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General Knowledge – Part 11

ROCKS

Rocks are made up of individual solid substance called minerals. A rock as any natural mass of mineral matter that makes up the earth's crust. On the basis of the formation, rocks are classified into :

1. Igneous Rocks
2. Sedimentary Rocks
3. Metamorphic Rocks

Igneous Rocks

These rocks are formed by cooling, solidification and crystallization of hot and molten magma found below the earth crust. These are granular and crystalline rocks. These are also known as 'Primary or Ba'sic Rocks' because of the fact that these rocks were first to be formed and supply raw material for other types of rocks to be formed. No layering is found in these rocks and fossils are also not found. Nearly 90% of the crust is made up of igneous rocks. For example Granite Basalt Dolerite and Magetite

Sedimentary Rocks

Rocks formed on the surface of the earth due to the erosion and depositon of igneous and metamorphi rocks are known as sedimentary rocks. Sedimentary rocks are found over about 75% area of the crust, but they contribute only 5% in the formation of the crust. These rocks contain fossils. On the basis of the nature of the sediments, sedimentary rocks are classified into :

- **Mechanically formed sedimentary rocks**, such as : Sandstones, Conglomerates, Clay rocks, Shale and Loess.

- **Organically formed sedimentary rocks**, such as : Limestones, Coal and Peat.
- **Chemically formed rocks**, such as : Chalk rocks, Gypsum and Salt rock.

Metamorphic Rocks

Metamorphic rocks are formed due to complete alternation in the appearance and constitution of pre-exising rocks due to change in mineral composition and texture through temperature and pressuer. These are the hardest rocks and do not contain fossils.

Metamorphic rocks formed through the sedimentary rocks. (Meta - Sedimentary of Para - Metamorphic Rocks.)

- Slate from Shale
- Marble from Limestone
- Quartzite from chalk & dolomite

Metamorphic rocks formed through the Igneous rocks. (Meta - Igneous or Ortho-Meta morphic rocks)

- Gneisses from Granites
- Amphibolite from Basalt
- Schist from Basalt

Metamorphic rocks formed by the further metamorphosis of metamorphic rocks.

- Phyllite from Slate
- Schist from Phyllite
- Serpentine from Gabbro

OCEAN CURRENTS

When ocean water moves in a fixed direction within a fixed limit (of area) with very high velocity, it is called current. The velocity of a current is more than that of drift. | Ocean currents can be divided into two type warm currents and cold currents. The currents flowing from the equator to the poles are warm and those flowing from poles to the equator are cold.

Due to Coriolis force, the Ocean currents in the Northern Hemisphere deflect towards their right and those in the Southern Hemisphere, towards their left. The only exception of this

rule of the flow of ocean is found in the Indian Ocean, where the direction of current flow changes with the change in the direction monsoon wind flow.

Ocean currents influence the climate of bordering coastal regions. They affect temperature, humidity and precipitation.

Coral Reefs

Coral reefs are the regions of very high bio-diversity. These are formed due to accumulation and solidification of skeletons of lime secreting organism known as coral polyps. They are dominating rocks. **Coral reefs are of three types :**

i. **Fringing Reef:** Coral reefs developed along the coasts are called fringing reefs. Examples: Gulf of Mannar (india), Southern Florida (USA) etc.
ii. **Barrier Reef :** The coral reefs qf the coastal platforms are called "barrier reefs". There is extensive but shallow lagoon between the coastal land and the reef. Great Barrier Reef, located parallel to the east coast of Australia, is the largest of all the barrier reefs of the world.
iii. **Coral Ring or Atoll :** A ring of narrow growing corals of horse-shoe shape is called atoll. It is generally found around an island or in elliptical form on a submarine platform. Examples : Fiji Atoll, Funfutti Atoll etc.

Tides

Rise and fall of the ocean water level due to the gravitational forces of the Sun and the Moon are referred to as **Tides**. The waves generated by tide-are called Tidal Waves. The hight of the tides at different places varies a lot due to several factors such as - depth of water, the coastal features and openness or closeness of the sea. Though the Sun is far bigger than the moon yet, the gravitational force of the Moon is double than that of the sun. This is due to the fact that the Sun is at a greater distance than the Moon, from the Earth.

Every place, along the coast, experiences tide and ebbs twice in 24 hours. When the Sun, the Earth and the Moon are aligned in a straight line this position is referred to as SYZYGY. The combined forces of the Sun and the Moon result into High or Spring Tides. High tides are experienced on the full moon and the new moon.

Unlike this, when the Sun, the Earth and the Moon are aligned in a right angle position, the gravitational forces of the Sun and the Moon work against each other, when **Neap or Low Tides** are experienced. The part of the Earth facing the Moon , experiences a tide due to the

gravitational pull of the Moon, but, at the same time the part of the Earth on the Opposite side also experidences a tide. This is due to the strong centrifugal force to balance the rotation of the earth

MOUNTAINS AND PLATEAU

Mountains are such highlands whose slopes are steep and the peaks are pointed. Generally, the mountains are more than 1000 mts high. The mountains whose height is less than 1000 mts, are called hills. The highest point of a mountain or a hill is called its peak. A mountain range is a system of mountains and hills having several ridges, peaks, summits and valleys, formed in a particular period and spread in a narrow belt.

Classification of Mountains

- **Folded Mountains**: These Mountains are the results of compressive forces, triggered by the endogenetic forces. When the rocks on (he surface of the earth are folded due to the forces generated within the earth, the resultant Himalaya Ural, Rockies, Andes, Atlas etc. examples of folded mountains.
- **Block Mountains**: These Mountains originate due to the forces of tension leading to the formation of rift valleys. These are also know as fault Block Mountains, as they are the result of faulting. Sierra Nevada mountain of California, USA, Vosages and Black Forest mountains of Europe.
- **Accumulated Mountains**: These mountain are formed due to accumulation of lava other ejected materials in the proccess of vulcanism. Fujiyama of Japan, Cotopaxi of Equador are its examples.
- **Relict Mountains**: When orginal mountains are eroded by the agents of gradation, they become relict mountains. Vindhyas, Aravallis, Satpura, Eastern Ghats, Western Ghats, Parasnath etc. are relict mountains.

Plateau

A plateau may be defined as that upland which has at least one side of very steep slope standing well above the neighbouring surface and whose upper part is extensive and almost flat.

Classification of Plateau

i. **Intermontane Plateau:** These Plateaus are surrounded by hills and mountains from all sides. For Example Tibetan plateau, Columbian plateau.
ii. **Piedmont Plateau:** Which is surrounded by-mountain range on one side and by plain or ocean on the other side. For Example Appalachian Mountains (USA) and Patagonian plateau of South America.
iii. **Dome Shaped Plateau:** These Plateaus are formed when the landmass is uplifted in such a manner that the middle portion is raised and the sides are rounded. Chhotanagpur plateau of Jharkhand, Ozark Plateau (USA).
iv. **Continental Plateau:** These are very extensive Plateau and surrounded by oceanic coasts or plains. These are also called Shield. For Example Siberian shield.
v. **Volcanic Plateau:** These Plateau are formed due to accumulation of thick layers of bassltic laves. Deccan plateau of India and Columbian plateau of USA are the best example of this type.

Plateaus	Location
Anatolia	Turkey
Meseta	Iberian Peninsula
Chiyapas	S. Mexico
Alaska / Yukon	USA
Columbian	USA
Great Basin	USA
Colorado	USA

MOUNTAIN RANGES OF THE WORLD

	Name	Location	Highest Point
1.	Cordillera de Los Andes	Western S America	Aconcagua
2.	Rockies	Western N America	Mount Albert
3.	Himalaya-Karakoram-Hindukush	South Central Asia	Mount Everest
4.	Great Dividing Range	Eastern Australia	Mount Kosciusko
5.	Trans-Antarctica Mountains	Antarctica	Mount Vinson Massif
6.	Tien Shan	South Central Asia	Pike Poveda
7.	Altai	Central Asia	Gora Velukha
8.	Ural	Central Russia	Gora Noradnaya

9.	Kamchatka	Eastern Russia	Kluchevskaya Sopka
10.	Atlas	North West Africa	Jewel Taubcal
11.	Verkhoyansk	Eastern Russia	Gora mas Khaya
12.	Western Ghats	Western India	Anaimudi
13.	Zagros	Iran	Zad Kuh
14	Elburz	Iran	Demaband
15.	Scandinavian Range	Western Norway	Galdhopijen
16.	Drackensberg	South East Africa	Dwanayentalenyana
17.	Caucasus	Russia	Mount Elbrus (Western Peak)
18.	Alaska Range	Alaska JJSA	Mount Mackinley (southern Peak)
19.	Cascade Range	USA-Canada	Mount Rainier
20.	Appenine	Itali	Corno Grande
21.	Appalachian	Eastern USA-Canada	Mount Michel
22.	Alps	Central Europe	Mount Blanc

MOTIONS OF THE EARTH

The Earth has two types of motions:

1. Rotational Motion
2. Revolutional or Orbital Motion

- **Rotation** : The Earth rotates on its axis, from west to east like a top. This motion is called Rotation of the Earth.
- **Revolution** : While rotating on its axis, the earth also goes around the sun in an elliptical path and completes one round in 365 days and 6 hours. The elliptical path traced by the earth is called its orbit. This motion of the earth is called revolution.
- **Perihelion** : When the earth is at the minimum distance from the sun, while in orbit, this position is known as perihelion. The earth is at this position on 4th July.

Change in Seasons

The earth moves not only on its axis but also in its orbit around the sun. Therefore, the earth changes its position continuously with respect to the sun. There are four major positions of the earth, while it revolves around the sun.

A. **Position on 21st June :** In this position the sun shines perpendicularly over the Tropic of Cancer. This position in called the Summer Solstice. It is the time of summer season in the northern hemisphere, while in the southern hemisphere, it is winter season. The day in the northern hemisphere is longest on 21st June.

B. **Position on 22nd December :** In this position the Sun shines perpendicularly over the Tropic of Capricorn. This position is called Winter Solstice. During this period, days are long and nights are short in the southern hemisphere. This positions marks the summers in the southern hemisphere and winters in the northern hemisphere.

C. **Positions on 21st March and 23rd September :** In these two positions the Sun shines directly overhead on the Equator. Therefore, half part of all latitudes receives the sun-light at these times. Hence, everywhere, the duration of day and night is equal.. Seasons are also similar in both the hemispheres. These two positions are referred to as Equinoxes. 21st March is called Spring or Vernal Equinox whereas 23rd September is called Autumn Equinox./li>

Eclipses

- Both the Earth and the Moon get hght form the Sun. Only one part of the Moon can be seen from the earth because of equal rotational speed of both the earth and the Moon. Illuminated face of the Moon is seen on the Earth once a month on the Full Moon. On the New Moon the Moon is not seen at all because on this night the completely dark Moon faces the Earth.
- When the Earth comes in between Sun and the Moon, the hght of the Sun is not able to reach the Moon, rather, the shadow of the Earth falls on the moon. This is called the Lunar Eclipse. Lunar Eclipse always occurs on a Full Moon. When the Moon comes in between the Sun and the Earth, the light of the Sun is interrupted and shadow of the Moon falls on the Earth. This is called the Solar Eclipse, which occurs on New Moon day.

MAJOR STRAITS OF THE WORLD

Name	Joins	Location
Malacca Strait	Andaman Sea & South China Sea	Indonesia - Malaysia
Palk Strait	Palk Bay & Bay of Bengal	India-Sri Lanka
Sunda Strait	Java Sea & Indian Ocean	Indonesia
Yucatan Strait	Gulf of Mexico and Carribbean Sea	Mexico-Cuba
Mesina Strait	Mediterranean Sea	Italy-Sicily
Otranto Strait	Adriatic Sea & Ionian Sea	Italy-Albania

Bab-el-Mandeb Strait	Red Sea & Gulf of Aden	Yemen-Djibouti
Cook Strait	South Pacific Ocean	New Zealand (N & S islands)
Mozambique Strait	Indian Ocean	Mozambique - Malagassy
North Channel	Irish Sea & Atlantic Ocean	Ireland-England
Taurus Strait	Arafura Sea & Gulf of Papua	Papua New Guinea - Australia
Bass strait	Tasman Sea & South Sea	Australia
Bering Strait	Bering Sea & Chuksi Sea	Alaska-Russia
Bonne-Fasio Strait	Mediterranean Sea	Corsika-Sardinia
Bosporous Strait	Black Sea and Marmara Sea	Turkey
Dardenleez Strait	Marmara Sea and Agean Sea	Turkey
Davis strait	Baffin Bay & Atlantic Ocean	Greenland-Canada
Denmark strait	North Atlantic and Arctic Ocean	Greenland-Iceland
Dover strait	English Channel & North Sea	England-France
Florida Strait	Gulf of Mexico and Atlantic Ocean	USA-Cuba
Hormuz strait	Gulf of Persia & Gulf of Oman	Oman-Iran
Hudson strait	Gulf of Hudson & Atlantic Ocean	Canada
Gibraltar Strait	Mediterranean Sea & Atlantic Ocean	Spain-Morocco
Magellan strait	Pacific and South Atlantic Ocean	Chile
Makkassar Strait	Java Sea & Celebeze Sea	Indonesia
Tsungaru Strait	Japan Sea and Pacific Ocean	Japan (Hokkaido-Honshu island)
Tatar Strait	Japan Sea & Okhotsk Sea	Russia (E Russia-Sakhalin Island)

LANDFORMS

Different Landforms on the earth crust are caused by both endogenetic forces and exogenectic forces

Endogenetic Forces

The forces, which the affect crust of the earth, are divided into two broad categories on the basis of their sources of origin, they are **Endogenetic Forces** and **Exogenetic Forces**. The Endogenetic Forces (Diastroph forces, volcanic eruption, Earthquak etc.) give rise to several vertical irregularities, which leads to the formation of numerous varieties of relief features on the earth surface (e.g. Plateau, mountain, plain, lakes, faults, folds etc).

Compressional Forces and Tensional Forces. Due to compressional forces, the rock strata gets folded. For example Folded Mountain Himalaya

Faults : Cracks, Fractures and Faulting are included in it. Faults are formed due to the combined effect of both the compressional and tensional forces.

Rift valley are actually formed due to displacement of crustal parts and subsidence of middle portion between two normal faults. The Dead Sea of Jordan is located in a Rift valley.

When the middle portion remains at place and the two side blocks move downwards, the Block Mountains are formed. Satpura mountains in India, Black Forest and Vosages in Germany.

Exogenetic Forces

The main function of the exogenetic forces on the surface of the earth is denudation which includes, the processes of weathering and erosion.

Weathering: The process of disintegration and decomposition of rocks, due to physical, chemical or biological factors, at their own place is known as weathering. Based on the causes, the process of weathering is classified into three types:

A. Physical or Mechanical Weathering

- Due to insolation (Temperature)
- Due to Frost action
- Due to Friction
- Due to Pressure
- Exfoliation

B.Chemical Weathering

- By oxidation
- By Carbonation
- By Hydration
- Chelation
- Hydrolysis

C. Biological Weathering

- By Plants
- By Animals

- Due to Human Activities (Anthropo Weathering).

Erosion: Large scale transportation of the weathered materials is termed as erosion

Running Water (River)

The area drained by a river and its tributaries known as River Basin Catchment Area. Differ landforms by a river are:

i. **V-shaped Valley** : During its youthful stage the river down-cuts (vertical erosion or valley deepening) its valley. This results into formation of V-shaped valley, which is very deep and narrow and both of its sides meet together at the valley floor. In India, indus gorge, Shipkila gorge and Dihang gorge are highly famous. Though lateral erosion is observed in the valley, down-cutting of the river is most dominant, making lateral erosion negligent. It is divided into two types on the basis of its size and shape - Gorge and Canyon. Generally Gorge is very deep and narrow valley Sometimes it is formed as a result of fast withdrawal of waterfalls. Canyon is the extended form of Gorge. Its side-walls a comparatively more vertical. The best example of Canyon in the world is the Grand Canyon on the Colorado river of USA.

ii. **Waterfalls and Rapids:** Water falls are caused because of sudden descents or abrupt breaks in the longitudinal course of the river, A waterfall may be defined as a vertical drop water of enormous volume from a great height in the long profiles of the rivers. Niagra fall North America and Victoria fall on the Zambezi river of Africa are leading examples of waterfall. The Jog or Gersoppa falls on the Sharavati river in the state of Karnataka (India) falls from a height of 260 m. Dhuandhar fall on the Narmada river and Hundru fall (97 m) on the Subarnrekha riverare well known for their scenic beauty. Rapids are of lesser height with respect to waterfalls.

iii. **Alluvial cones:** When rivers leave the mountains and enter the plains, their channel gradient drops substantially, resulting into drop in the load carrying capacity of the river. Consequently, load consisting of finer to coarser and big-sized materials coming from the upstream is deposited at the point of break in slope of foothill zone and thus alluvial cones are formed. When several alluvial fans get combined, it forms Bhabhar region.

iv. **Alluvial Fans:** When river descends from the hills, it spreads the load in a vast area. This results into the formation of fan-shaped plains, called alluvial fans.

v. **Meanders:** While flowing through the plains, the river stream flow take several turns and makes meanders. River meandering refers to the bends of longitudinal courses of the rivers and are 'S' shaped.

vi. **Oxbow Lake:** When the river straightens after abandoning its meandering path, then the abandoned part forms the oxbow lake.

vii. **Levees :** The narrow belt of ridges of low height built by the deposition of sediments by the spill water of the stream on its either banks is called natural Levee or embankments. These are formed due to the deposition of the load carried by the river as it moves ahead.

viii. **Delta:** The depositional feature of almost triangular shape at the mouth of a river debouching either in a lake or a sea, is called delta. These are formed when the river flow.-through low lying plains and consequently its load carrying capacity reduces due to decrease in its speed. It resembles the shape of the Greek-alphabet Delta.

There are various kinds of Deltas such as :

1. Arcuate type : Delta of Nile River, Ganga- Brahmaputra Delta
2. Bird-foot type : Mississippi - Missouri Delu
3. Estuarine type : Narmada river Delta and Tap: river Delta in India.
4. Cuspate type : Ebbro delta in Spain

Sea Water

Seawater carves different landforms with the help of sea-waves, currents, tidal waves or tsunamis

i. **Coastal Cliffs:** Steep rocky coast rising almost vertically above seawater, is called cliff.

ii. **Coastal Caves:** The coastal landform formed due to heavy sea-wave erosion on the coastal rocks having fissure, fracture and weak rocks.

iii. **Stacks:** The natural arcs formed due to the coalescence of two caves are not permanent landforms. After collapsing the natural arc, the left portion projecting well above the sea-level is called stack.

iv. **Beach:** Temporary or short-lived deposits of marine sediments, consisting of sands, shingles etc, on the .seashore are called beaches. Beaches are deposited by breaker waves between high and low tide waters. These are formed when sea is calm and winds are of low velocity.

v. **Lagoons** are formed when the coves or bays are almost completely enclosed by bars. Chilka Lake and Pulicat Lake on the east coast and Vembanad Lake on the west coast of India are lagoon lakes.

Glaciers

Glaciers : The moving ice mass down slope under the impact of gravity is called glacier. Snow line is generally defined as a zone between permanent and seasonal snow.

They formed on high mountains are long and narrow because they are formed in an abandoned river valley. These are known is 72 km long, is the largest of all the Indian glaciers. Different landforms carved out by glaciers are:

i. **U-shaped Valley** : U-shaped valleys are formed due to vertical erosion by the glaciers in the already existing river valley.
ii. **Hanging Valley** : The valleys of tributary structure with steep walls, is formed, it is called cirque.
iii. **Horns** : The pyramidal or triangular-faceted peak, formed due to recession and intersection of three or more cirques, is called horn. The Matterhorn Peak of Switzerland is very famous.

Wind

The wind is the most active agent of gradation in the arid and semi-arid regions where rainfall is very scanty and the ground surface is covered with loose particle of soil in the absence of both moisture and vegetation cover.

Mushroom-Rock : The rocks having broad upper part and narrow base resembling an umbrella or mushroom are called mushroom rocks. These are the result of abrasional work of wind in which the base of the rock is abraded rigorously.

Sand Dunes: The heaps or mounds of sand deposited by wind, are called sand dunes. Sand dunes keep their position changing the direction of wind. Sand dunes of crescentic shape having two horns are called Barchans. Loess: Loess plain are the extensive plains formed by the deposition of very thin soild particles brought by the wind in the outskirt of the desert region. Loess turns into very fertile soil when it gets water.

Playa: The temporary lakes created by the ephemeral streams in the bolsons, i.e. basins enclosed by hills in desert regions are called playas.

LAKES AND RIVERS

Lakes

- **Lake Baikal (Russia)** is the deepest lake of the world.One of the biggest and most ancient lakes of world is situated nearly in the center of Asia in a huge stone bowl set 445 m above sea level. Everyone who has been to its shores is impressed and charmed by the grandeur, size, and unusual might of this Siberian miracle of nature. Other important lakes in Russia are Lake Onega and Lake Ladoga.
- **Lake Eyre** is a important lake of Australia.
- **Lake Onakal** (Uganda) and **Lake Aswan** (Egypt) are man made lakes.
- **Lake Tso Sekuru** located on the Tibetan Plateau is the highest lake of the world.
- **Lake Titicaca**, located at the boundary of Bolivia and Peru is the highest navigable lake of the world.
  The highest lake in India is **Devtal**, located at a height of 17,745 ft in the Garhwal Himalayas.
- **Dead Sea** is the lowest lake of the world, its base is located 2500 ft below the sea level.
- **Lake Van (Turkey)** is the most saline lake of the world, with salinity of330%. It is followed by Dead Sea (238%) Jordan, and Great Salt Lake (220% salinity) USA.
- **Caspian Sea** is the largest lake of the world. It is a salt water lake. Ural and Volga rivers drain into it from the north, therefore its northern part is less saline.
- **Lake Victoria**, forms the border between Uganda, Tanzania and Kenya.
- **Lake Nyasa** or Lake. Malawi forms the border of Tanzania, Malawi and Mozambique.
- **Lake Tanganyika** forms the border of Zaire. Tanzania and Zambia.
- **Lake Superior** is the largest fresh water lake of the world.
- The nuclear test range of China is located near the lake **Lop Nor**.
- **Lake Chad** forms the border of Chad, Niger, Nigeria, Camroon.
- **Lake Great Bear** it is famous as Port Radium.
- **Lake Athabasca** famous as Uranium City.
- **LakeVolta** in Ghana is a largest man made lake.
- **Lake Maracaibo** in Venezuela is famous for oil reserves.
- **Wular Lake:** Wular Lake is one of the largest fresh water lakes in Asia and the largest in India, is located in Jammu and Kashmir. It is measures 24 kms across and surrounded by towering mountains, The green water of the Wular Lake is an important natural habitat for fish, a rich population of birds and wildlife. Thousands

of people living on its shores and elsewhere in the Kashmir valley depend on Wular Lake for fishing to earn their livelihood.

- **Dal Lake:** The Kashmir valley is blessed with exotic natural beauty of landscape and water bodies, out of them one of the best is Dal Lake. Dal Lake is one of the most beautiful lakes of India and is the second largest in the J&K valley. This is one of the most famous lakes in India and an icon of the Kashmir tourism industry. Apart from the natural beauty, Dal Lake attractions are The floating gardens, colorful shikaras and houseboats. The east of Dal Lake was the residence of goddess Maa Durga. The Dal lake is situated in the beautiful city of Srinaga,Some of the most famous mosques are also located in Srinagar city to visit.
- **Loktak Lake:** Loktak Lake is the largest freshwater lake in northeastern India, located in Manipur. It is also called the only floating lake in the world due to the floating phumdis. This ancient lake plays an important role in the economy of Manipur. It serves as a source of water for hydro power generation, irrigation drinking water supply and wildlife. The Keibul Lamjao National Park, which is the last natural refuge of the endangered sangai now found only in manipur.
- **Chilka Lake:** Chilka Lake is the brackish water lake and is the largest coastal lake in India. The Chilka Lake in situated in Orissa and is Asia's largest inland salt-water lagoon. Brackish water is water that has more salinity than fresh water, but not as much as seawater. Chilika Lake, popularly known as Chilka, is the queen of natural scenery in the tribal state Orissa, also known as the Swiss-lake in the continent. Attraction of chilika lake are fishing boats, migratory birds and an entertaining baba. The beautiful chilka lake is paradise for the migratory birds.
- **Pulicat lake:** It is a saline backwater lake lying along the Tamil Nadu and Andhra Pradesh coast; part extending to Chengalpattu district of Tamil Nadu. It has an area of 481 sq.KM and it is the 2nd largest brackish water lagoon in India after Chilka lake in Orissa.

Rivers

- **The Ganga :** The source of Ganga is at Gaumukh (the shape of the ice formation is like a cow's mouth), where the mighty river emerges from the depths of Gangotri glacier. The Gangotri glacier is situated at the height of4255 m above sea level and is approximate 24 km in length and 7-8 km in width. Here the river is known as Bhagirathi after King -Bhagirath. Rising in the icy caves of Gangotri glacier, the gushing , tossing and gurgling Bhagirathi starts its long journey downwards where later it joins river 'Alaknanda' and becomes Ganga. There are many legends

associated with river Ganga, some of which are even mentioned in the ancient holy scriptures.

- **The Godavari :** It is the only river in India that flows from western to southern India and is considered to be one of the big river basins in India. With a length of 1465 km, it is the second longest river in India after the Ganges river. .It is also known as "Dakshin ganga (Southern Ganges)" or "Budi Ganga". Godavari originates near Trimbak in Nashik District of Maharashtra state and flows east across the Deccan Plateau into the Bay of Bengal near Narasapuram in West Godavari district of Andhra Pradesh.
- **The Kavery :** The origin of this river is traditionally placed at Talakaveri, Kodagu in the Western Ghats in Karnataka, flows generally south and east through Karnataka and Tamil Nadu and across the southern Deccan plateau through the southeastern lowlands, emptying into the Bay of Bengal through two principal mouths. The Kaveri basin is estimated to be 27,700 square miles (72,000 km2)
- **Krishna River** starts its journey in the Western Ghats at an altitude of about 1300 metres above sea level in Mahabaleshwar. The river passes through Sangli District and enters the sea in the Bay of Bengal at Hamasaledevi in Andra Pradesh. It passes through the states of Maharashtra, Karnataka and Andra Pradesh.
- **Narmada River :** This river rises on the summit of Amarkantak Hill in Madhya Pradesh state .It traverses the first 320 kilometres course around the Mandla Hills, which form the head of the Satpura Range; then moves towards Jabalpur passing through the `**Marble Rocks**`, it enters the Narmada Valley between the Vindhya and Satpura ranges, and moves westwards towards the Gulf of Cambay. It flows through the states of Madhya Pradesh, Maharashtra, and Gujarat, and finally meets the Arabian Sea in the Bharuch District of Gujarat. Narmada River flows through the states of Madhya Pradesh 1,077 km (669.2 miles), Maharashtra, 74 km (46.0 miles)), 35 km (21.7 miles) border between Madhya Pradesh and Maharashtra and 39 km (24.2 miles) border between Madhya Pradesh and Gujarat and in Gujarat 161 km (100.0 miles)).
- **The river Brahmaputra** is one of the major river in the world. It originates from **Mansarovar** near Mount Kailash in the Himalayas, flows via Tibbet, China, India and Bangladesh to Bay of bangal. The total length it travels from Himalayans to the Bay is **2900 Km**. In Tibbet the river is known as '**Tsangpo**'. It follows the great Himalayans in its course till India with an avergae height of 4000 meters. It enters India in Arunachal Pradesh where it is called '**Siang**'. It then flows down to the plains of Assam, where it is called **Dibang**. It joins with other two giant rivers, Dibang and Lohit.

- **The Mahanadi River** rises in the Indian state of Chhattisgarh and then flows in the eastward direction, cutting a ravine in the Eastern Ghat. Before joining the Bay of Bengal at False Point through several channels, the river enters the plains of Orissa near Cuttack and forms a delta. This delta is one of the largest mangrove forests in peninsular India, and also a rice producing area. The term `Mahanadi` means Great River and it is truly one of the largest rivers in southeast India and the sixth largest in India. The **Tel** and the **Hadso** are the main tributaries of the Mahanadi. Maharashtra, Chhattisgarh, Jharkhand and Orissa share are drained by the Mahanadi.
- **Tapti** is a river of western India and the history of this river starts with its origin in the Betul district. It rises in Betul district of Madhya Pradesh and flows between two spurs of the Satpura Hills, across the plateau of Khandesh, and thence through the plain of Surat to the sea. It has a total length of around 724 km. and drains an area of 30,000 sq. m. For the last 32 m. of its course, it is a tidal flow, but is only navigable by vessels of small tonnage; and the port of Swally at its mouth. The history of this river is closely associated with the Anglo Portuguese history. The upper reaches of the river are now deserted, owing to silting at the outflow of the river. The waters of the Tapti are usually not used for irrigation.
- **Yamuna River** : The main stream of the river Yamuna originated from the Yamunotri glacier near Bandar Punch in the Mussorie range of lower Himalayas in the district of Uttar Kashi in Uttarakhand. Some say the source of the river is the Saptarishi Kund, a glacial lake. There is a sacred shrine of Yamunotri or Yamnotri, near this source at an altitude of 3235 m. The Tons and Giri rivers are the important tributaries of Yamuna and principal source of water in mountaineous range. The river Yamuna traverse a route length of about 1200 km in the plain from Saharanpur district of Uttar Pradesh to the confluence with river Ganga at Allahabad.
- **Nile River (4,132 miles 6,650 km.)** : The Nile River is the longest river in the world. It has its origins in **Burundi**, south of the Equator, and flows northward through north eastern Africa, eventually flowing through Egypt and finally draining into the **Mediterranean Sea**. Three principal streams form the Nile. In Ethiopia's highlands, water flows from the **Blue Nile** and the Atbara. Headstreams of the White Nile flow into **Lake Victoria** and **Lake Albert**. The Nile River basin is immense and occupies an area about one-tenth of the continent of Africa. It includes portions of Tanzania, Burundi, Rwanda, Zaire, Kenya, Uganda, Ethiopia, The Sudan, and Egypt. It is estimated to drain an area of 1,293,000 square miles (3,349,000 sq. km.)

- **Amazon** : The length of the Amazon River is approximately 6400 kilometres (4000 miles). The Amazon River is located in South America. It runs through Guyana, Ecuador, Venezuela, Bolivia, Brazil, Colombia and Peru.
- **Mississippi-Missouri River** : The Mississippi is the world's fourth-longest river at 3,870 miles, including the Missouri River. It flows from its source, at **Lake Itasca**, in **Minnesota**, to the **Gulf of Mexico**. It is the longest river in the United States. This river forms the **Bird-foot Delta**.
- **Rio-Grande** : This river forms the border between the USA and the Mexico.
- **St Lawrence River** : This river forms the biggest inland waterway of the world. Niagara Fall is located on this river.
- **Colorado River** : World famous Grand Canyon and Hoover Dam are located on this river. Rhine River. This river forms the busiest waterway in Europe. This river is also called **'Coal River'**. The busiest port of the Europe, Rotterdam, is situated on the mouth of this river.
- **Danube River** : This river, originating from the Black Forest Mountains of Germany and flowing through the capitals of five European nations - Belgrade (Yugoslavia), Bratislava (Slovania), Bucharest (Romania), Budapest (Hungary) and Vienna (Austria) - falls into the Black Sea.
- **Volga River** : This is the longest river of Europe. It originates from the Voldai Hills and drains into the Caspian Sea.
- **Niger River** : The river Niger, draining into the Gulf of Guinea, is also known as the **'Oil River'**.
- **Zambezi River** : Victoria Fall and Kariba dam are located on this river.
- **Congo/Zaire River** : This river intersects the Equator twice. Stanley and Livingston Falls are located on this river.
- **Amur River** : This river forms the border of Russia and China.
- **Mekong River** : This is the longest river of South-East Asia.
- **Murray-Darling River** : This river originates from the Mt Kosciusko and is the largest river of Australia.
- **R. Limppo** : This river which originates from the high velds of South Africa, cuts across the tropic of Capricorn twice.
- **R. Mahe** : This river of India cuts across the tropic of Cancer twice.
- **Seine River:** The Seine is a 776 km (482 mi)-long river and an important commercial waterway within the Paris Basin in the north of France. It rises at Source-Seine, 30 kilometres northwest of Dijon in northeastern France in the Langres plateau, flowing through Paris and into the English Channel at Le Havre.

- **Tigris River:** River that was a boundary of Mesopotamia, or the "land between the rivers" (Tigris and Euphrates) The Tigris was the eastern of the two rivers and flowed from a source deep in the Armenian mountains all the way to the Persian Gulf, about 1,200 miles. Both rivers were the lifeblood of Mesopotamian civilizations, giving them water and a vehicle for their trade and defense.
- **Euphrates River:** River that was a boundary of Mesopotamia, or the "land between the rivers" (Tigris and Euphrates) The Euphrates was the western of the two rivers and flowed from a source deep in the Armenian mountains all the way to the Persian Gulf, almost 1,800 miles. Both rivers served as means of defense and trade for every civilization in this area.
- **The Huang Ho River:** The Huang Ho is the world's sixth-longest river at 3,395 miles. Its source is the Kunlun Mountains, in western China. Its mouth is the Gulf of Bohai. The river is called the Yellow River, named for the color of the silts that are carried downstream in its flow. The earliest civilization in China settled on the banks of the Huang Ho. Ever since, the river has been a source of life and death. The river has flooded so often that is has become known as the River of Sorrow. Possibly the worst flood in written history occurred in 1931. Between July and November of that year, the river overflowed its banks, flooding about 34,000 square miles of land completely and about 8,000 square miles partially. Entire villages and huge amounts of agriculture and farmland were washed away. About 80 million people were left homeless. Nearly 1 million people died in the flood itself and in the famines and epidemics that resulted from the flooding.
- **Rhine River:** The Rhine River is 1,230 kilometres (760 mi) long. It is one of the longest rivers in Europe. The Rhine is an important waterway. Many goods are transported over the Rhine, and the Rhine valley is also an important wine producing region. The river Rhine begins at Tomasee, a lake in the canton of Graubünden in Switzerland, and runs through Switzerland, Germany and the Netherlands. It is also the border between Switzerland and Liechtenstein and also the border between Germany and France.
- **Irrawaddy River:** Irrawaddy River, Burmese Ayeyarwady, principal river of Myanmar (formerly Burma), running through the centre of the country. Myanmar's most important commercial waterway, it is about 1,350 miles (2,170 km) long. The river flows wholly within the territory of Myanmar. Its total drainage area is about 158,700 square miles (411,000 square km). Its valley forms the historical, cultural, and economic heartland of Myanmar.

LATITUDES, LONGITUDES, AND INTERNATIONAL DATE LINE

Latitudes

It can be defined as the angular distance measured at the centre of the Earth with espect to any point on the meridian. These are depicted in degrees, minutes and seconds. Equator is called the 0° latitude. These are imaginary circles, drawn on the surface of the earth, at an interrval of 1° on both the hemispheres making the total number of latitudes to 181. 23 1/2 ° latitude on the Northern hemisphere is called the **Tropic of Cancer** (23 1/2°N), whereas in the southern hemisphere the same latitude is called the **Tropic of Capricorn** (23 1/2 ° S). 66 1/2° latitude in the northern hemisphere is called the **Sub-Arctic Circle** (66 1/2° N) whereas 66 1/2° latitude in the southern hemisphere is called **Sub-Antarctic Circle** (66 1/2 ° S). The latitudinal distance of 1° is about 11 km.

Longitudes

Angular distance of any place from the Prime Meridian, is called longitude. It is also measured in degrees, minutes and seconds. The **Prime Meridian** is at 0° and is known as the Greenwich Line as it passes through **Greenwich**, in London. Part of the Earth on the eastern side of the Prime Meridian is called **Eastern hemisphere** and that on the western side of it is called **Western hemisphere.**

Since, the Earth is Geoid shape so it rotates by 360° in 24 hours. Therefore, the earth takes 4 minutes to move by 1° of longitude. Since the Sun rises in the east and the Earth moves from west to east, time on the eastern hemisphere is ahead of the Greenwich and that on the western hemisphere is behind it. This is the reason behind differences in local times at different places on the Earth. For every 15° of longitudes there is a difference of one hour in time. In this way The time on the 180° E longitude is 12 hours ahead of the Greenwich and that on the 0°-180°W longitude is 12 hours behind the time at Greenwich. Hence, there is a difference of 24 hours in the time in east and west of the 180° longitude.

International Date-Line

It is an imaginary line drawn at the 180° longitude, avoiding the continuous land parts. It is bent at 75° N latitude towards east to avoid division of Siberia and to separate Siberia and Alaska. There is a difference of 24 hours or one day in east and west of it. Therefore, one day is either gained or lost while crossing this line. While crossing it from east to west one day is gained and while going from west to east one day is lost.

Local Time: The time at a particular place on the Earth, as calculated by the position of the Sun, is termed as the Local Time of that place. In India there is a difference of 2 hours in the local time of the eastern most (Arunachal Prades) and the western most (Dwarka in Gujarat) parts.

Standard Time: This is the imaginary line passing through mid of the standard Meridian in the middle of the country. Standard Time of the country is followed all over the country to avoid the inconvenience caused by the difference in local times of different place in the country. For example, 82M>° E longitude, passing through Naini, near Allahabad (Uttar Pradesh), is the Standard Meridian of India. The time at this longitude is the Standard time of India, called Indian Standard Time (1ST).

Some helpful facts to calculate the Standard Time of a Place:

- To the left of the 0° longitude (the Prime Meridian) are the Western longitudes and to its right are eastern longitudes, whereas to the left of the 180° longitude (the International Date Line) are the eastern longitudes and to its right are the western longitudes.
- When we move towards the left of any longitude the time gets reduced by 4 minutes for every 1° of longitude whereas while moving towards the right of any longitude the time gets enhanced by 4 minutes for every 1° of longitude.
- We gain one day (24 hours) while crossing the International Date Line from its right and loosing one day while crossing it from its left.

INDIAN IRRIGATION

Water is very important for survival of all forms of life- plant as well as animal. India, by virtue of its peculiar placement in the foothills of the Himalayas and the Deccan Plateau running through it, has vast water resources which have been very meagrely tapped. Conventional and recognised means of irrigation are tanks, wells and canals.

Wells: Well irrigation is an important type of irrigation in India. Wells are particularly suitable for small farms. The important well-irrigated States are Uttar Pradesh, Punjab, Tamil Nadu and Maharashtra. In these States water-table is high, soil is soft and, therefore, wells are easily sunk.

Tubewells are an important development in India. They are worked by electricity or diesel oil and thus, they relieve our cattle of much of the strain. They are being quickly developed

in Uttar Pradesh, Bihar, Haryana and Punjab. This is because these have ample sub-soil water.

Wells and tubewells account for about 48 percent of the total irrigation in India.

Tanks: Tanks are also an important and ancient source of irrigation. They are of considerable importance in central and southern India, specially in Andhra Pradesh and Tamil Nadu. About 8 percent of the total irrigated area is irrigated by tanks.

Canals: Canals are the most important means of irrigation in the country. Some canals were constructed by the early Hindu and Mohammedan kings. Most of the canals, however, are the product of the British rule. At present, canals irrigate about 39 percent of total irrigated area of India. Most of the canals of the country are found in Uttar Pradesh and Punjab. Storage canals have been constructed in Deccan and Madhya Pradesh.

Major , Medium and Minor Irrigation Projects: The methods of irrigation used in India can be broadly classified into major, medium and minor irrigation schemes. Irrigation projects having Culturable Command Area (CCA) of more than 10,000 hectares each are classified as major projects. Those having a CCA between 2,000 hectares and 10,000 hectares fall under the category of medium irrigation projects. And the projects which have a CCA of less than 2,000 hectares are classified as minor irrigation schemes. For the purpose of analysis the major and the medium irrigation projects are generally grouped together. These projects comprise a network of dams, bunds, canals and other such schemes. Such projects require substantial financial outlay and are, therefore, constructed by the government or any other agency which may draw financial assistance form the government and financial institutions.

The minor irrigation projects, on the other hand, comprise all ground water development schemes such as dug wells, private shallow tubewells, deep public tubewells, and boring and deepening of dugewells, and small surface water development works such as storage tanks, lift irrigation projects, etc. Minor irrigation projects or the groundwater development schemes are essentially people's programmes implemented primarily through individual and cooperative efforts with finances obtained mainly through institutional sources.

IRRIGATION DEVELOPMENT

Creation for irrigation potential of 10 million hectares was targeted under Bharat Nirman during 2005-06 to 2008-09. The target was proposed to be met through completion of on-

going major and medium irrigation projects, and extension, renovation and modernization of existing projects. As per information provided by State Governments, the total irrigation potential created during the period is 7.31 million hectares against the target of 10 million hectares.

SOME IRRIGATION AND MULTIPURPOSE PROJECTS

Bargi Project (Madhya Pradesh): It is a multipurpose project consisting of a masonry dam across Bargi river in the Jabalpur district and a left bank canal.

Beas Project (Joint venture of Haryana, Punjab and Rajasthan): It consists of Beas–Sutlej Link and Beas Dam at Pong.

Bhadra Project (Karnataka): A multipurpose project across the river Bhadra.

Bhakra Nangal Project (Joint project of Haryana, Punjab, and Rajasthan): India's biggest, multipurpose river valley project comprises a straight gravity dam across the Sutlej river at Bhakra, the Nangal dam, the Nangal hydel channel, two power houses at Bhakra dam and two power stations at Ganguwal and Kotla.

Bhima Project (Maharashtra): Comprises two dams, one on the Pawana river near Phagne in Pune district and the other across the Krishna river near Ujjaini in Sholapur district.

Chambal Project (Joint project of Madhya Pradesh and Rajasthan): The project comprises Gandhi Sagar dam, Rana Pratap Sagar dam and jawahar Sagar dam.

Damodar Valley Project (West Bengal and Bihar): A multipurpose project for the unified development of irrigation, flood control and power generation in West Bengal and Bihar. It comprises multipurpose dams at Konar, Tilaiya, Maithon and Pancher; hydel power stations at Tilaiya, Konar, Maithon and Panchet; barrage at Durgapur; and thermal power houses at Bokaro, Chandrapura and Durgapur. The project is administrated by the Damodar Valley Corporation.

Dulhasti Power Project (Jammu & Kashmir): It is a 390 MW power project in Kishtwar region of Jammu & Kashmir on Chenab river. Work for this project started in 1981. The foundation stone was laid on April 15, 1983 by the then Prime Minister, Indira Gandhi. Work on this project was suspended due to threats of kidnapping and killings by Kashmiri militants resulting in long delay in completion of project.

Farakka Project (West Bengal): The project was taken up for the preservation and maintenance of Calcutta port and for improving the navigability of the Hoogly. It comprises a barrage at Jangipur across the Bhagirathi and a feeder channel taking off from the Ganga at Farakka and tailing into the Bhagirathi below the Jangipur barrage.

Gandak Project (Joint project of Bihar and Uttar Pradesh): Nepal also derives irrigation and power benefits form this project.

Ghataprabha Project (Karnataka): A project across Ghataprabha in Belgaum and Bijapur districts.

Hirakund (Odisha): World's longest dam, is located on the Mahanadi river.

Jayakwadi Project (Maharashtra): A masonry spillway across the river Godavari.

Kahalgaon Project (Bihar): The 840-MW Kahalgaon Super Thermal Power Project, a joint venture between National Thermal Power Corporation and the Russian State Enterprise Foreign Economic Association, was on August 12,1996 commissioned and put into commercial operation.

Kakrapara Project (Gujarat): On the Tapti river near Kakrapara, in Surat district.

Kangsabati Project (West Bengal): The project, put in operation in 1965, is located on the Kangsabati and Kumari rivers.

Karjan Project (Gujarat): A masonry dam across Karjan river near Jitgarh village in Nandoo Taluka of Bharuch district.

Kosi Project (Bihar): A multipurpose project, which serves Bihar and Nepal.

Koyna Project (Maharashtra): It is built on a tributary of river Krishna with a capacity of 880 MW. It feeds power to Mumbai-Pune industrial belt.

Krishna Project (Maharashtra): Dhom dam near Dhom village on Krishna and Kanhar dam near Kanhar village on Varna river in Satna district.

Kukadi Project (Maharashtra): Five independent storage dams, i.e. Yodgaon, Manikdohi, Dimbha, Wadaj and Pimpalgaon Jog. The canal system comprises (i) Kukadi left bank Canal, (ii) Dimbha left bank canal, (iii) Dimbha right bank canal, (iv) Meena feeder and (v) Meena branch.

Kundoh Project (Tamil Nadu): It is in Tamil Nadu whose initial capacity of 425 MW has since been expanded to 535 MW.

Let Bank Ghaghra Canal (Uttar Pradesh): A link channel taking off from the left bank of Ghaghra river of Girja barrage across Sarju.

Madhya Ganaga Canal (Uttar Pradesh): A barrage across Ganga in Bijnore district.

Mahanadi Delta Scheme (Odisha): The irrigation scheme will utilize releases from the Hirakud reservoir.

Mahanadi Reservoir Project (Madhya Pradesh): It has three phases: (1) Ravishankar Sagar Project and feeder canal system for supply of water of Bhilai Steel Plant and Sandur dam across Sandur village. (2) Extension of Mahanadi feeder canal. (3) Pairi dam.

Mahi Project (Gujarat): A two –phase project, one across the Mahi river near Wanakbori village and the other across Mahi river near Kadana.

Malaprabha Project (Karnataka): A dam across the Malaprabha in Belgaum district.

Mayurakshi Project (West Bengal): An irrigation and hydro-electric project comprise the Canada dam.

Minimato Bango Hasdeo Project (Madhya Pradesh): This project is locted at Hasdeo Bango river in Korba district and envisages construction of a masonry dam. A hydel power plant of 120 MW capacity has been commissioned on the Bango dam.

Nagarjunasagar (Andhra Pradesh): On the Krishna river near Nandikona village (about 44 km from Hyderabad).

Panam Project (Gujarat): A gravity masonry dam across Panam river near Keldezar village in Panchmahal district.

Parambikulam Aliyar (Joint venture of Tamil Nadu and Kerala): The integrated harnessing of eight rivers, six in the Annamalai Hills and two in the plains.

Pochampad (Andhra Pradesh): Across Godavari river.

Pong Dam (Punjab): It is an important hydro-electric project located on Beas river.

Rajasthan Canal (Indira Gandhi Canal- Rajasthan): The Project uses water released from Pong dam and provides irrigation facilities to the north-western region of Rajasthan, i.e., a part of the Thar desert. It consists of Rajasthan feeder canal (with the first 167 km in Punjab and Haryana and the remaining 37 km in Rajasthan) and 445 km Rajasthan main canal entirely in Rajasthan.

Rajghat Dam Project (Madhya Pradesh): The Rajghat Dam and Rajghat Hydro Electric Projects are Inter-State projects of MP and UP. The Rajghat Dam is almost complete. All the three units of Rajghat Hydro-Electric Project had been synchronized during 1999 and power generation has been continuing ever since.

Ramganga (Uttarakhand): A dam across Ramganga, a tributary of the Ganga river located in Garhwal district. The project has, besides reducing the intensity of floods in central and western Uttar Pradesh, provided water for the Delhi water supply scheme.

Ranjit Sagar Dam (Thein Dam) (Punjab): A multi-purpose highest dam in the country, built on the Ravi river for the benefit of Punjab, Haryana and Jammu and Kashmir.

Rihand Project (Uttar Pradesh and Madhya Pradesh): It is the largest man-made lake in India on the borders of Uttar Pradesh and Madhya Pradesh with a capacity of 300 MW annually.

Sabarmati (Gujarat): A storage dam across Sabarmati river near Dhari Village in Mehsana district and wasna barrage near Ahmedabad.

Salal Project (Jammu & Kashmir): With the successful completion of the 2.5-km long tailrace tunnel, the 690-MW Salal (Stage I and II) project in Jammu and Kashmir became fully operational on August 6, 1996.

Sarda Sahayak (Uttar Pradesh): A barrage across the river Ghaghra, a link channel, a barrage across River Sarda and a feeder channel of two major aqueducts over rivers Gomti and Sai.

Sharavathi Project (Karnataka): It is located at the Jog Falls with a capacity of 891 MW. It primarily feeds Bengaluru industrial region and also Goa and Tamil Nadu.

Sone High Level Canal(Bihar): An extension on Sone Barrage project.

Tawa Project (Madhya Pradesh): A project across the Tawa river, a tributary of the Narmada in Hoshangabad district.

Tehri Dam Project (Uttarakhand): Earth and rock-fill dam on Bhagirathi river in Tehri district.

Tungabhadra Project (Joint Project of Andhra Pradesh and Karnataka): On the Tungabhadra River.

Ukai Project (Gujarat): A multipurpose project across Tapti river near Ukai village.

Upper Krishna Project (Karnataka): A project consisting of Narayanpur dam across the Krishna river and a dam at Almatti.

Upper Penganga Project (Maharashtra): Two reservoirs on Penganga river at Isapur in Yavatmal district and the other on Rayadhu river at Sapli in Parbhani district.

Uri Power Project (Jammu & Kashmir): It is located on the river Jhelum in the Uri Tehsil of Baramulla district in Jammu & Kashmir. It is a 480-MW hydroelectric project which was dedicated to the nation of February 13, 1997.

HUMIDITY AND PRECIPITATION

Humidity of the air refers to the content of water vapour present in the air at a particular time and place. The moisture retaining capacity or humidity capacity refers to the capacity of an air of certain volume at certain temperature to retain maximum amount of moisture content.

Saturated air: The air having moisture content equal to its humidity capacity is called saturated air. Humidity capacity of air is directly proportional to the temperature, i.e. higher the temperature higher the humidity capacity of "the air.

Dew Point: The temperature at which the air becomes "saturated is called Dew Point. Humidity is expressed in three forms:

1. **Absolute Humidity** : The total weight of. moisture content per volume of air at a definite temperature is called absolute humidity.
2. **Specific Humidity** : It represents the actual quantity of moisture present in a definite air. It is expressed In gm/kg3.
3. **Relative Humidity** : Relative humidity is defined as a ratio of the amount of water vapour actually present in the air having definite volume and temperature (absolute humidity) to the maximum amount the air can hold (humidity capacity). It is generally expressed in percentage.

Forms of Condensation

The transformation of gaseous form of water into solid or liquid form is called condensation. The process of condensation depends upon two factors:

i. Temperature deficiency and
ii. Relative humidity of air

Due to fall in temperature, condensation starts around the dust particles present in the atmosphere. These tiny dust particles are called 'hygroscopic nuclei'.

Dust, smoke and salt particles are considered good hygroscopic nuclei. The process of condensation results into the formation of dew, fog, clouds and mist. These are known as different forms of condensation.

- **Dew** : When the temperature of the. air falls below the dew point, the water vapour present in it starts condensing and gets accumulated on the leaves of plants and trees in the form of small water droplets. It is called dew.
- **Frost** : When the process of condensation takes place at such temperature that the water vapour gets converted into solid form without condensing into liquid form, it is called frost. In other words we can say that frozen dew is called frost.
- **Fog** : Fog consists of small microscopic water droplets which are kept in suspension in the air near the ground surface. It is formed when the moist air (with relative humidity above 97%) becomes saturated, reaches its dew point and further cools.
- **Mist** : Mist is a type of fog. In case of mist, the visibility is more than 1 km but less than 2 km, whereas in the case of fog it is difficult to see the objects beyond 200 m of distance.

Clouds

Clouds are defined as aggregates of innumerable tiny water droplets, ice particles or mixture of both in the air generally much above the ground surface.

Classification of Clouds

1. **High Clouds (Height 6000-12000m)**
   - **Cirrus clouds :** The high altitude detacher clouds having fibrous (chain-like) or silk; appearance are called cirrus clouds. These clouds are indicative of cyclones.
   - **Cirro-cumulus :** These are white coloured clouds having patches of small white flakes or small globules which are arranged it distinct groups.
   - **Cirro-stratus clouds :** These clouds are generally white in colour and spread in the sky like milky thin sheets. They indicate the arrival of a cyclone in the near future.
2. **Middle clouds (Height 2000-6000m)**
   - **Alto-stratus clouds:** These are thin sheets of grey or blue clouds having fibrous or uniform appearance.
   - **Alto-cumulus clouds:** These clouds are characterised by white and gray wavy layers or globular forms are called as 'Sheep clouds', or 'wool pack clouds'.
3. **Low clouds (Height upto 2000m)**
   - **Stratus clouds:** These are dense, low lying fog-like clouds of dark gray colour, but are seldom close to the ground surface.
   - **Nimbo-stratus clouds:** These are low clouds of dark colour, very close to the ground surface.

Rainfall

When the moist air rises upwards, it starts condensing due to fall in temperature. Clouds are formed after condensation of water vapour around hygroscopic nuclei. Rainfall occurs only when cloud droplets become so large due to that the air becomes unable to hold them. Based on the mode of origin, rainfall is classified into these types:

1. **Convectional Rainfall:** It occurs due to thermal convection currents caused by the insolation heating of ground surface. It occurs when the warm and moist air rises due to convection. When this reaches at certain height it becomes saturated which cause heavy rainfall.
2. **Orographic Rainfall:** When warm and moist air is obstructed by any hill or plateau, it starts ascending along the slope of the hill or plateau and gets cooled. As a result, it gets saturated and the process of condensation starts. But, as the wind starts

descending along the slope of opposite side, it becomes warm and dry and and due to decreased humidity a little rainfall occur. This region is called '**Rain shadow region**' or '**Leeward slope**'.

Cyclonic or Frontal Rainfall: Cyclonic rainfall is caused due to ascending of moist air and adiabatic cooling caused by convergence of two extensive air masses of entirely different physical, properties.

AIR MASSES, FRONTS AND CYCLONES

Air Mass: An air mass may be defined as a large body of air whose physical properties, especially temperature and humidity are more or less uniform horizontally for hundreds of kilometres.

Fronts: A Front is that sloping boundary which separates two opposing air masses having contrasting characteristics in terms of air temperature, humidity, density, pressure and wind direction.

Classification of Fronts

Warm Fronts : Warm front is that gently sloping frontal surface along which warm and light air becomes active and aggressive and rises rapidly over the cold and dense air.

Cold Fronts : In this front, cold and heavy air is active and uplifts the warm and light air.

Cyclones

Cyclones are centres of low pressure surrounded by closed isobars and having increasing pressure outwards. It has closed air circulation from outside towards the Central low pressure in such a way that air blow inward in anticlockwise in the Northern Hemisphere and clockwise in the S. Hemisphere. Cyclones range in shape circulars, elliptical to 'V shaped. Cyclone-immense influence on the climate and weather. Wherever they reach, they alter the temperature and precipitation conditions of the place. The origin of these cyclones is associated with the polar fronts, where two contrasting air masses converge.

Cyclones are of Two Types

1. Temperate Cyclones : These may becircular, elliptical contrasting air masses e.g. warm, moist and light tropical air masses (westerly winds) and cold and dense polar air masses. After their formation, temperate cyclones move in easterly direction

under the influence of westerly winds and control the weather conditions in the middle latitudes. The path followed by these cyclones is called 'Storm Track'.

2. Tropical Cyclones: This type of cyclones developed in the regions lying between the Tropics of Cancer and Capricorn are called Tropical cyclones. The weather conditions of low latitudes mainly rainfall regimes are largely controlled by tropical cyclones. Tropical cyclones usually develop in summer season in the vicinity of Inter-Tropical Convergence Zone (ITCZ) over warm ocean surface.

EARTHQUAKES

An earthquake is a vibration or oscillation of the surface of the earth caused by the elasticity or the isostatic adjustment of the rocks, beneath the surface of the earth. It may be caused by human as well as natural activities. Before the earthquake waves hit a region, the amount of 'Radon' gas increases in the atmosphere of that region. Therefore, rise in the concentration ofRadon gas' over the atmosphere of a region indicates that the region is going to be hit by an earthquake. The point, below the surface of the earth, from where the seismic (earthquake) waves originate is called the 'Focus' of the earthquake. The place, perpendicularly above the focus on the surface.

The waves generated during an earthquake are called Seismic Waves, which arc classified into 3 types:

i. **Primary or Longitudinal Waves.** These are simply known as P-Waves. These are longitudinal waves analogous to the sound waves. These waves have the maximum velocity among the three types of seismic waves. These waves can pass through the solid as well as liquid mediums, though their velocity gets slowed down in the liquid medium.

ii. strong>Secondary or Transverse Waves. These are also called as S-Waves. These are transversal waves analogous to the light waves. These waves can travel only through the solid medium and disappear in the liquid medium. Since these waves do not pass through the core of the earth, they give an idea about the core being in liquid state.

iii. **Surface or Long Period Waves.** These are also known as 'L' waves which originate when 'P' wave hits the surface. These waves affect only the surface of the earth. These are the most destructive and cover the longest distance among the three types of waves.

The Sismographs

The instruments sensitive to the seismic waves, which help us to measure the intensity of an earthquake are called 'Seismographs' -Different scales are used to measure the intensity of earthquakes such as

1. Rossy-Feral Scale - This scale measures the earthquakes between 1 to 11 units.
2. Mercalli Scale - It is an empirical scale. It is divided into 12 units.
3. Richter Scale - It is a mathematical (logarithmic) scale, which measures the intensity of an earthquake between 0 to 9. For each unit of increase in the Richter Scale, the amplitude of the earthquake wave increases by a factor of 10.

The lines joining the regions of same seismic intensity are called as Isoseismal Lines. The lines joining the places which experience the earthquake termors at the same time called Homoseismal Lines.

Tsunami

'Tsu-na-mi' is a Japanese word which means oncoming oceanic waves. These waves are very long and with less oscillation which originate in the oceans due to earthquakes that occur on the ocean-bed. The movement of water with the Tsunami waves is upto complete depth which makes them more caastrophic.