern states of West Bengal and Odisha, Ten people in a boat were killed when they were thrown up to 20ft high.

Thirty-five children were crushed to death when a school building being used as a shelter collapsed at Goborghata in the Balasore district in Odisha, the tornadoes flattened 15000 homes and left more than 10000 people homeless.

In USA, it is known as a twister, because of the twisting motion of funnel shaped cloud.

Mitigation

- ✓ As soon as tornadoes warnings are heard, people need to get inside their homes or storm cellars or lie down on the ground.
- ✓ If you are outside, stay in a safe place and return home when it is declared safe by the authorities.
- ✓ Always follow the instructions and warnings given by the authorities.

Disaster management

Disaster management involves awareness of the different type of disasters, disaster preparedness, prevention, relief and recovery.

People should be forewarned and educated to safeguard themselves and their property against disaster. Awareness programmes should be organised in schools, colleges and offices. General public should be made aware through radio, newspapers and television programmes. Governments should have a plan of action to mobilise various departments to provide timely and quick relief to the affected people.