Indian Geography Black Book PDF

Milky Way Galaxy and Earth Solar System

Our Sun (a star) and all the planets around it are part of a galaxy known as the Milky Way Galaxy. A galaxy is a large group of stars, gas, and dust bound together by gravity. They come in a variety of shapes and sizes. The Milky Way is a large barred spiral galaxy. The Milky Way is the galaxy that contains our Solar System.

Earth solar system consists of:

- The Sun
- The Planets (8 Planets)
- Dwarf Planets such as Pluto, Ceres, Eris etc. & countless fragments of left – overs called asteroids, meteors, comets & satellites of the planets (called small solar system Bodies).

Some Facts about Solar System

- **Biggest Planet** : Jupiter
- **Smallest Planet** : Mercury
- **Nearest Planet to Sun** : Mercury
- **Farthest Planet from Sun** : Neptune
- **Nearest Planet to Earth** : Venus
- **Brightest Planet** : Venus
- **Brightest star after Sun** : Sirius
- **Planet with maximum satellites** : Saturn
- **Coldest Planet** : Neptune
- **Hottest Planet** : Venus
- **Heaviest Planet** : Jupiter
- **Red Planet** : Mars
- **Biggest Satellite** : Ganymede
- **Smallest Satellite** : Deimos
- **Blue Planet** : Earth
- **Morning/Evening Star** : Venus
- **Earth's Twin** : Venus
- **Green Planet** : Neptune
- **Planet with a big red spot** : Jupiter
- **Greatest Diurnal Temperature** : Mercury

Earth Latitude & Longitude

Earth Latitude

- Imaginary lines drawn parallel to the equator. Measured as an angle whose apex is at the centre of the Earth.
- The equator represents 0° latitude, while the North Pole is 90° N & the South Pole 90° S.Equator is the 'Greatest Circle' that can be drawn on the earth's surface.
- 23½° N represents Tropic of Cancer while 23½° S represents Tropic of Capricorn.
- 66½° N represents Arctic Circle while 66½° S represents Antarctic Circle.
- The distance between any two parallels of latitude is always equal.
- 1 degree latitude = 111 km (approx.).

Earth Longitude

- The lines of longitude are drawn as a series of semicircles that extend from the North Pole to the South Pole through the equator. They are also called meridians.
- The distance between any two meridians is not equal.
- At the equator, 1 degree = 111 km. At 30°N or S, it is 96.5 km. It goes on decreasing this way until it is zero at the poles.
- There are 360 meridians of longitude. The prime meridian is a longitude of 0°, passing through the Royal Observatory at Greenwich near London.
- This meridian is taken by geographers to divide the earth into the eastern & the western hemispheres.
- Each meridian of longitude is a semi-circle. 180° meridian (International Date Lin(e) lies exactly opposite to 0° meridian. Such points are called Antipodal Points.
- The earth is divided into 24 longitudinal zones, each being 15° or 1 hour apart in time (4 minutes / degre(e).

Longitude & Time

- Places that are on the same meridian have the same local (sun) time. Since the earth makes one complete revolution of 360° in 24 hours, it passes through 15° in one hour or 1° in 4 minutes.
- The earth rotates from West to East, hence places east of Greenwich see the sun earlier & gain time whereas places west of Greenwich see the sun later & lose time.
- India, whose longitudinal extent is approx. 30°, has adopted only one time zone, selecting the 82.5°E for the standard time which is 5 hours & 30 minutes ahead of GMT (Greenwich Mean Tim(e).

International Date Line

- It is the 180° meridian running over the Pacific Ocean, deviating at Aleutian Islands, Fiji, Samoa & Gilbert Islands. It is a zig-zag line.
- Travelers crossing the Date Line from west to east (i.e., from Japan to US(A) repeat a day & travelers crossing it from east to west (i.e., from USA to Japan) lose a day.

Important Parallels of Latitude

1. The Tropic of Cancer: It is in the northern hemisphere at an angular distance of 23 1/2° (23°30'N) from the equator.

2. The Tropic of Capricorn: It is in the southern hemisphere at an angular distance of 23 1/2° (23°30'S) from the equator.

3. The Arctic Circle: It lies at a distance of 66 1/2° (66°30'N) north of the equator.

4. The Antarctic Circle: It lies at a distance of 66 1/2° (66°30'S) south of the equator. There are two solstices each year, called the Summer Solstice & the Winter Solstice.

Summer Solstice: The day of 21st June when the sun is vertically overhead at the Tropic of Cancer (23°30'N). It is longest day in Northern Hemisphere.

Winter Solstice: The day of 22nd December when the sun is vertically overhead at the Tropic of Capricorn (23°30'S). It is Shortest Day in Northern Hemisphere.

Meridians of Longitude

The semi-circles running from pole to pole or from north to south are known as meridians of longitude & distance between them are measured in degrees of longitude. Greenwich Meridian or Prime Meridian with a value of 0° longitude serves as a common base for numbering meridians of longitude lying on either side of it — east as well as west. There are 360 meridians including Prime Meridian. Each degree of a longitude is divided into sixty equal parts, each part is called a minute. Each minute is again divided into sixty equal parts, each part being called a second.

Local Time: Local time of any place is 12 noon when the sun is exactly overhead. It will vary from the Greenwich time at the rate of four minutes for each degree of longitude.

Greenwich Mean Time: The time at 0° longitude is called Greenwich Mean Time. It is based on local time of the meridian passing through Greenwich near London.

Indian Standard Time: It is fixed on the mean of 82 1/2°E Meridian, a place near Allahabad. It is 5 1/2hours ahead of Greenwich Mean Time.

Facts about earth

- The Earth is also called Blue Planet. It is the densest of all planets.
- **Earth Circumference**: 40,232 Kilometers.
- **Earth Area**: 510 million square Kilometers
- **Average distance from sun:** 149 million Kilometers.
- **Earth Perihelion:** Nearest position of earth to sun. The earth reaches its perihelion on January 3 every year at a distance of about 147 million-Kilometers.
- **Aphelion:** Farthest position of earth from sun. The earth reaches its aphelion on July 4, when the earth is at a distance of 152 million Kilometers.
- The shape of the earth is oblate spheroid or oblate ellipsoid (i.e. almost spherical, flattened a little at the poles with a slight bulge at the centr(e).

Types of Earth Movements:

1. Rotation or daily movement.
2. Revolution or annual movement.

Earth Rotation

- Earth spins on its imaginary axis from west to east in 23 hrs, 56 min & 40.91 sec.
- Rotational velocity at equator is 1667 Km/hr & it decreases towards the poles, where it is zero.

Earth's rotation results in

i. Causation of days & nights;
ii. A difference of one hour between two meridians which are 15° apart;
iii. Change in the direction of wind & ocean currents; Rise & fall of tides everyday.
iv. The longest day in North Hemisphere is June 21, while shortest day is on 22 Dec (vice-versa in Southern Hemispher(e). Days & nights are almost equal at the equator.

Earth Revolution

• It is earth's motion in elliptical orbit around the sun. Earth's average orbital velocity is 29.79 Km/sec.
• Takes 365 days, 5 hrs, 48 min & 45.51 sec. It results in one extra day every fourth year.

Revolution of the earth results in

i. Change of seasons
ii. Variation in the lengths of days & nights at different times of the year
iii. Shifting of wind belts
iv. Determination of latitudes.

Earth Eclipses

Lunar Eclipse

- When earth comes between sun & moon.
- Occurs only on a full moon day. However, it does not occur on every full moon day because the moon is so small & the plane of its orbit is tilted about 5° with respect to the plane of the earth's orbit. It is for this reason that eclipses do not occur every month.
- This light is red because the atmosphere scatters the other colors present in sunlight in greater amounts than it does red.

Solar Eclipse

A **solar eclipse** is a type of eclipse that occurs when the Moon passes between the Sun & Earth, & the Moon fully or partially blocks the Sun. This can happen only at new moon.

INTERIOR STRUCTURE OF THE EARTH

The uppermost layer of the earth's crust which is capable of supporting life is called Lithosphere.
The earth's interior has three different layers; they are
(i) the crust (ii) mantle & (iii) the core.

(a) Earth's Crust:
All of the Earth's landform (mountains, plains, & plateaus) are contained within it, along with the oceans, seas, lakes & rivers. The thickness of earth's crust is about 30 km. There are two different types of crust: thin oceanic crust that underlies the ocean basins & thicker continental crust that underlies the continents. The boundary between the crust & the mantle is Mohorovicic Discontinuity.
(b) Earth's Mantle: It is the thick, dense rocky matter that surrounds the core with a radius of about 2900 km. The mantle covers the majority of the Earth's volume. This is basically composed of silicate rock rich in iron & magnesium. This layer is separated from the core by Gutenberg-Wiechert Discontinuity. The outer & the inner mantle are separated by another discontinuity named Repetti discontinuity.
(c) Earth's Core: Earth's Core is composed mainly of an iron & nickel alloy. The thickness of core is about 3400 km. The core is made of two layers: the outer core, which borders the mantle, and the inner core.

EARTHQUAKES

(a) The sudden tremors or shaking of earth's crust for a few second is called an earthquake.
(b) The point at the surface directly above the focus is called the earthquake epicentre.
(c) When the earth moves in an earthquake, it can cause waves in the ocean, & if a wave grows large enough, it's called a "tsunami". Underwater earthquakes sometimes produce large waves called Tsunami.
(e) The magnitude of an earthquake & the intensity of shaking, is measured on a numerical scale called Mercalli Scale. On the scale, 3 or less is scarcely noticeable, & magnitude 7 (or mor(e) causes damage over a wide area. The point of origin of earthquake is called Seismic focus. The point on the earth's surface vertically above the earth's surface is called Epicentre.
(f) The passage of earthquake waves is recorded by Seismograph. The magnitude of waves is measured on Richter's scale. For measurement of the intensity of the earthquake (damage cause(d), the Modified Mercalli Intensity Scale is used.

Distribution of Earthquakes

(a) Around the Pacific Ocean along a belt of volcanoes known as the Ring of Fire. Roughly 90% of all earthquakes occur along the Ring of Fire.
(b) From the middle of Asia (Himalayas, Caspian Se(a) through the Mediterranean Sea to West Indies.
(c) Mid-Atlantic ridge belt.

VOLCANOES

A volcano is an opening in Earth's crust that allows molten rock from beneath the crust to reach the surface. This molten rock is called magma when it is beneath the surface and lava when it erupts or flows from a volcano. Along with lava, volcanoes also release gases, ash, and rock.

Types of Volcanoes

Geologists have classified five different types of volcanoes. This classification is based on the geomorphic form, magma chemistry, & the explosiveness of the eruption. The least explosive type of volcano is called a **basalt plateau.** These volcanoes produce a very fluid basaltic magma with horizontal flows. Deposits of these volcanoes can be as thick as 1800 meters. Large basalt plateaus are found in the Columbia River Plateau, western India, northern Australia, Iceland, Brazil, Argentina, & Antarctica. Some basaltic magmas can produce very large slightly sloping volcanoes, 6 to 12°, that have gently flowing magmas called shield volcanoes **Shield volcanoes** can be up to 9000 meters tall. The volcanoes of the Hawaiian Islands are typical of this type.
A cinder cone is a small volcano, between 100 & 400 meters tall, made up of exploded rock blasted out of a central vent at a high velocity. These volcanoes develop from magma of basaltic to intermediate composition. They form when large amounts of gas accumulate within rising magma. Examples of cider cones include Little Lake Volcano in California & Paricuti Volcano in Mexico.
Composite volcanoes are made from alternate layers of lava flows & exploded rock. Their height ranges from 100 to 3500 meters tall. The chemistry of the magma of these volcanoes is quite variable ranging from basalt to granite.
Magmas that are more granitic tend to be very explosive because of their relatively higher water content. Water at high temperatures & pressures is extremely volatile. Examples of composite volcanoes include Italy's Vesuvius, Japan's Mount Fuji, & Washington State's Mount Rainier & Mount St. Helens.

Classification on the basis of Periodicity of Eruptions:

Active Volcano:
Volcanoes which erupt periodically. E.g. Maona Loa in Hawaii, Etna in Sicily, Vesuvius in Italy, Stromboli in Mediterranean Sea, etc.
Dormant Volcano:
Volcanoes which has been quiet for a long time but in which there is a possibility of eruption. E.g. Fujiyama in Japan, Krakatoa in Indonesia, Barren island Volcano in Andamans, etc.
Extinct Volcano:
An extinct volcano is one which is no longer active and hasn't erupted in historical times. E.g. Mount Kilimjaro.
Distribution of Volcanoes in the World
About 15% of world's active volcanoes are found along the 'constructive or divergent' plate margins, whereas 80% volcanoes are associated with the 'destructive or convergent' plate boundaries.

Earth Mountains

Mountains Types – Fold, Block, Volcanic Mountains
Types of Mountains
Fold Mountains: They are formed when the rocks of the crust of the earth folded under stress, mainly by forces of compression (as a result of series of earthquakes). **E.g.**Himalayas, Alps, Andes, Rockies, Atlas, etc.
Block Mountains: Earth movements generate tensional forces that tend to pull the crust apart,and faults are developed. If the block enclosed by faults remains as it is rises, and the land on either side subsides, the upstanding block become the horst or block mountain. The Great African Rift Valley (valley floor is graben), The Rhine Valley and the Vosges Mountain in Europe are examples.
Volcanic Mountains: Volcanic mountains are formed due to volcanic activity.These are, in fact, volcanoes which are built up from material ejected from fissures in the earth's crust. The materials include molten lava, volcanic bombs, cinders, ashes, dust and liquid mud.Volcanic mountains are often called mountains of accumulation. They are common in the Circum-Pacific belt and include such volcanic peaks as Mt. Fuji (Japan) Mt. Mayon (Philippines), Mt. Merapi (Sumatr(a) etc.

Plateau -Plateau are elevated uplands with extensive level surfaces, and usually descends steeply to the surrounding lowland.
Types of plateau - Tectonic and Volcanic plateau.

Plain- A plain is a type of landform made up of a flat area that can exist in valleys, lowlands, on plateaus, or uplands.
Types of plain- Structural Plain, Erosional Plain, Depositional plain, Glacial plain and Abyssal plain.

ROCKS & MINERALS

About 98 per cent of the total crust of the earth is composed of eight elements like oxygen, silicon, aluminum, iron, calcium, sodium, potassium & magnesium, & the rest is constituted by titanium, hydrogen, phosphorous, manganese, sulphur, carbon, nickel & other.
(1) **The three types of rocks are**
(i) Igneous Rocks
(1) Igneous rocks solidify from a liquid magma as it cools. When magma cools rapidly, mineral crystals do not have time to grow very large. On the other hand when magma cools slowly crystals grow to several millimeters or more in size.

Granite & basalt are the examples of IR. Igneous rocks are classified as
(a) Extrusive Rocks
Extrusive igneous rocks solidify from molten material that flows over the earth's surface (lav(a).
Common extrusive rocks are
(a) basalt,
(b) andesite, &
(c) rhyolite.

(b) Intrusive Rocks
Intrusive rocks form from molten material (magm(a) that flows & solidifies underground.
Common rock types within the intrusive category are granite & diorite.
ii. Sedimentary Rocks
These are types of rocks created from deposition of layers upon layers of sediments over time. These types of rocks are formed on the Earth's surface as well as underwater.
Examples – Sandstone, limestone, stromatolites, oil shale & coal shale, gypsum, shale, & conglomerate.
iii. Metamorphic Rocks
Metamorphic rocks are any rock type that has been altered by heat, pressure, and/or the chemical action of fluids & gases. When igneous rocks, or sedimentary rocks, or even metamorphic rocks get buried very deep under the earth's surface, a process that takes millions of years, they get changed into something else by the enormous pressure & heat inside the earth.
Some examples of metamorphic rocks are:
- Limestone being changed into marble
- Shale turning into slate
- Granite being changed into gneiss
- Sandstone turning into quartzite.

ATMOSPHERE

Atmosphere is a thick gaseous envelope that surrounds the earth & extends thousands of kilometers above the earth's surface. Much of the life on the earth exists because of the atmosphere otherwise the earth would have been barren. Nitrogen & Oxygen comprise 99% of the total volume of the atmosphere.

Structure of the Atmosphere
The atmosphere consists of almost concentric layers of air with varying density & temperature.
(a) Troposphere:
- Lowest layer of the atmosphere.
- The height of troposphere is 16 km thick over the equator & 10 km thick at the poles.
- All weather phenomena are confined to troposphere (e.g. fog, cloud, frost, rainfall, storms, etc.)
- Temperature decreases with height in this layer roughly at the rate of 6.5° per 1000 metres, which is called **normal lapse rate.**
- Upper limit of the troposphere is called **tropopause** which is about 1.5 km.

(b) Stratosphere:
- The stratosphere is more or less devoid of major weather phenomenon but there is circulation of feeble winds & cirrus cloud in the lower stratosphere.

- Jet aircrafts fly through the lower stratosphere because it provides perfect flying conditions.
- Ozone layer lies within the stratosphere mostly at the altitude of 15 to 35 km above earth's surface.
- Ozone layer acts as a protective cover as it absorbs ultra-voilet rays of solar radiation.
- Depletion of ozone may result in rise of temperature of ground surface & lower atmosphere.
- Temperature rises from -60°C at the base of the stratosphere to its upper boundary as it absorbs ultra-voilet rays.
- Upper limit of the Stratosphere is called **stratopause.**

(c) Mesosphere

- Mesosphere extends to the height of 50-90 km.
- Temperature decreases with height. It reaches a minimum of -80°C at an altitude of 80-90 km
- The upper limit is called **mesopause**.

(d) Thermosphere

- It lies at 80 km to 640 km above the earth's surface.
- It is also known as ionosphere.
- Temperature increases rapidly with increasing height.
- It is an electrically charged layer. This layer is produced due to interaction of solar radiation & the chemicals present, thus disappears with the sunset.
- There are a number of layers in thermosphere e.g.
- D-layer, E-layer, F-layer & G-layer.
- Radio waves transmitted from earth are reflected back to the earth by these layers.

(e) Exosphere

- This is the uppermost layer of the atmosphere extending beyond the ionosphere.
- The density is very low & temperature becomes 5568°C.
- This layer merges with the outer space.

About Ionosphere

At heights of 80 km (50 miles), the gas is so thin that free electrons can exist for short periods of time before they are captured by a nearby positive ion. This portion of the atmosphere is ionized & contains plasma which is referred to as the ionosphere. The Ultraviolet (UV), X-Ray & shorter wavelengths of solar radiation ionizes the atmosphere. The ionosphere is broken down into the D, E & F regions.

Pressure Belts of the World

PRESSURE & WIND BELTS

Air pressure is thus defined as total weight of a mass of column of air above per unit area at sea level. The amount of pressure exerted by air at a particular point is determined by temperature & density which is measured as a force per unit area.

Aneroid Barometer-It is the most common type barometer used in homes.

(a) Equatorial Low Pressure Belt:

At the Equator heated air rises leaving a low-pressure area at the surface. This low pressure area is known as **equatorial low pressure.** The zone shifts along with the northward or southward movement of sun during summer solstice & winter solstice respectively. The pressure belt is thermally induced because the ground surface gets heated during the day. Thus warm air expands, rises up & creates low pressure. They are also called Doldrums. Extend 5° N & S to the equator.

(b) Sub-tropical High Pressure Belt:

The warm air risen up at the equator due to heating reaches the troposphere & bend towards the pole. Due to coriollis force the air descends at 30-35° N & S latitude thus creates the belt of **sub-tropical high pressure.** The pressure belt is dynamically induced as it owes its origin to the rotation of the earth & sinking & settling of winds. This zone is characterized by anticyclonic conditions which cause atmospheric stability & aridity. These pressure belts are called Horse latitudes.

(c) Temperate Low Pressure Belt:

This belt is located between 60-65 degrees N & S latitudes in both the hemisphere. This pressure belt is also dynamically induced. The belt is more developed & regular in the southern hemisphere than the northern due to over dominance of water in the former.

(d) Polar High Pressure Belt:

High pressure persists at the pole due to low temperature. Thus the Polar High Pressure Belt is thermally induced as well as dynamically induced as the rotation of earth also plays a minor role.

Coriolis Force

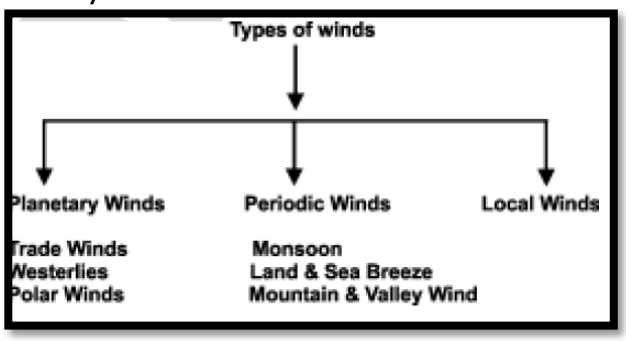
The rotation of the Earth creates force, termed Coriolis force, which acts upon wind. Instead of wind blowing directly from high to low pressure, the rotation of the Earth causes wind to be deflected off course. In the Northern Hemisphere, wind is deflected to the right of its path, while in the Southern Hemisphere it is deflected to the left. Coriolis force is absent at the equator, & its strength increases as one approaches either pole. Furthermore, an increase in wind speed also results in a stronger Coriolis force & thus in greater deflection of the wind.

Winds

When the movement of the air in the atmosphere is in a horizontal direction over the surface of the earth, it is known as the wind. Movement of the wind is directly controlled by pressure. Horizontally, at the Earth's surface wind always blows from areas of high pressure to areas of low pressure usually at speeds determined by the rate of air pressure change between pressure belts.

TYPES OF WINDS

I. Planetary winds:



Planetary winds are major component of the general global circulation of air. These are known as planetary winds because of their prevalence in the global scale throughout the year. Planetary winds occur due to temperature & pressure variance throughout the world.

The planetary winds are discussed below:

(a) Trade winds

Winds blowing from the Subtropical High Pressure Belt or horse latitudes towards the Equatorial Low Pressure Belt or the ITCZ are the trade winds. In the Northern Hemisphere, the trade winds blow from the northeast & are known as the **Northeast Trade Winds**; in the Southern Hemisphere, the winds blow from the southeast & are called the **Southeast Trade Winds.**

(b) Westerlies

The Westerlies are the prevailing winds in the middle latitudes between 35° & 65° latitude, blowing from the high pressure area in the Sub Tropical High Pressure Belt i.e. horse latitudes towards the sub polar low pressure belt. The winds are predominantly from the south-west to north-east in the Northern Hemisphere & from the north-west to south-east in the Southern Hemisphere.

The Westerlies are strongest in the winter season & times when the pressure is lower over the poles, while they are weakest in the summer season & when pressures are higher over the poles. The Westerlies are particularly strong, especially in the Southern Hemisphere, as there is less land in the middle latitudes to obstruct the flow.

(c) Polar Wind

The winds blowing in the Arctic & the Antarctic latitudes are known as the Polar Winds. They have been termed the **'Polar Easterlies',** as they blow from the Polar High Pressure belt towards the Sub-Polar Low-Pressure Belts. In the Northern Hemisphere, they blow in general from the north-east, & are called the North-East Polar Winds; & in the Southern Hemisphere, they blow from the south-east & are called the South- East Polar Winds. As these winds blow from the ice-capped landmass, they are extremely cold.

They are more regular in the Southern Hemisphere than in the Northern Hemisphere.

II. Periodic Winds:

They change their direction periodically with change in season. Land & sea breezes & monsoon winds are winds of a periodic type. Land & sea breezes occur daily, whereas the occurrence of monsoon winds is seasonal. Following are periodic winds:

(a) Monsoon winds
(b) Land & Sea Breeze
(c) Mountain & Valley Breeze

(a) Monsoon Winds

Monsoons are regional scale wind systems that periodically change direction with the passing of the seasons. Like land & sea breezes, these wind systems are created by the temperature contrasts that exist between the surfaces of land & ocean.

(b) Land & Sea Breezes:

A **land breeze** is created when the land is cooler than the water such as at night & the surface winds have to be very light. When this happens the air over the water slowly begins to rise, as the air begins to rise, the air over the surface of the ocean has to be replaced, this is done by drawing the air from the land over the water, thus creating a sea breeze.

A **sea breeze** is created when the surface of the land is heated sufficiently to start rising of the air. As air rises, it is replaced by air from the sea; created a sea breeze. Sea breezes tend to be much stronger & can produce gusty winds as the sun can heat the land to very warm temperatures, thereby creating a significant temperature contrast to the water.

(c) Mountain & Valley winds:

Mountain-valley breezes are formed by the daily difference of the thermo effects between peaks & valleys. In daytime, the mountainside is directly heated by the sun, the temperature is higher, air expands, air pressure reduces, & therefore air will rise up the mountainside from the valley & generate a valley breeze.

Anabatic & Katabatic winds - Anabatic Winds are upslope winds driven by warmer surface temperatures on a mountain slope than the surrounding air column. Katabatic winds are downslope winds created when the mountain surface is colder than the surrounding air and creates a down slope wind.

III. Local Winds

These local winds blow in the various region of the world.

Hot Winds

Sirocco - Sahara Desert
Leveche - Spain
Khamsin - Egypt
Harmattan - Sahara Desert
Santa Ana - USA
Zonda - Argentina
Brick fielder – Australia
Loo – India

Cold Winds
Mistral - Spain & France
Bora - Adriatic coast
Pampero - Argentina
Buran - Siberia

JET-STREAMS
The JET STREAMS located in the upper troposphere (9 - 14 km) are bands of high speed winds (95-190 km/hr). The term was introduced in 1947 by Carl Gustaf Rossby. Average speed is very high with a lower limit of about 120 km per hours in winter & 50 km per hours in summer. The two most important types of jet streams are the **Polar Jet Streams &** the **Subtropical Jet Streams.**

ELNINO & LANINA - El Nino is a naturally occurring phenomenon characterized by the abnormal warming of sea surface temperature in the central and eastern equatorial Pacific Ocean. La Nina is a climate pattern that describes the cooling of surface ocean waters along the tropical west coast of South America.

CYCLONES
Cyclones are well developed low-pressure systems surrounded by closed isobars having increasing pressure outside & closed air circulation towards the centre such that the air blows inward in anticlockwise direction in the northern hemisphere & clockwise in the southern hemisphere.

A. Tropical cyclones
Tropical cyclones are intense cyclonic storms that develop over the warm oceans of the tropics. Surface atmospheric pressure in the centre of tropical cyclones tends to be extremely low.
The main characteristics of tropical cyclones are:-

- Have winds that exceed 34 knots (39 miles/hr)
- Blow clockwise in the Southern Hemisphere
- Blow Counter-clockwise in the Northern Hemisphere
- This is one of the most devastating natural calamities. They are known as Cyclones in the Indian Ocean, Hurricanes in the Atlantic, Typhoons in the Western Pacific & South China Sea, & Willy-Willies in the Western Australia.

B. Temperate cyclones
The systems developing in the mid & high latitude, beyond the tropics are called the middle latitude or temperate cyclones.
Extra tropical cyclones form along the polar front. Two air masses of contrasting physical properties: one air mass is polar in character & is cold, denser & north-easterly in direction while the other air mass is tropical in origin & is warm, moist, lighter & south westerly in direction.
An **anticyclone** is a region of high atmospheric pressure related to the surrounding air, generally thousands of kilometre in diameter & also known as a **high** or **high-pressure system.** Winds in an anticyclone form a clockwise out-spiral in the Northern Hemisphere; whereas they form an anti-clockwise out-spiral in the Southern Hemisphere.

OCEANOGRAPHY
The study of physical and biological aspects of the ocean is called Oceanography. It reveals that the sea floor is not a flat area. It consists of mountains, plateaus, plains & trenches etc.
Some major submarine features are described below.

(a) Continental Shelf
(1) The portion of the land which is submerged under sea water is continental shelf.
(2) The continental shelf is shallow & its depth is not more than 200 metres.
(3) In all about 7.5 percent of total area of the oceans is covered by the continental shelves.

The shelves are of great use to man because:
1. Marine food comes almost entirely from them.
2. About 20 percent of oil & gas of the world is extracted from them.
3. They are the sites of productive fishing grounds.

(b) Continental Slope
It is an area of steep slope extending just after the continental shelf up to a considerable depth from where a gentle sea plain takes its form. The extent of the slope area is usually between 200-2000 m. But sometimes it may extend to 3660 metre from the mean sea level. The continental slope along many coasts of the world is followed by deep canyon like trenches terminating as fan shaped deposits at the base. Continental slope covers 8.5 percent of the total ocean area.

(c) Continental Rise
The gently sloping surface at the base of the continental slope is called continental rise. It may extend to hundreds of km into the deep ocean basin.

(d) Deep Ocean Basins
It is the portion of sea floor that lies between the continental margin & the oceanic ridge system. It contains deep-ocean trenches, abyssal plains, & broad volcanic peaks called sea mounts.

I. Deep-Ocean Trenches:
These are long, narrow features that form the deepest parts of the ocean. Most trenches are located in the Pacific Ocean. They may reach 10,000 m deep. Mariana trench is about 11,000 m below sea level in Pacific Ocean.

II. Abyssal Plains:
These are the most level places on Earth. The abyssal plains may have less than 3 m of relief over a distance that may exceed 1300 km. Scientists determined that abyssal plains low relief is due to the fact that thick accumulations of sediment, transported by turbidity currents, have buried rugged ocean floor.

III. Sea mounts:

It is an isolated volcanic peak that rises at least 1000 m (3300 ft) above the deep-ocean floor. They are more extensive in the Pacific Ocean, where subduction zones are common. These undersea volcanoes form near oceanic ridges (regions of seafloor spreading). Some of these volcanoes may emerge as an island.

(e) Submarine Canyons

These are depressions with walls of steep slopes & have a V shape. They exist on the continental slopes & the shelves. They are found to have a length of 16 km at the maximum.

OCEAN CURRENTS

Ocean currents are large masses of surface water that circulate in regular patterns around the oceans. Those that flow from equatorial regions polewards have a higher surface temperature & are called warm currents. Those that flow from polar regions equatorwards have a lower surface temperature & are called cold currents.

Factors affecting Ocean Current

1. **The planetary winds**.
2. **Temperatures.**
3. **Salinity**.
4. **The earth's rotation.**
5. **Land**.

THE CIRCULATION OF OCEAN CURRENTS

THE ATLANTIC OCEAN CIRCULATION

At the 'shoulder' of north-east Brazil, the protruding lands mass splits the South Equatorial Current into the Cayenne Current which flows along the **Guiana coast, & the Brazilian Current** which flows southwards along the east coast of Brazil.

Part of the current enters the Gulf of Mexico & emerges from the Florida Strait between Florida & Cuba as the **Florida Current.** The rest of the equatorial water flows northwards east of the Antilles **to join the Gulf Stream off the south-eastern U.S.A.** The Gulf Stream Drift is one of the strongest ocean currents & hugs the coast of America as far as Cape Hatteras (latitude 35°N), where it is deflected eastwards under the combined influence of the Westerlies & the rotation of the earth. It reaches Europe as the **North Atlantic Drift**.

The cold **Labrador Current** drift southeastwards between West Greenland & Baffin Island to meet the warm Gulf Stream off Newfoundland. On reaching the west coast of Africa the current is diverted northwards as **the cold Benguela Current** (the counterpart of the Canaries Current).

THE PACIFIC OCEAN CIRUCLATION

The North- East Trade Winds blow the **North Equatorial Current** off the coasts of the Philippines & Formosa into the East China Sea as the Kuroshio or Japan current. The cold **Bering Current or Alaskan Current** creeps southwards from the narrow Bering Strait & is joined by Okhotsk Current to meet the warm Japan Current as **the Oyashio,** off Hokkaido. The South Equatorial Current, driven by the South-East Trade winds, flows southwards along the coast of Queensland as the **East Australian Current**. Obstructed by the tip of southern Chile, the current turns northwards along the western coast of South America as the **cold Humboldt or Peruvian Current.**

THE INDIAN OCEAN CIRCULATION

The currents of **South Indian Ocean** form a circuit. The Equatorial Current, turning southwards past Madagascar as the Agulhas or Mozambique Current merges with the West Wind Drift, flowing eastwards & turns equator-wards as the West Australian Current. In the North Indian Ocean, there is a complete reversal of the direction of currents between summer & winter, due to the changes of monsoon winds. In summer from June to October, when the dominant wind is the South-West Monsoon, the currents are blown from a south-westerly direction as the South- West Monsoon Drift. This is reversed in winter; Monsoon blows the currents from the north-east as the North-East Monsoon Drift. The currents of the North Indian Ocean, demonstrate most convincingly the dominant effects of winds on the circulation of ocean currents.

OCEANS

Arctic Ocean- The Arctic Ocean is the smallest of the world's five oceans. The Northwest Passage (US & Canad(a) & Northern Sea Route (Norway & Russi(a) are two important seasonal waterways.

It is a body of water between Europe, Asia, & North America, mostly north of the Arctic Circle.

Lowest point: Fram Basin (Now known as Nansen Basin).

Atlantic Ocean- The Atlantic Ocean is the second largest of the world's five oceans. The Kiel Canal (Germany), Oresund (Denmark-Sweden), Bosporus (Turkey), Strait of Gibraltar (Morocco-Spain), & the Saint Lawrence Seaway (Canada-US) are important strategic access waterways.

It is a body of water between Africa, Europe, the Southern Ocean, & the Western Hemisphere. It includes includes Baltic Sea, Black Sea, Caribbean Sea, part of the Drake Passage, Gulf of Mexico, Mediterranean Sea, & other tributary water bodies.Panama Canal connects the Atlantic and Pacific oceans.
Lowest point: Milwaukee Deep in the Puerto Rico Trench.
Indian Ocean - The Indian Ocean is the third largest of the world's five oceans. Four critically important access waterways are the Suez Canal (Egypt), Bab-el Mandeb (Djibouti-Yemen), Strait of Hormuz (Iran-Oman), & Strait of Malacca (Indonesia-Malaysi(a). It is a body of water between Africa, the Southern Ocean, Asia, & Australia. It includes Andaman Sea, Arabian Sea, Bay of Bengal, Flores Sea, Gulf of Aden, Gulf of Oman, Java Sea, Red Sea, Strait of Malacca, Timor Sea, & other tributary water bodies.
Lowest point: Java Trench

Pacific Ocean - The Pacific Ocean is the largest of the world's five oceans. Strategically important access waterways include the La Perouse, Tsugaru, Tsushima, Taiwan, Singapore, & Torres Straits.
It is body of water between the Southern Ocean, Asia, Australia, & the Western Hemisphere. It includes Bali Sea, Bering Sea, Coral Sea, East China Sea, Gulf of Alaska, Philippine Sea, Sea of Japan, Sea of Okhotsk, Tasman Sea, & other tributary water bodies.
Lowest point: Challenger Deep in the Mariana Trench.

Southern Ocean- The Southern Ocean is also called Antarctic Ocean. It is the fifth-largest drainage basin in the world by basin area (14,000,000 sq. km).

TIDES

The tide is the periodic rise & fall of the sea levels caused by the combined effects of the gravitational forces exerted by the Moon & Sun & rotation of the earth. Most places in the ocean usually experience two high tides & two low tides each day (semidiurnal tid(e), but some locations experience only one high & one low tide each day (diurnal tid(e). The times & amplitude of the tides at the coast are influenced by the alignment of the Sun & Moon, by the depth of the ocean, & by the shape of the coastline & near-shore bathymetry.

Causes of Tides
- Gravitational attraction between moon & the earth.
- Gravitational attraction between sun & the earth.
- Attraction force of the earth towards earth centre.
- Moon is mainly responsible for the tides.

Types of Tides
- Semi diurnal tides - Recur at the intervals of 12½ hours.
- Diurnal Tides - Recur at the intervals of 24½ hours.
- Spring Tides - once a fortnight, due to the revolution of the moon & its declination.
- Neap tides - Once a fortnight due to the revolution & declination of moon.
- Monthly tides - Due to the revolution of the moon & its position at Perigee & Apogee.

SPRING TIDES
Spring tides are especially strong tides or high tides. They occur when the Earth, the Sun, & the Moon are in a line. The gravitational forces of the Moon & the Sun both contribute to the tides. Spring tides occur during the full moon & the new moon.

NEAP TIDES
Neap tides are especially weak tides. They occur when the gravitational forces of the Moon & the Sun are perpendicular to one another (with respect to the Earth). Neap tides occur during quarter moons. The Bay of Fundy between Nova Scotia & New Brunswick in Canada experiences the world's greatest tidal range of 50 feet (15.25 meters).

MOUNTAINS OF INDIA

The Himalayas
Means 'Abode of Snow'. They are one of the youngest fold mountain ranges in the world & comprise mainly sedimentary rocks. They stretch from the Indus River in the west to the Brahmaputra River in the east. The Eastern Himalayas-made up of Patkai Hills, Naga Hills, Mizo Hills & the Garo, Khasi & Jaintia Hills-are also known as Purvanchal.
The Pamir, popularly known as the Roof of the World, is the connecting link between the Himalayas & the high ranges of Central Asia.
Can be divided into 3 parallel or longitudinal zones, each with separate features.

THE GREAT HIMALAYAS OR THE HIMADRI
There are few passes & almost all of them have a height above 4,500 m. They include Shipki La & Bara Lapcha La in Himachal Pradesh, Burzil & Zoji La in Kashmir, Niti, Lipulekh & Thang La in Uttarankhand, & Jelep La & Nathu La in Sikkim.
Average elevation extends upto 6000m & some of the world's highest peaks are here :

Mt Everest (or Sagarmatha or Chomo Langm(a)	8848 m (in Nepal)
Mt Kanchenjunqa	8598 m (in Indi(a)
Mt Makalu	8481 m (in Nepal)
Mt Dhaulagiri	81 72 m (in Nepal)
Mt Cho Oyu	8153m (in Nepal)
Mt Nanga Parbat	8126m (in Indi(a)
Mt Annapurna	8078 m (in Nepal)
Mt Nanda Devi	7817 m (in Indi(a)

LESSER HIMALAYAS OR THE HIMACHAL

Average height of mountains is 3700 – 4500 m.
Mountains & valleys are disposed in all direction (mountains rising to 5000 m & the valleys touching 1000 m).
Its important ranges are : Dhauladhar, Pir Panjal, Nag Tibba, Mussoorie.

Outer Himalayas or The Shiwaliks

Lowest range (average elevation is 900-1200 m).
Forms the foothills & lies between the Lesser Himalayas & the plains.

TRANS – HIMALAYAN ZONE

This range lies to the north of the Great Himalayas. It has some important ranges like Karakoram, Laddakh, Zanskar, etc. The highest peak in this region is K2 or Godwin Austin (8611m, in Pak occupied Kashmir). Other high peaks are Hidden Peak (8068 m), Broad Peak (8047 m) & Gasherbrum II (8035 m).
The longest glacier is Siachin in the Nubra valley, which is more than 72 km long (biggest glacier in the worl(d). Biafo, Baltaro, Batura, Hispar are the other important glaciers in this region. This area is the largest snow-field outside the Polar Regions.

IMPORTANT FACTS

⇒ Uttar Pradesh borders the maximum number of States-8(Uttarakhand, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar). After UP is Assam, which touches the border of 7 States.
⇒ **Tropic of Cancer passes through 8 States** : Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura, Mizoram.
⇒ **Indian Standard Meridian passes through 5 States** : Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Orissa, Andhra Pradesh.
⇒ **10 States form the coast of India. They are** : Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Telangana, Orissa & West Bengal.
⇒ 2 Union Territories, viz. Daman & Diu & Pondicherry are also on the coast.
⇒ The Union Territories of Andaman & Nicobar Islands & Lakshadweep are made up of islands only.

THE PLAINS OF INDIA

To the south of the Himalayas & to the north of the Peninsula lies the great plains of North India. They are formed by the depositional works of three major river systems, Indus, Ganga & Brahmaputra. The vast plains of north India are alluvial in nature & the westernmost portion is occupied by the Thar Desert.
The thickness of the alluvium is maximum in the Ganga plains & minimum in the Western Plains.
The plains consist of four divisions:
Bhabar : Along the foothills of Shiwaliks. Highly porous and small streams known as Chos and Raos disappear.
Tarai : Re-emergence of streams. Zone of excessive dampness – South of Bhabar.
Bhangar : Older alluvial plains, contain calcareous formations called 'kankar'.Also exihibit small tracts of saline and alkaline efflorescences known as Reh,Kallar or Thur.

Khadar : New alluvium & forms the flood plains along the river banks. Also called Bet lands.
Delta Plains : It is extension of Khadar land.Consists mainly of old mud,new mud and marsh. The uplands are called Chars while marshy areas are known as Bils.

PENINSULAR PLATEAU OF INDIA

Spreads south of the Indo-Gangetic plains flanked by sea on three sides. This plateau is shaped like a triangle with its base in the north. The Eastern Ghats & the Western Ghats constitute its eastern & western boundaries, respectively.
⇒ Narmada, which flows through a rift valley, divides the region into two parts: The Malwa Plateau in the north & the Deccan Plateau in the south.
⇒ Vindhya Plateau is situated south of Malwa plateau.
⇒ Chhota Nagpur Plateau lies to the west of Bengal basin, the largest & most typical part of which is the Ranchi plateau.
⇒ The Deccan Plateau is the largest plateau in India. It is made up of lava flows in the Cretaceous-Eocene era through the fissure eruptions.

ISLANDS OF INDIA

Total coastline of India: 7516 km. Longest coastline: Gujarat (Second longest is of Andhra Pradesh).

The Andaman & Nicobar Group

Andaman and Nicobar is a group of 572 islands of which the largest is Middle Andaman. The Andaman are believed to be extensions of mountains system in the N.E. part of the country. Saddle Peak (737 m) in North Andaman is the highest peak.

Volcanic Islands: Barren & Narcondam Islands. Barren is in the process of eruption these days after lying dormant for 200 years.

The Arabian Sea Group

All the islands in the Arabian Sea are coral islands & are surrounded by Fringing Reefs (North: Lakshadweep, South: Minicoy).

DO YOU KNOW?
Ten Degree Channel separates Andaman from Nicobar (Little Andaman from Car Nicobar)
Duncan Passage lies between South Andaman & Little Andaman.
Nine Degree Channel separates Kavaratti from Minicoy Island.
Eight Degree Channel separates Minicoy Island (Indi(a) from Maldives.

RIVERS OF INDIA

In India, the rivers can be divided into two main groups:
Himalayan Rivers-1) Indus 2) Ganga 3) Brahmaputra
Peninsular Rivers-1) East flowing 2) West flowing

HIMALAYAN RIVERS OF INDIA

THE INDUS SYSTEM

It has a total length of 2880 km (709 km in Indi(a). Rises in Tibet (Chin(a) near Mansarovar Lake. In Jammu & Kashmir, its Himalayan tributaries are: Zanskar, Dras, Gartang, Shyok, Shigar, Nubra, Gilgit, etc. Its most important tributaries, which join Indus at various places, are: Jhelum, Chenab, Ravi, Beas & Satluj.

Sources: Jhelum from Verinag (SE Kashmir), Ravi from Kullu Hills near Rohtang Pass in Himachal Pradesh, Beas from a place near Rohtang Pass in Himachal Pradesh & Satluj from Mansarovar– Rakas lakes in W. Tibet, Chenab-near Bara Lacha Pass in Himachal Pradesh

THE GANGA SYSTEM

It is 2525 km long of which 1450 km is in Uttarakhand & UP, 445 km in Bihar & 520 km in West Bengal. The Ganga, the head stream is constituted of two main rivers – Bhagirthi & Alaknanda, which combine at Devprayag to form Ganga.

Sources: Bhagirathi from Gaumukh, Alaknanda from Badrinath, Mandakini from Kedarnath (all from Uttarakhan(d). Yamuna (1375 km) is its most important tributary (on right bank). It rises at the Yamunotri glacier in Uttarakhand. It runs parallel to Ganga for 800km & joins it at Allahabad. Important tributaries of Yamuna are Chambal, Betwa (480 km) & Ken (all from south). Apart from Yamuna, other tributaries of Ganga are Ghaghra (1080 km), Son (780 km), Gandak (425 km), Kosi (730 km), Gomti (805 km), Damodar (541 km). Kosi is infamous as 'Sorrow of Bihar', while Damodar gets the name 'Sorrow of Bengal' as these cause floods in these regions. Hooghli is a distributory of Ganga flowing through Kolkata.

THE BRAHMAPUTRA SYSTEM

It has a total length of 2900 km. It rises in Tibet (from Chemayungdung glacier), where it is called Tsangpo, & enters the Indian territory (in Arunachal Pradesh) under the name Dihang. Important Tributaries: Subansiri, Kameng, Dhansiri, Manas, Teesta. In Bangladesh, Brahmaputra is known by the name of Jamuna while Ganga gets the name Padma. Meghna is the most important distributory before it enters the Bay of Bengal.
The combined stream of Ganga & Brahmaputra forms the biggest delta in the world, the Sundarbans, covering an area of 58,752 sq. km. Its major part is in Bangladesh.
Majuli island on Brahamaputra in Assam, is the biggest river island in the world.

Brahmaputra, or the Red River, is navigable for a distance of 1384 km up to Dibrugarh & serves as an excellent inland water transport route.

RIVERS OF THE PENINSULA IN INDIA

A. EAST FLOWING RIVERS OF INDIA (OR DELTA FORMING RIVERS)

Mahanadi River (885 km) : Rises in Raipur district in Chhatisgarh. Hirakud dam is on Mahanadi river.

Godavari River (1465 km) : Also called Vriddha Ganga or Dakshina Ganga. It is the longest peninsular river. Rises in Nasik. Main tributaries: Manjira, Penganga, Wardha, Indravati, Wainganga, etc.

Krishna River (1327 km): Rises in Western Ghats near Mahabaleshwar. Main tributaries: Koyna, Dudhganga, Panchganga, Malprabha, Bhima, Tungabhadra, etc.

Cauvery River (805 km): It is the largest peninsular river (maximum amount of water). Infact, it is the only peninsular river which flows almost throughout the year. It rises from the Brahmagir range of Western Ghats. Main tributaries: Hemavati, Lokpawni, Shimsa.
Subernrekha River (395 km) & Brahmani (705 km) : Rises from Ranchi Plateau.

B. WEST FLOWING RIVERS IN INDIA

Narmada River (1312 km) : Rises in Amarkantak Plateau & flows into Gulf of Khambat and form estuary. It forms the famous Dhuan Dhar Falls near Jabalpur. Main tributaries: Hiran, Burhner, Banjar, Sher, Shakkar, Tawa, etc.

Tapti River (724 km) : Rises from Betul district in Maharashtra. Also known as twin or handmaid of Narmada. Main tributaries: Purna, Betul, Arunavati, Ganjal, etc.

Sabarmati River (416 km) : Rises from Aravallis in Rajasthan.

Mahi River (560 km) : Rises from Vindhyas in Maharashtra.

Luni River (450 km) : Rises from Aravallis. Also called Salt River. It is finally lost in the marshy grounds at the head of the Rann of Kuchchh.

Sharavati is a west flowing river of the Sahyadris. It forms the famous Jog or Gersoppa or Mahatma Gandhi Falls (289 m), which is the one of the highest waterfall in India.

Note:
⇒ The largest man-made lake in India is Indira Sagar Lake, which is the reservoir on Indira Sagar Dam on Narmada Sardar Sarovar Project, Omkareshwar Project & Maheshwar Project in Gujarat-Madhya Pradesh.
⇒ Chilka Lake (Oriss(a) is the largest brackish water lake of India. Otherwise also, it is the largest lake of India.
⇒ Wular Lake (J & K) is the largest fresh water lake of India. Dal Lake is situated in J & K.
⇒ From Sambhar & Didwana Lake (Rajasthan), salt is produced. Other important lakes are Vembanad in Kerala & Kolleru & Pulicat in Andhra Pradesh.

The three important Gulfs in the Indian Territory are:
Gulf of Kachchh (west of Gujarat) : Region with highest potential of tidal energy generation.
Gulf of Cambay or Gulf of Khambat (Gujarat) : Narmada, Tapti, Mahi & Sabarmati drain into it.
Gulf of Mannar (south east of Tamil Nadu) : Asia's first marine biosphere reserve.

IMPORTANT RIVER VALLEY PROJECTS IN INDIA

- **Bhakhra Nangal Project:** On Satluj in Punjab. Highest in India. Height 226 m. Reservoir is called Gobind Sagar Lake.
- **Mandi Project:** On Beas in Himachal Pradesh.
- **Chambal Valley Project:** On Chambal in Madhya Pradesh & Rajasthan. 3 dams are there under this project: Gandhi Sagar Dam, Rana Pratap sagar Dam & Jawahar Sagar dam.
- **Damodar Valley Project:** On Damodar in Bihar.
- **Hirakud:** On Mahanadi in Orissa. World's longest dam: 4801 m.
- **Rihand :** On Son(river) in Mirzapur. Reservoir is called Govind Vallabh Pant reservoir.
- **Mayurkashi Project :** On Mayurkashi in West Bengal.
- **Kakrapara Project :** On Tapi in Gujarat.
- **Nizamsagar Project:** On Manjra in Andhra Pradesh.
- **Nagarjuna Sagar Project :** On Krishna in Andhra Pradesh.
- **Shivasamudram Project:** On Cauvery in Karnataka.
- **Tata Hydel Scheme :** On Bhima in Maharashtra.
- **Sharavathi Hydel Project :** On Jog Falls in Karnataka.
- **Kundah & Periyar Project -** On Bhawani and Periyar river respectively in Tamil Nadu.
- **Farakka Project:** On Ganga in West Bengal. Apart from power & irrigation it helps to remove silt for easy navigation.
- **Ukai Project :** On Tapti in Gujarat.
- **Salal Project :** On Chenab in J & K.
- **Mata Tila Multipurpose Project :** On Betwa in U.P & M.P.
- **Thein Project :** On Ravi, Punjab.
- **Pong Dam :** On Beas, Punjab.

Climate of INDIA

India has tropical monsoon type of climate.

CLIMATE SEASONS IN INDIA

In India, the year can be divided into four seasons, resulting from the monsoons which occur mainly due to the differential heating of land & movement of the sun's vertical rays.
The highest temperature experienced in South is in April while in North it is in May & June. **NORWESTERS 'Cherry Blossoms'** are there in Karnataka, beneficial to coffee plantation & **'Mango showers'** in elsewhere South India, which are beneficial to mango crops.
The south – west monsoon enters the country in two currents, one blowing over the Bay of Bengal & the other over the Arabian Sea. This monsoon causes rainfall over most of the country (except Tamil Nadu & Thar Desert are(a).
The Bay of Bengal branch after crossing the deltaic region enters the Khasi valley in Meghalaya & gets entrapped in it due to funnel shape of the region. It strikes Cherrapunji in a perpendicular direction causing heavies rainfall in Mausryam (Approx. 1400 cm). From mid-Sept to mid-Dec, the monsoon retreats. As the sun's vertical rays start shifting towards the Tropic of Capricorn, the low pressure area starts moving south & winds finally start blowing from land to sea. This is called **north-east monsoon.** The withdrawal of monsoon is a much more gradual process than its onset. It causes rainfall in Tamil Nadu as the winds pick some moisture from Bay of Bengal. This explains the phenomenon why Tamil Nadu remains dry when the entire country receives rain & why it gets rain when practically the entire country is dry.

CLIMATIC REGIONS OF INDIA

India can be divided into a number of climatic regions.
Tropical Rainy Climate: Found in the west coastal plains, the Western Ghats & parts of Assam. Characterised by high temperatures throughout the year. Rainfall, though seasonal, is heavy- about 200 cm annually during May-November.
Tropical Savanna Climate : In most of the peninsula region except the semi-arid zone in the leeward side of the Western Ghats. It is characterized by long dry weather throughout winter & early summer & high temperature (above 18.2 Deg.(c); annual rainfall varies from 76 cm in the west to 150 cm in the east.
Tropical Semi-Arid Steppe Climate : It prevails in the rain-shadow belt running southward from Central Maharashtra to Tamil Nadu in the leeward side of the Western Ghats & the Cardamom Hills. It is characterized by low rainfall which varies from 38 cm to 80 cm, high temperature between 20 & 30 degree.
Tropical & Subtropical Steppes : Large areas in Punjab, Haryana & Kutch region. Temperature varies from 12-35 Deg. c. The maximum temperature reaches up to 49 Deg.c. The annual rainfall, varying from 30.5-63.5 cm, is also highly erratic.
Tropical desert : This climate extends over the western parts of Banner, Jaisalmer & Bikaner districts of Rajasthan & parts of Kutch. It is characterized by scanty rainfall (30.5 cm), which is highly erratic. Rains are mostly in the form of cloud-burst. Mean monthly temperature is uniformly high (about 35(c).
Humid Subtropical Climate with Dry Winters : This area includes south of the Himalayas, east of the tropical & subtropical steppes & north of tropical savannah. Winters are mild to severe while summers are extremely hot. The annual rainfall varies from 63.5 cm to more than 254 cm, most of it received during the south west monsoon season.

Mountain Climate : Such type of climate is seen in mountainous regions which rise above 6,000 m or more such as the Himalayas & the Karakoram Range.

Factors Affecting India's Climate

Latitude: The Indian landmass is equally divided by The Tropic of Cancer. Hence, half of India has tropical climate & another half has subtropical climate.
Altitude: While the average elevation in the coastal areas is about 30 metre, the average elevation in the north is about 6,000 metre. The Himalayas prevent the cold winds from Central Asia from entering the Indian subcontinent. Due to this, the subcontinent gets comparatively milder winters as compared to Central Asia.
Pressure & Winds: The Indian subcontinent lies in the region of north-easterly winds. These winds originate from the subtropical high-pressure belt of the northern hemisphere. After that, these winds blow towards south. They get deflected to the right due to the Coriolis force & then move towards the low pressure area near the equator.

Soils

1. Alluvial Soil:
In India it covers about 40 per cent of the total land area. It is very fertile & contributes the largest share of agricultural wealth. Found mostly in the Northern Plains, starting from Punjab in the west to West Bengal & Assam in the east. The northern parts & the coastal areas of Gujarat also have some deposits of alluvial soil. The fine particles of sand, silt & clay are called alluvium.
The alluvial soil can be divided into
a. Old alluvium, called bhangar
b. New alluvium, called khadar.
Alluvial soil is most suited to irrigation & can produce bumper crops of rice, wheat, maize, sugarcane, tobacco, cotton, jute, oilseeds, etc.

2. Black Soil:
The black soil is locally called regur, a word derived from Telugu word 'reguda'. It is also called the Black Cotton Soil, as cotton is the most important crop grown in this soil. The black soil is mostly found in the Deccan Trap, covering large areas of Maharashtra, Gujarat & western Madhya Pradesh. The black soil is well-known for its capacity to hold moisture. Black soil is widely used for producing cotton, wheat, linseed, millets, tobacco & oilseeds.

3. Red Soil:
The red soil occupies about 18 per cent area of India, mostly in the south-eastern part of the Peninsular India. The red soil is found in Tamil Nadu, parts of Karnataka, southeast Maharashtra, eastern parts of Andhra Pradesh, Madhya Pradesh, Orissa & Jharkhand. The red colour is due to the high percentage of iron contents. This soil is rich in potash, but poor in lime, phosphate, nitrogen & humus. Red soils can give excellent yields of cotton, wheat, rice, pulses, millet, tobacco, oilseeds, etc.

4. Laterite Soil:
The word 'laterite' has been derived from a Latin word meaning 'brick'. It is mainly found on the summits of the Western Ghats, Eastern Ghats, Rajmahal Hills, Vindhyas, Satpuras & Malwa plateau. It is well- developed in southern Maharashtra, & parts of Orissa, West Bengal, Karnataka, Andhra Pradesh, Kerala, Bihar, Assam & Meghalaya. Such climatic conditions promote leaching of soil. Leaching is a process in which heavy rains wash away the fertile part of the soil.
The laterite soil is red in colour & composed of little clay & much gravel of red sandstones.
Due to intensive leaching, the laterite soil generally lacks fertility & is of low value for crop production. But when manured & timely irrigated, the soil is suitable for producing plantation crops like tea, coffee, rubber, coconut, arecanut, etc.

5. Mountain Soil:
The mountain soil is generally found on the hill slopes covered with forests. This soil is also found in the Western & Eastern Ghats & in some parts of the Peninsular India. This soil is rich in humus, but poor in potash, phosphorus & lime.
In the Himalayan region wheat, maize, barley & temperate fruits are grown on this soil. This soil is especially suitable for producing plantation crops, such as tea, coffee, spices & tropical fruits in Karnataka, Tamil Nadu & Kerala.

6. Desert Soil:
The desert soil is found mostly in the arid & semi-arid regions, receiving less than 50 cm of annual rainfall. Such regions are mostly found in Rajasthan & the adjoining areas of Haryana & Punjab. The Rann of Kachchh in Gujarat is an extension of this region. The desert soil has sand (90 to 95 per cent) & clay (5 to 10 per cent). Desert soil can produce a variety of crops, such as wheat, millet, barley, maize, pulses, cotton, etc.

NATURAL VEGETATION IN INDIA

Tropical Evergreen Forests-In areas over 250 cm rainfall. In Western Ghats, hilly areas in N.E. India & Andaman & Nicobar Islands. Trees are rosewood, shisham, ebony, ironwood, etc.
Tropical Deciduous Forests-In areas having rainfall 100 – 200 cm. In peninsular region & along the foothills of Himalayas in Shivaliks, Bhabhar & Tarai. The trees of these forests drop their leaves for about 6-8 weeks during the spring & early summer when sufficient moisture isn't available. Trees are teak, sal, bamboo, sandalwood, rosewood, etc.
Tropical Thorny Forests-In areas having rainfall between 25 & 80 cm. In arid regions of Rajasthan, Punjab, Haryana & Gujarat. Trees are palm, acacia, etc.

Alpine and Sub-alpine Forest-In hills of Southern India & the Himalayas.**The type of trees depends upon the height of the mountain** : Sal & bamboo below 1000 m; oaks, chestnuts & other fruit trees, & chir forests between 1000 & 2000 m; pine, deodar, silver fern & spruce between 1600 & 3300 m; above 3600 m alpine forests with trees like silver firs, pines, birches, etc. Alpine forests give way to Alpine grasslands & scrubs as we move up further.

Tidal or Mangrove Forests- Also known as Littoral or Swamp Forests. Occur along the sea coast & in the estuaries of rivers, especially in Sunderbans & the Andamans. Most important tree is Sundari. It provides hard & durable timber which is used for construction & building purposes as well as for making boats.

IMPORTANT POINTS

Madhya Pradesh has the largest area under forests followed by Arunanchal Pradesh. As per percentage of forest area to total area, first is Andaman & Nicobar Islands, followed by Mizoram. In Mangrove forests, West Bengal holds the first position, followed by Gujarat & Andaman & Nicobar Islands. The lowest forest percentage is in Haryana & Punjab, because of the extensive agriculture.

BIOSPHERE RESERVES IN INDIA

In India, the first biosphere reserve – Nilgiri biosphere reserve – came into being in 1986. So far, 18 biosphere reserves have been set up in the country.

NATIONAL PARKS & WILD LIFE SANCTUARIES

There are 103 National Parks & 544 Wildlife Sanctuaries in India. Madhya Pradesh & Andaman & Nicobar Islands have the maximum number of National Parks (9 each) while Andaman & Nicobar Islands has 96 & Maharashtra has 42 Wildlife Sanctuaries (maximum in Indi(a).

CROPPING SEASONS IN INDIA

Kharif Crops of India

Sown in summers between May & July, & harvested after the rains, in September & October.

E.g. : Rice, Jowar, Bajra, Maize, Cotton, Jute, Sugarcane, Tobacco, Groundnut, Pulses, etc.

Rabi Crops of India

Sown at the beginning of winter & harvested before the onset of the summer season, between February & April. E.g. : Wheat, barley, oilseeds, gram, potatoes, etc.

Zaid Crops

They are raised between April & June.

E.g. : Melon, Watermelon, Cucumber, Toris, leafy & other vegetables.

Cash Crops of India (Commercial Crops)

Grown mainly for the market, only a small portion of the product is consumed by the farmers themselves (cotton, sugarcane etc.)

Sugarcane	In UP, Maharashtra, Karnataka
Cotton	In Maharashtra, Gujarat, Andhra Pradesh
Jute & Mesta	In West Bengal, Bihar, Assam
Tea	In Assam, West Bengal, Himachal Pradesh
Coffee	In Kamalaka, Kerala, Tamil Nadu
Rubber	In Kerala, Tamil Nadu, Karnataka
Silk	In Karnataka, Jammu& Kashmir, Andhra Pradesh. In India all 4 varieties of silk are available: Mulberry, Tussar, Eri & Muga. Mulberry is the main variety, while Tussar is mainly found in Bihar.
Tobacco	In Gujarat, Andhra Pradesh, Karnataka

Jhum

Shifting type of cultivation practiced in the hill slopes of Assam, Arunachal Pradesh, Mizoram & Nagaland. In this, the trees are felled & set on fire. The ash of the burnt trees & the other vegetation adds to the fertility of soil. This land is used for 2-3 years till the soil gets exhausted & the jhum is abandoned. It is also known as Dahi, Koman, Penda, Podu and Bewar in different parts of country.

Green Revolution

- To increase yield per hectare government of India introduced a programme called Green Revolution.
- The Green Revolution (first) was launched in 1967-68.
- Father of Green Revolution - Dr. Norman Borlaug.
- Father of Green Revolution in India - Dr. M.S. Swaminathan.
- Green Revolution focused the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, & distribution of hybridized seeds, synthetic fertilizers, & pesticides to farmers.

- **White Revolution**
- The White Revolution in the country has been achieved by means of Operation Flood. It was carried out in three phases.
- Operation Flood I - 1970 - 1981
- Operation Flood II - 1981 - 1985

- Operation Flood III - 1985 - 1996.
- White revolution launched to increase the quality & quanity of milk & dairy products.
- The Father of the White Revolution in India is Dr. Varghese Kurien. He is also known as **Milkman of India.**

TRANSPORT IN INDIA

Indian Railway-Indian railway system is the largest in Asia & the fourth largest in the world. It is the biggest departmental public undertaking in the country. The first train ran in India between Bombay & Thane, a stretch of 34 km. on April 16th, 1853. The second train ran between Howrah & Hooghly in 1854. The headquarters of Indian Railway is in New Delhi.

The first electric train in India was 'Deccan Queen'. It was introduced in 1929 between Bombay & Poona. Indian Railways has the second biggest electrified system in the world after Russia.

The fastest train in India is the Shatabadi Express whose maximum speed is 140 km/hr. The total route covered is approx 63,000 km. The total number of railway stations in India is 7,100. The longest railway platforms are: Gorakhpur railway station, Uttar Pradesh, India: 1,366.33 m (4,483 ft) (longest in the worl(d). Mumbai is the destination where maximum number of trains in India head for.

The first Metro Rail was introduced in Kolkata(West Bengal) on October 24, 1984. The two stations connected were Dumdum & Belgachhia.

Konkan Railways India : It is a project to shorten the distance between Maharashtra, Goa & Karnataka. The total route length is 786 km between Apta (Maharashtr(a) & Mangalore (Karnatak(a).

Water Transport in India

The total length of navigable waterways in Indian comprising rivers, canals, backwaters, etc, is 14,500 km out of which 3700 km is navigable by mechanised boats.

The government has recognised the following National Waterways of India:

NW 1: Allahabad to Haldia – 1,629 kms
NW 2: Sadia to Dhubari (on Brahmaputra river) – 891 kms
NW 3: Kollam to Kottapuram – 186 kms
NW 4: Kakinada to Marakkanam (Along Godavari & Krishna river) – 1,100 km

Ports in India

The Waterways Authority in India divides Indian ports into three categories, major, minor & intermediate. India has about 190 ports in all, with 12 major & the rest intermediate & minor.

The 12 Major Ports are:

Port	State
Kolkata (including Haldi(a)	West Bengal
Paradip	Orissa
Vishakhapatnam	Andhra Pradesh
Chennai	Tamil Nadu
Ennore	Tamil Nadu
Tuticorin	Tamil Nadu
Cochin	Kerala
New Mangalore	Karnataka
Mormugao	Goa
Jawaharlal Nehru	Maharashtra
Mumbai	Maharashtra
Kandla	Gujarat

BOUNDARY LINES

Durand Line	Pakistan & Afghanistan
MacMohan Line	India & China
Radcliffe Line	India & Pakistan
Maginot Line	France & Germany
Oder Niesse Line	Germany & Poland
Hindenberg Line	Poland & Germany (at the time of First World War)
38th Parallel	North & South Korea
49th Parallel	USA & Canada

Area Geography & Boundaries OF INDIA

1. Geography Area of India: 32,87,263 sq. km. Accounts for 2.4% of the total world area & roughly 16% of the world population.
2. Mainland India has a coastline of 6,100 km. Including the Lakshadweep & Andaman & Nicobar Islands, the coastline measures about 7516.6 km.
3. In India, of the total land mass:
   a. Plains: 43.3%
   b. Plateaus: 27.7%
   c. Hills: 18.6%
   d. Mountains: 10.7%
4. In the South, the Gulf of Mannar & the Palk Strait separate India from Sri Lanka.
5. Total land neighbours: 7 (Pakistan, Afghanistan, China, Nepal, Bhutan, Bangladesh & Myanmar).
6. India's Islands include the Andaman & Nicobar Islands in Bay of Bengal & Lakshadweep, Minicoy & Amindive Islands in the Arabian Sea.

INDIA FACTS

- Highest Civilian Award-Bharat Ratna
- Highest Gallantry Award-Param Vir Chakra
- Longest Tributary river of India-Yamuna
- Largest Lake-Wular Lake, Kashmir (Fresh Water)
- Largest Lake (Saline Water)-Chilka Lake, Orrisa
- Largest Man-Made Lake-Govind Vallabh Pant Sagar (Rihand Dam)
- Highest Lake-Devtal Lake, Gadhwal (Uttarakhan(d)
- Highest Peak-Karkoram or K-2(8,611 meters) (Indi(a)
- Largest Populated City-Mumbai
- Highest rainfall-Cherrapunji (426 inches per annum) Mawsynram
- State wise largest area under forest- Madhya Pradesh
- Largest Delta- Sunderbans Delta
- Longest River Bridge- Bhupen Hazarika Setu on Lohit river(Assam)
- Biggest Cave temple-Ellora
- Longest Road-Grand Trunk Road
- Longest Canal-Indira Gandhi Canal or Rajasthan Canal (Rajasthan)
- Largest Museum-India Museum at Kolkata
- Longest Dam-Hirakud Dam (Odish(a)
- Highest Dam-Tehri Dam (260 meters , 850 ft)
- Largest District-Kutch district (Area wis(e)
- Longest Highway National Highway 44 (NH 44) begins from Srinagar and terminates in Kanyakumari
- Smallest State (Population)-Sikkim
- Smallest State (Are(a)-Goa
- Largest State (Are(a)-Rajasthan
- Largest State (Population)-Uttar Pradesh
- Largest Cave Temple-Kailash Temple, Ellora (Maharastr(a)
- Largest Port-Mumbai
- Largest Church-Saint Cathedral (Go(a)
- Longest Beach-Marina Beach, Chennai
- Highest Airport-Leh (Laddakh)
- Largest River Island-Majuli (Brahmaputra River, Assam)

Major Mountain Ranges of the World

- **Andes** -South America
- **Himalayas**-Karakoram-Hindukush -South Central Asia
- **Rockies** -North America
- **Great Dividing Range**-East Australia
- **Western Ghats**-Western India
- **Caucasus Europe**-Asia
- **Alaska** -USA
- **Alps** -Europe
- **Apennines** -Europe
- **Ural** -Asia
- **Pennines** -Europe
- **Pyrenees**-Europe
- **Appalachian** -North America

HIMALAYAS

- **Punjab Himalaya**-Between Indus & Satluj
- **Kumaon Himalaya**-Between Satluj & Kali
- **Nepal Himalaya**-Between Kali & Tista
- **Assam Himalaya**-Between Tista & Dihang (Brahmaputr(a)

IMPORTANT LAGOONS & LAKES

- **VEMBNAD LAKE-** Large sized lagoon located in Kerala.
- **KAYALS-**Popularly called back water in Kerala. Peaty soils of backwaters are called Kari in Kerala.
- **CHILKA LAKE-** Situated in south west of the Mahanadi Delta.
- **WULAR LAKE**: Situated in Jammu & Kashmir. Largest fresh water lake of India
- **KOLLERU LAKE**: Andhra Pradesh
- **PULICAT LAKE:** Andhra Pradesh
- **JAISAMAND LAKE:** Largest fresh water lake of Rajasthan
- **NAKKI LAKE:** Small natural lake near Mt. Abu surrounded by hills important as tourist place.
- **LOKTAK LAKE**: Manipur.
- **SAMBHAR LAKE:** Largest Lake of Rajasthan lies on the border of Jaipur & Nagaur District.
- **DEEDWANA LAkE**: Rajasthan

MISCELLANEOUS

Principal Peaks of Himalayas

1. Mt. Everest -8848 m (Nepal-Tibet)
2. Mt. K2-8611 m (Indi(a)
3. Kanchenjunga -8597 m (Nepal-Indi(a)
4. Dhaulagiri - 8172 m (Nepal)
5. Nanga Parbat - 8126 m (Indi(a)
6. Annapurna - 8078 m (Nepal)
7. Gasherbrum - 8068 m (Indi(a)
8. Nanda Devi - 7817 m (Indi(a)
9. Mt. Kamet - 7756 m (Indi(a)
10. Gurla Mandhata - 7728 (Tibet)

Valleys and its locations

- Araku Valley : Andhra Pradesh
- Damodar Valley : Jharkhand and West Bengal
- Darma Valley : Uttarakhand
- Dzukou Valley : North-eastern part
- Johar Valley : Uttarakhand
- Markha Valley : Ladakh
- Nubra Valley : Ladakh
- Sangla Valley : Himachal pradesh
- Saur Valley : Uttarakhand
- Suru Valley : Ladakh
- Tons Valley : Uttarakhand
- Yumthang Valley : Sikkim

States and Union Territories of India

States - Capital

1. Andhra Pradesh - Hyderabad
2. Arunachal Pradesh - Itanagar
3. Assam – Dispur
4. Bihar - Patna
5. Chhattisgarh- Raipur
6. Goa - Panaji
7. Gujarat - Gandhinagar
8. Haryana - Chandigarh
9. Himachal Pradesh - Shimla
10. Jharkhand - Ranchi
11. Karnataka - Bangaluru
12. Kerala - Tiruvanantapuram
13. Madhya Pradesh - Bhopal
14. Mahrashtra - Mumbai
15. Manipur - Imphal
16. Mehghalaya - Shillong
17. Mizoram - Aizawl
18. Nagaland - Kohima
19. Odisha - Bhubaneshwar
20. Punjab - Chandigarh
21. Rajasthan - Jaipur
22. Sikkim - Gangtok
23. Tamil Nadu - Chennai
24. Uttarakhand - Dehradun
25. Uttar Pradesh - Lucknow
26. Tripura - Agartala
27. West Bengal - Kolkata
28. Telangana - Hyderabad

Union Territory - Capital

1. Andaman and Nicobar Islands - Port Blair
2. Chandigarh - Chandigarh
3. Dadra & Nagar Haveli and Daman & Diu - Daman
4. Lakshadweep - Kavaratti
5. Puducherry - Puducherry
6. National Capital Territory of Delhi - New Delhi
7. Jammu & Kashmir - Srinagar
8. Ladakh - Leh

River Valley Projects

- Bhakra Nangal Project On Sutlej in Punjab, Highest in India. Ht 226 m. Reservoir is
- called Gobind Sagar Lake.
- Mandi Project On Beas in HP.
- Chambal Valley Project On Chambal in M.P. & Rajasthan. 3 dams are there: Gandhi Sagar Dam, Rana Pratap Sagar Dam and Jawahar Sagar Dam.
- Damodar Valley Project On Damodar in Bihar. Based on Tennessee Valley Project, USA.
- Hirakud Project On Mahanadi in Orissa. World's longest dam : 4801 m.
- Rihand Project On Son in Mirzapur. Reservoir is called Govind Vallabh Pant reservoir.
- Kosi Project On Kosi in Bihar.
- Mayurkashi Project On Mayurkashi in WB.
- Kakrapara Project On Tapti in Gujarat.
- Nizamsagar Project On Manjra in AP.
- Nagarjuna Sagar Project On Krishna in AP.
- Tungabhadra Project On Tungabhadra in AP & Karnataka.
- Shivasamudram Project On Kavery in Karnataka. It is the oldest river valley project of India.
- Tata Hydel Scheme On Bhima in Maharashtra.
- Sharavathi Hydel Project On Jog Falls in Karnataka.
- Kundah & Periyar Project In Tamil Nadu.
- Farakka Project On Ganga in WB. Apart from power and irrigation it helps to remove silt for easy navigation.
- Ukai Project On Tapti in Gujarat.
- Mahi Project On Mahi in Gujarat.
- Salal Project On Chenab in J & K.
- Mata Tila Multipurpose Project On Betwa in UP & MP.
- Thein Project On Ravi, Punjab.
- Pong Dam On Beas, Punjab.
- Tehri Project On Bhagirathi, Uttarakhand.
- Sardar Sarovar Project On Narmada, Gujarat/MP.

Wildlife Sanctuaries and National Parks in India

1. Bandipur National Park - Mysore, Karnataka.
2. Balpakram Sanctuary - Garo Hills, Meghalaya.
3. Chandraprabha Sanctuary - Varanasi, Uttar Pradesh.
4. Corbett National Park - Nainital, Uttarakhand.
5. Dachigam Sanctuary - Jammu and Kashmir.
6. Dudhwa National Park - Lakhimpur Kheri, Uttar Pradesh.
7. Ghana Bird Sanctuary - Bharatpur, Rajasthan.
8. Gir National Park (Home of the Asiatic Lion) - Junagarh, Gujarat.
9. Hazaribagh National Park - Hazaribagh, Jharkhand.
10. Jaldapara Sanctuary - Jalpaiguri,West Bengal.
11. Kanha National Park - Mandla and Balaghat, Madhya Pradesh.
12. Kaziranga National Park - Jorhat, Assam.
13. Manas (Tiger Sancutary) - Barpeta, Assam.
14. Mudumalai Sanctuary - Nilgiri Hills, Tamil Nadu.
15. Namdapha National Park - Tirap district, Arunachal Pradesh.
16. Palamau - Daltonganj, Jharkhand.
17. Parkal - Warangal, Andhra Pradesh.
18. Periyar - Idukki, Kerala.
19. Ranganthitu Bird Sancutary - Mandya, Karnataka.
20. Shivpuri National Park - Shivpuri, Madhya Pradesh.
21. Sunderbans (Tiger Sanctuary) -West Bengal.
22. Vedanthangal Bird Sanctuary - Tamil Nadu.
23. Wild Ass Sanctuary - Little Rann of Kutch, Gujarat.

Indian Towns on Rivers

1. Allahabad (Prayagraj) - At the confluence of the Ganga and Yamuna.
2. Patna - Ganga
3. Varanasi- Ganga
4. Kanpur- Ganga
5. Haridwar - Ganga
6. Badrinath - Alaknanda
7. Agra- Yamuna
8. Delhi - Yamuna
9. Mathura - Yamuna
10. Ferozpur - Satluj
11. Ludhiana - Satluj
12. Srinagar - Jhelum
13. Lucknow - Gomti
14. Jaunpur - Gomti
15. Ayodhya - Saryu
16. Bareillly - Ram ganga
17. Ahmedabad - Sabarmati
18. Kota - Chambal
19. Jabalpur - Narmada
20. Panji - Mandavi
21. Ujjain - Kashipra
22. Surat -Tapti
23. Jamshedpur - Subarnarekha
24. Dibrugarh -Brahmaputra
25. Guwahati -Brahmaputra
26. Kolkata -Hooghly
27. Sambalpur- Mahanadi
28. Cuttack -Mahanadi
29. Serirangapatnam -Cauvery
30. Hyderabad -Musi
31. Nasik - Godavari
32. Vijayawada - Krishna
33. Curnool - Tungabhadra
34. Tiruchirapalli - Kaveri

Nick Name of Indian Places

1. Golden City - Amritsar.
2. Manchester of India - Ahmedabad
3. Twin City Hyderabad-Sikandarabad
4. City of festivals - Mudurai
5. Deccan Queen - Pune
6. City of Buildings - Kolkata
7. Dakshin Ganga - Godavari
8. Old Ganga - Godavari
9. Egg bowls of Asia - Andhra Pradesh
10. Soya region - Madhya Pradesh
11. Manchester of the South - Coimbatore
12. City of Nawabs - Lucknow
13. Venice of the east - Kochi
14. Queen of the Mountains - Mussoorie (Uttarkhan(d)
15. Sacred river - Ganga
16. Hollywood of India - Mumbai
17. City of Castles - Kolkata
18. State of five rivers - Punjab
19. City of weavers - Panipat
20. City of lakes - Srinagar
21. Steel city of India - Jamshedpur (called Tatanagar)
22. City of Temples - Varanasi
23. Manchester of the north - Kanpur
24. City of Rallies - New Delhi
25. Heaven of India - Jammu & Kashmir
26. Boston of India - Ahmedabad
27. Garden of spices of India - Kerala
28. Switzerland of India - Kashmir
29. Abode of the God- Prayag (Allahaba(d)
30. Pittsburg of India -Jamshedpur
31. City of seven islands- Mumbai
32. Blue Mountains -Nilgiri
33. Queen of Arabian Sea- Kochi
34. Space City -Bengaluru
35. Garden City of India - Bengaluru
36. Silicon valley of India - Bengaluru
37. Electronic City of India - Bengaluru
38. Pink City – Jaipur
39. Gateway of India- Mumbai