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Volume - 4

**Geography, Geology, and
Environment of World and India**



Geography, Geology, and Environment of World and India

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Major Physical Features



Mountains

- Covers **27%** of the world's land surface.
- Provide **80%** of the planet's freshwater.
- **12%** of the world's population resides here.
- Over **50%** are **directly or indirectly dependent** on mountain resources.
- **Relief Features of Mountains:**
 - **Mountain ridges:**
 - long, narrow and high hills.
 - Has **one side** with a **steep slope** and the **other** is of **moderate slope**.
 - **Mountain range:**
 - Mountains and hills having **several ridges, peaks and summits and valleys**.
 - Represents a **long but narrow strip of mountains and hills**
 - **All hills** of a mountain range **are of the same age** but there are structural variations in different members of the range.
 - **Separated by valleys**.
 - **Mountain chain:**
 - Consists of **several parallel long and narrow mountains** of different periods.
 - **Mountain system:**
 - Consists of different **mountain ranges** of the **same period**
 - **Mountain group:**
 - Consists of **several unsystematic patterns** of different mountain systems.
 - **Cordillera:**
 - Consists of **several mountain groups and systems**.
 - **Eg:** The mountainous region of the **western part of North America**

Classification of Mountains

1. **On the basis of height**
 - A. **Low mountains:** 700 -1,000 m.
 - B. **Rough mountains:** 1000 m - 1,500 m
 - C. **Rugged mountains:** 1,500 - 2,000 m.
 - D. **High mountains:** > 2,000 m.
2. **On the basis of location**
 - A. **Continental mountains**
 - a. **Coastal mountains:** Nearby **Coasts**.
 - **Examples:** Appalachians and Rockies (North America), Alpine (Europe), Western and Eastern Ghats of India etc.



b. Inland mountains: On main landform

- **Examples:** Ural Mountains (Russia), Vosges and Black Forest block mountains (Europe), Himalayas, Aravallis, Satpura etc. (India), Kunlun, Tienshan, Altai etc. (Asia) etc.

B. Oceanic mountains

- a. Mostly **below the water surface**, some can be found **above** also.
- b. **Majorly** on continental **shelves** and ocean **floors**.
- c. **Example:** Mauna Kea volcanic mountain of Hawaii Island , Antilean Mountain system

3. On the basis of mode of formation

A. Circum-erosional or relict mountains:

- The remnants of old fold mountains
- **Formation:** A result of **denudation**
- **Eg:** Vindhya ranges, **Aravallis**, Satpura, Eastern Ghats, Western Ghats etc.

B. Original or tectonic mountains:

- **Formation:** Due to **tectonic forces**
- These can be further divided into **4 types:**

I. Folded Mountains

- **Formation:** when **two or more** of Earth's tectonic **plates** are **pushed** together by **compressive forces** generated by **endogenetic forces of earth**.
- **Location:** **Convergent plate Boundaries**
- **Characteristics:**
 - **Youngest** mountain group.
 - **Fossils present.**
 - **Concave slope** on **one side** and **convex slope** on the **opposite side**.
 - **Earthquake prone**
 - Most **numerous** and the most **significant**.
 - Have **abundant mineral resources** such as tin, copper, gold, and other metals.
 - **Area of volcanic activity.**
- **Types:**
 - **Young folded mountains:**
 - ✓ **Least affected by denudation**
 - ✓ **Eg:** Rockies, andes, Alps, **Himalayas**.etc
 - **Mature folded mountains:**
 - ✓ **Affected by denudation.**
 - ✓ Characterized by **mono clinical ridges and valleys**.
 - **Old folded mountains:**
 - ✓ **Extremely affected by the denudational process.**
 - ✓ **Eg:** Aravalis, Vindhya etc.

II. Block/ Fault-Block/ Horst mountains

- **Formation:** By **tensile and compressive forces by endogenic factors**.
- **Location:** **Between two faults or on either side of a rift valley or a graben**.
- **Eg:** **The Vosges mountains** (in France) and the Black Forest (in Germany) etc.
- **Characteristics:**

- Formed when the **earth's crust between two fault lines is pushed to rise up** (owing to horizontal pressure from either side).
- **Eg: Satpura range** is a horst and the rivers Narmada and Tapi flow along the rift valleys on either side
- **Generated when a portion of the earth's crust collapses along two fault lines** due to divergent pressures.
- **Eg: River Rhine (Germany)** flows along a rift valley and the **Black Forest and Vosges** represent the block mountains or horst on either side of it
- Characterised by **steep slopes and flattened summits**.
- **Moderate size and lack peaks**.

Origin: 2 theories

A. Fault Theory:

- opinion that **block mountains are formed due to faulting**.
- **Formed in a number of ways:**
 - **Due to upward movement of the middle block** between two normal faults.
 - **When the side blocks of two faults move downward** whereas the **middle block remains stable at its place**
 - When the **middle block between two normal faults moves downward**.

B. Erosion theory:

- Opinion that these mountains were not formed due to faulting and tilting, rather they were **formed due to differential erosion**.
- The mountains, after their **origin in the Mesozoic era**, were subjected to **intense erosion**.
- Consequently, **differential erosion resulted in the formation of existing denuded Great Basin Range mountains**.
- **Not acceptable to most of the scientists** since they believe that denudation may modify mountains but cannot form a mountain

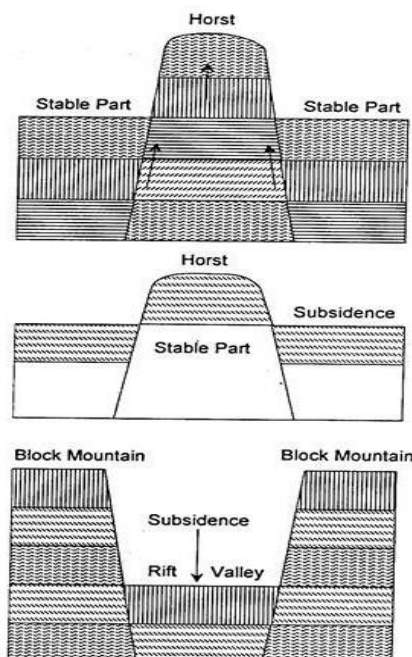


Fig: Block Mountain

III. Dome Mountains

- **Formation:** By magmatic intrusions and upwarping of the crustal surface.
- **Location:** In a region of flat-lying sedimentary rocks is warped or bowed upward making a structural dome.
- **Eg:** Normal domes, Lava domes, **Batholithic domes, Laccolithic domes, Salt domes** etc.

IV. Mountains of Accumulation/ volcanic mountains:

- **Formation:** Due to accumulation of volcanic materials.
- **Eg:** cinder cones, composite cones, acid lava cones, basic lava cones etc

Major Mountains of the world:



Fig: location of fold mountains

Major Mounatins of the Worldjmyuh

S.No.	Mountain Range	Important/ Highest Peaks	Location	Description
1.	Rocky Mountain	Mt. Elbert (highest peak in the Rockies)	North America	It is one of the longest fold mountains in the world and extends from Canada to western US (New Mexico State)
2.	Appalachain Mountains	Mt. Aitchell, North Carolina, US (highest	North America	It is fold mountain with rich in mineral resources.

		peack of Appalachian Mountains)		
3.	Alphs	dMont Blanc (French – Italian Border)	Europe	It is a folded mountain and source for river like Danube, Rhine etc.
4.	Sierra Nevada	Mt. Whitney	California, USA	Habitat for many Red Indian tribes
5.	Alaska Range	Mt. McKinley	North America	Mt. McKinley highest peak in North America
6.	Altai Mountains	Belukha mountain	Central Asia	Young folded mountain which extends from Kazakhstan to northern China.
7.	Andes Mountains	Mt. Aconcagua	South America	Longest Mountain chain in the world
8.	Atlas Mountains	Mt. Toubkal	Northwestern Africa	Young fold mountain spreading over Morocco and Tunisia.
9.	Drakensberg Mountains	Mt. Lesotho	South Africa	Young folded mountain
10.	Caucasus Mountain	Mt. Elbrus	Europe	Located between the Black sea and the Caspian sea
11.	Ural Mountains	Mt. Narodnaya	Russia	This mountain range act as a boundary between Europe and Asia.
12.	Hindukush Mountains	Mt. Trich Mir	Pakistan and Afganistan	Folded mountain with rugged topography which makes it difficult for transportation.
13.	Himalyas	Mt. Everest	Asia	Young fold mountains in Asia which separates.
14.	Arakhan Yoma	Mt. Kennedy peak	Myanmar	It extends from north to south direction. Shifting cultivation is practiced.
15.	Kunlun Mountains	Mt. Muztag	North of Tibetan plateau and western China	It is one of the young folded mountains.
16.	Vosges	Mt. Grand Ballon	Eastern, France, Europe	Famous for the cultivation of grapes and manufacture of wines
17.	Great Dividing Range	Mt. Kosciuszko	Australia	This range is the source for the rivers Darling and Murray.

Plateaus

- A **raised area** with terrain that is **levelled on top**.
- Features a **big top surface area** and a **steep side slope**.
- aka **High plains or tablelands**



- Cover ~ **18% of land**
- Found on every continent and cover **1/3rd of the Earth's surface.**
- **Young or old- Deccan plateau - old**
- **Tibet Plateau- highest**
- Have **abundance of mineral resources.**
- **Formation:**
 - **Form over millions of years** as fragments of the Earth's crust collide, melt, and gurgle back to the surface.
 - **Some were created by a single process**
 - **Others- several processes** over the course of Earth's history.

Major Process of Plateaus Formation:

- **Volcanism:** from eruptions that occurred during the Cenozoic or Mesozoic.
 - **Eg: Deccan Plateau, Columbia Plateau(US), Laurentian plateau or The Canadian Shield and the Siberian Traps of Russia.**
- **Crustal shortening : Thrusting of one block of crust over another** and occurrence of **folding.**
 - **Eg: Tibet Plateau, plateaus in North Africa, Turkey, Iran.**
- **Thermal expansion: Replacement of cold mantle lithosphere by hot asthenosphere.**
 - **Eg: Ethiopian Highlands (Africa), Yellowstone Plateau(US), Massif Central (France)**

Classification of Plateaus

1. Intermontane Plateaus

- **Intermontane: Area between two mountains.**
- **Occurrence:** Majorly **bordered by mountain ranges** (usually fold mountains) or are partially or completely **enclosed inside** them.
- **Highest** Plateaus on the planet.
- **Features:** Almost **horizontal rock layers** that are uplifted to **great heights by the earth's vertical movements.**
- **Eg: Tibetan Plateau, Bolivian plateau etc.**

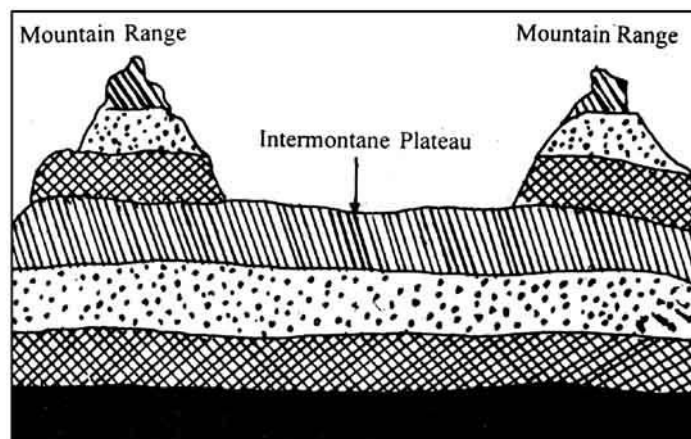


Fig: intermontane plateau

2. Piedmont Plateaus

- **Piedmont: Mountain foot.**
- **Occurrence:** Foot of a mountain and are **bordered by a plain on one side or a sea/ocean.**

- aka **Plateaus of denudation** as places **formerly high to the level of mountains** but have now been **reduced to the mountain's foot level** due to numerous agents of **erosion**.
- **Examples:** The **Malwa Plateau** (India), **Patagonian plateau** (Argentina) etc.

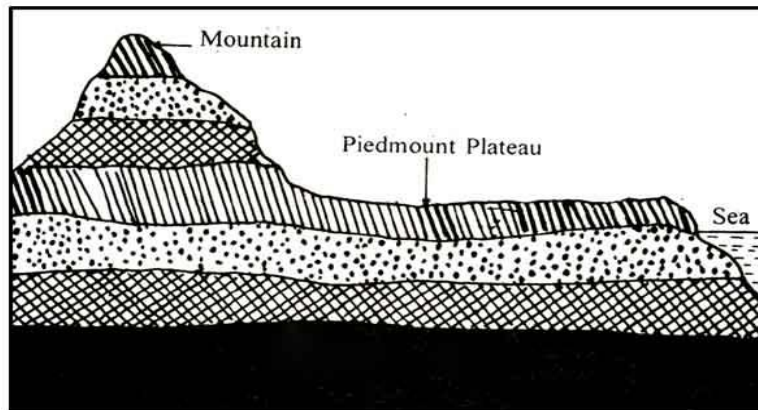


Fig: Piedmont plateau

3. Continental Plateaus

- aka **Plateaus of Accumulation**.
- **Occurrence:** **Bordered on all sides by the plains or seas, forming away from mountains.**
- **Formation:** Due to either a large-scale **continental uplift** or the **spread of horizontal basic lava sheets** (less viscous) that entirely cover the old landscape.
- **Feature:** In contrast to the neighbouring plain or sea, these plateaus have a **sharp elevation** (i.e. more steepness on sides).
- **Eg:** The **Maharashtra Plateau**, **Antarctic Plateau** or **Polar Plateau** in East Antarctica

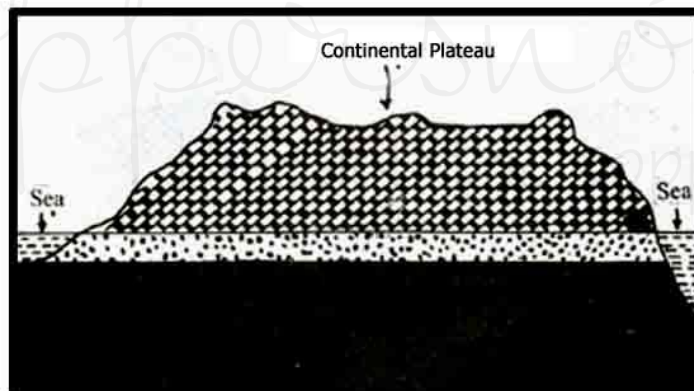


Fig: The Continental Plateaus

4. Volcanic Plateaus

- **Formation:** by **volcanic activity**.
- **Types:**
 - **Lava plateaus:** Generated by **extremely fluid basaltic lava** flowing through a series of vents without causing violent explosions.
 - **Pyroclastic plateaus:** Formed by **massive pyroclastic flows** and are underlain by pyroclastic rocks.
- **Eg:** **Antrim** plateau (Ireland), The **Deccan** Plateau (India), The **Columbia** Plateau (US) etc.

Pyroclastic flow: A fast-moving river of hot gas and volcanic materials that flows out from a volcano at rates of up to 700 km/h on average.

5. Dissected Plateaus

- **Dissected** : Area that has been **severely eroded** such that the relief is sharp.
- **Formation**: Due to **upward movement** in the Earth's **crust** caused by the slow **collision** of **tectonic plates**.
- **Feature**: The region will **appear to be mountainous**.
- **Examples**: **Ozark Plateau** (US), **Hornsby Plateau** (Australia), The **Deccan Plateau** (India) etc.

Major Plateaus of the world



Fig: Distribution of Plateaus across the world.

- **Tibetan Plateau**
 - **Highest and largest plateau** in the world
 - aka 'roof of the world'.
 - Formed due to **collision of the Indo-Australian and Eurasian tectonic plates**.
 - **Sufficiently high enough to reverse the Hadley cell convection cycles**.
 - **Covers-** Autonomous **Tibetan Region**, **Qinghai Province** of Western China, and a part of **Ladakh** in **Jammu and Kashmir**.
 - **Surrounded by mountains** to the south by the **Himalayan Range**, to the northeast by the **Kunlun Range**, and to the west by the **Karakoram Range**.
- **Columbia – Snake Plateau**
 - **River Columbia** and tributary **Snake** meet in this plateau.
 - **Bordered** by the **Cascade Range** and **Rocky Mountains** and divided by the **Columbia River**.
 - **Formed as the result of volcanic eruptions** with a consequent coating of basalt lava (**Flood Basalt Plateau**).
- **Colorado Plateau**
 - **Western part of U.S.A.**
 - **Largest plateau in America**.
 - Divided by the **Colorado River** and the **Grand Canyon**.
 - Example of **intermontane plateau**. **Mesas and buttes** are found here at many places [Arid Landforms].
 - **Known for the groundwater** which is under positive pressure and causes the **emergence of springs** called **Artesian wells**.

- **Deccan Plateau**
 - Forms most of the **southern part of India**.
 - Bordered by **two mountain ranges, the Western Ghats and the Eastern Ghats**.
 - **Includes the Deccan Traps - largest volcanic feature on Earth**.
 - **Made of multiple basalt layers or lava flows**, the Deccan Traps covers 500,000 square kilometers in area.
 - Known for containing some **unique fossils**.
 - **Rich in minerals- mica and iron ore** in the Chotanagpur region, and **diamonds, gold and other metals** in the Golconda region.
- **Kimberley Plateau**
 - Lies in the **northern part of Australia**.
 - Made of **volcanic eruption**.
 - Minerals- **iron, gold, lead, zinc, silver and diamond** are found here.
- **Katanga Plateau**
 - In **Congo**.
 - Famous for **copper production**.
 - **Minerals - Cobalt, Uranium, Zinc, Silver, Gold and Tin**.
- **Laurentian Plateau**
 - Lying in the **eastern part of Canada**, it is a **part of Canadian Shield**.
 - Fine quality of **iron-ore** is found here.
- **Patagonian Plateau**
 - **Piedmont plateau (Arid Landforms)** lying in **southern part of Argentina**.
 - **Rain shadow desert plateau**.
 - Important region for **sheep rearing**.
- **Altiplano Plateau or Bolivian Plateau**
 - **Intermontane plateau** which is located between **two ranges of Andes Mountain**.
 - Major area of **Tin reserves**.
- **Others**
 - **Spanish Plateau / Iberian Plateau: middle of Spain**. It is a **lava plateau**. It is **rich in minerals like Iron**.
 - **Loess Plateau: It is in China**. The soil here is made of fine particles brought by the wind. This **fine loamy soil is extremely productive**. Crops grown in this soil along the Yellow River give great yields.

Plains

- A **low-lying**, relatively **flat** land surface with a **low local relief** and a **very mild slope**.
- Most **common** landforms on the surface of the planet.
- **Occurrence: On every continent**.
- **Area: > 55 % of the earth's land surface**.
- **Formation: By the deposition of sediments** carried down by rivers.
- **Factors in Formation: Aside from rivers, wind, shifting ice, and tectonic activity** have all contributed to the formation of plains.
- **Examples: Indo Gangetic Plains, Mississippi Plains & Yang-Tze plain**



Classification of Plains

- On the basis of their mode of formation:

A. Structural plains

- **Undisturbed plain landforms** on the Earth's surface.
- **Structurally depressed areas** which make up some of the most expanse **natural lowlands on Earth**.
- Formed from **horizontally bedded rocks** relatively **undisturbed by crust movements of the Earth**.
- **Created by an uplifting diastrophic movement** of a large landmass.
- **Eg: Russian Platforms, Great plains (USA) & Central lowlands (Australia)**.



B. Erosional Plains (Peneplains)

- Plain landforms **produced from action of various agents of denudation** (River, running water, glacier and wind) on an existing landform.
- **Agents wear out the rugged surface on an existing landform and smoothens them** - low undulating plain landforms.
- **Major types :**
 - **Peneplains (Almost plain):** Results from the action of the various agents of denudation mentioned above, exempting wind.
 - **Pediains or Pediments:** Mountain **slopes** are **worn** away by mechanical weathering in **dry and semi-arid locations**, leaving a **gentle slope**.
 - **Desert Plains:** Produced by **wind Erosion**. **Eg: Reg, serir and hamada** in sahara.
 - **Karst Plains:** **Massive limestone plateaux** are **vulnerable to chemical weathering and erosion** by groundwater, eventually transforming into a depressed topographic surface with low relief. **Eg: The Canadian shield** and the West Siberian plain.

C. Depositional Plains

- **Formation:** Due to **depositional action** of numerous **geomorphic processes**.
 - **Riverine or alluvial plains:** Plains formed by **river deposits**.
 - **Lacustrine Plains or Lake Plains:** By sediment **deposition in a lake**. **Eg: Kashmir Valley**.
 - **Glacial or Drift Plains:** Produced by **glacial deposits**.
 - **Loess Plains:** when the **wind is the primary deposition mechanism**.
- **Feature: Most productive agricultural plains** of the world.
- **Examples: Gangetic plain** (for rice & jute), Nile delta of Egypt (for rice & cotton) & Hwang ho plain in China
- **Types**
 1. **Alluvial plains:**
 - **Vast, sweeping stretches of plain land** that are formed by the **deposition of sediments called alluvium**.
 - **Represents the pattern of floodplain shift** over geological time.
 - **River flows down mountains or hills- carries sediments** resulting from erosion and transports the sediments to the lower plain.
 - **Sediments build up over time- elevation of the floodplain increases and width of the river channel decreases**.

2. Flood plain

- Plain that stretches from the banks of a river or stream to the enclosing valley walls.
- Usually subjected to flooding when the adjacent water body overflows.
- Fertile and are made of deposits of silts, sands, levees, etc., deposited by floodwaters.
- Usually support a rich ecosystem.
- Most devastating floods in history have taken place here.
- Eg. Yellow River's floodplains.

3. Scroll plain

- Formed where a river meanders across a low gradient.
- Deposition of sediments at such locations - Plains formed.
- Oxbow lakes are common occurrences in such areas.
- Eg. Taieri River

4. Lacustrine plain

- Formed in areas previously occupied by lakes.
- When a lake drains out completely, sediments remain behind on the lakebed to form a plain.
- Might be highly fertile and support agriculture or might form a wetland or even a desert depending on the composition of the sediments.
- Common in Southern Indiana of the US .
- Eg. Kashmir Valley of India

5. Lava plain/ Lava field

- Formed by the accumulation of layers of lava.
- Can stretch for miles and are easily visible from the air or in satellite images - appear darker in color than the surrounding landscape.

D. Glacial plains

- Formed by the movement of glaciers under the force of gravity.
- Categorized as:
 - **Outwash plains/ Sandur :**
 - ✓ Formed when a glacier deposits sediments at its terminus.
 - ✓ As a glacier moves, it erodes the bedrock and carries the eroded sediments downstream.
 - ✓ These sediments are deposited by the meltwater of the glacier at the snout.
 - ✓ Common landform in Iceland.
 - ✓ World's largest outwash plain- Skeiðarársandur in Iceland - 1,300 square km.
 - **Till plain**
 - ✓ Formed by the deposition of glacial till (unsorted glacial sediment).
 - ✓ When a sheet of glacial ice gets detached from the main glacier and melts in place, the sediments are deposited on the ground to result in the formation of a till plain.
 - ✓ Can be seen in northern Ohio where they were created by the Wisconsin glaciation.

E. Abyssal plain

- Located at great depths - between 9,800 ft and 20,000 ft.
- Comprise- ~ 50% of the earth's surface of our planet.
- World's least explored areas as well as the flattest and smoothest ones.
- Massive in size.

- **Eg. Sohm Plain** of the North Atlantic Ocean - 900,000 square km. Most common in the Atlantic Ocean but quite rare in the Pacific Ocean.
- **Considered to be formed by the deposition of sediments**, derived from land, in the abyssal depressions.

Major plains of the world

1. Indo-Gangetic plain of India

- Lies in the south of the Himalayas stretching **from the Sulaiman mountains to the Gargo and Lushai Hills**.
- ~ **100 to 300 miles wide**.
- Flat and alluvial plain with **deep and fertile soil**.
- One of the **most thickly populated parts of the world**.



2. Llanos (S.America)

- The vast plains of the **Orinoco basin**.
- **Dry season - desert**
- **Rainy season - abundance of grass**.

3. Lombardy Plains

- **Most fertile parts of Italy** watered by the **River Po**.
- **Major activities- Corns, fruits and mulberry** plants over which silkworm is reared.

4. Pampas (S. America)

- **Wide, treeless, grass-covered plains** of the **La Plata river system**.
- **Most extensive pasture lands** in the world.

5. Selvas

- **Vast impenetrable forests** of the **Amazon Valley**.
- **Region of great heat and heavy rainfall**.
- Has the **largest forest in the world?**

6. Steppes

- **Vast treeless plains** of **Russia** extending from the Caspian Sea eastwards.
- Very **hot in summer** and very **cold in winter** and have no rainfall.

7. Tundras

- Swampy plains **near the Poles** in the extreme north of America, Asia and Europe.
- **Remain frozen for about nine months**.
- **Major activities- Fishing and hunting**.

Other important plains- **Veldt** in South Africa, **Downs** in Australia, **Prairies** in North America, **Savannah** in Northern Africa and **Parklands** in East Africa.

Rivers

Important Rivers of the World

River	Location	Description
River Amazon	South America	It is the second-longest river that flows through Peru, Columbia, and Brazil, and drains into the Atlantic Ocean.

River Mississippi	North America	It forms a bird-foot like a delta at the Gulf of Mexico, River Missouri is an important tributary of it.
River St. Lawrence	North America	It drains into the Gulf of St. Lawrence which is an important transport corridor of North America.
River Orange	South Africa	Longest river in South Africa and contains diamond beds along with its mouth.
River Congo	Africa	This river crosses the equator twice and drains into the South Atlantic Ocean.
River Nile	Africa	It is the longest river in the world, originates near Lake Victoria, and drains in the Mediterranean Sea.
River Rhine	Western Europe	It flows through Germany and Netherlands. It is one of the busiest waterways of Europe.
River Danube	Europe	It passes through Germany, Hungary, Austria, Slovakia, Serbia, Romania and drains into the Black Sea.
River Volga	Europe, Russia	It is the longest river in Europe, it drains into the Caspian Sea.
River Tigris	Turkey, Iraq	Cities like Mosul, Baghdad, Basra were located along its banks and it drains into the Gulf of Persia.
River Euphrates	Turkey, Syria, Iraq	Main source of water for Syria. It drains into the Persian Gulf.
River Irrawaddy	Myanmar	Drains into Gulf of Martaban
River Mekong	China, Laos, Cambodia, Vietnam	It is also called 'Danube of the east', and it merges with south China sea.
River Yangtze	China	It originates from the Tibetan plateau and ends in east china sea. It is the longest river in China.

Important Lakes of The World

NAME	LOCATION	FACTS
Titicaca lake	South America	It is the highest navigable lake in the world located in the Andes mountains.
Great bear lake	Canada, North America	It is a big glaciated lake of Canada. The Eskimos of Canada camp here during the summer season.

Great lakes	North America	This comprise of five large lakes of North America such as Lake Superior, Michigan, Huron, Erie, Ontario. Lake Superior is the second largest lake in the world.
Lake Malawi	Central Africa	It is the third largest lake of Africa and borders Tanzania, Mozambique.
Lake Tanganyika	East Africa	It is deepest and second largest lake of Africa.
Lake Victoria	Africa	Largest river of Africa and passes through the equator.
Lake Kainji	Africa	Largest manmade lake of Africa, used for irrigation purposes.
Dead sea	West Asia	It is bordered by Jordan in the east and Palestine, Israel in the west. It is known for high salinity.
Aral Sea	Central Asia	Located between Uzbekistan and Kazakhstan. It is shrinking rapidly in recent years.
Lake Baikal	Russia	It is the largest freshwater lake in Asia and deepest in the world.
Caspian Sea	Eurasia	It is the largest lake in the world and is surrounded by Russia, Kazakhstan, Turkmenistan, Iran and Azerbaijan.