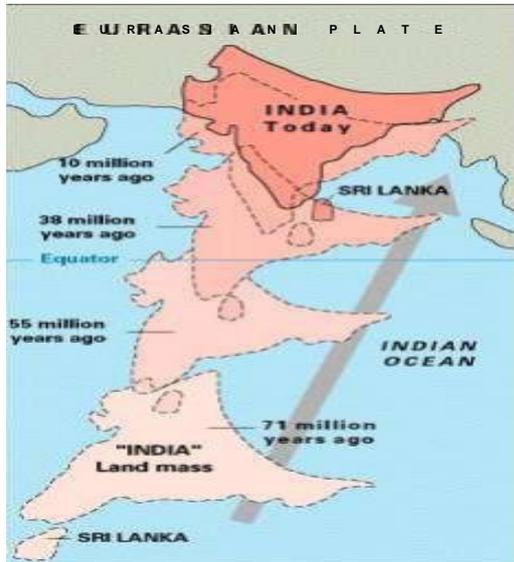


## UNIT II CHAPTER -2 PHYSIOGRAPHY - INDIA

### PHYSIOGRAPHY

- Structure and Relief; physiographic divisions
- Drainage systems: concept of water sheds — the Himalayan and the Peninsular

Can you map different phases in the movement of the Indian plate?



This northward movement of the Indian plate is continuing and it has significant consequences on the physical environment of the Indian subcontinent.

Can you name some important consequences of the northward movement of the Indian plate?

1. FORMATION OF HIMALAYAS
2. FORMATION OF INDO GANGETIC PLAIN
3. ARABIAN SEA FORMATION
4. EMERGENCE OF DECCAN PLATEAU

It is primarily through the interplay of these endogenic and exogenic forces and lateral movements of the plates that the present geological structure and geomorphologic processes active in the Indian subcontinent came into existence.

Based on the variations in its geological structure and formations, India can be divided into three geological divisions.

### STRUCTURE AND PHYSIOGRAPHY



Figure 2.3: India: Physical.

- (i) The Peninsular Block
- (ii) The Himalayas and other Peninsular Mountains
- (iii) Indo-Ganga-Brahmaputra Plain.

### THE PENINSULAR BLOCK

#### Boundaries of the PENINSULAR BLOCK

1. The northern boundary of the Peninsular Block may be taken as an irregular line
- Movement of Indian plate running from Kachch along the western flank of the Aravali Range near Delhi and then roughly parallel to the Yamuna and the Ganga as far as the Rajmahal Hills and the Ganga delta. Apart from these,
2. The Karbi Anglong and the Meghalaya Plateau in the northeast and Rajasthan in the west are also extensions of this block.
3. The northeastern parts are separated by the Malda fault in West Bengal from the Chotanagpur plateau.
4. The Peninsula is formed essentially by a great complex of very ancient gneisses and granites,

5. Since the Cambrian period, the Peninsula has been standing like a rigid block with the exception of some of its western coast which is submerged beneath the sea and some other parts changed due to tectonic activity without affecting the original basement.

6. As a part of the Indo-Australian Plate, it has been subjected to various vertical movements and block faulting. The rift valleys of the Narmada, the Tapi and the Mahanadi and the Satpura block mountains are some examples of it.

The Peninsula mostly consists of relict and residual mountains like the Aravali hills, the Nallamala hills, the Javadi hills, the Veliconda hills, the Palkonda range and the Mahendragiri hills, etc.

### THE HIMALAYAS AND OTHER PENINSULAR MOUNTAINS

1. The Himalayas along with other Peninsular mountains are young, weak and flexible in their geological structure unlike the rigid and stable Peninsular Block.

2. Consequently, they are still subjected to the interplay of **exogenic and endogenic forces**, resulting in the development of faults, folds and thrust plains.
3. These mountains are tectonic in origin, dissected by fast-flowing rivers which are in their youthful stage.
4. Various landforms like gorges, V-shaped valleys, rapids, waterfalls, etc. are indicative of this stage.

#### **INDO-GANGA-BRAHMAPUTRA PLAIN**

The third geological division of India comprises the plains formed by the river **Indus, the Ganga and the Brahmaputra**.

It was a geo-synclinal depression which attained its maximum development during the third phase of the Himalayan mountain formation approximately about **64 million years ago**.

Since then, it has been gradually filled by the sediments brought by the Himalayan and Peninsular rivers.

Average depth of alluvial deposits in these plains ranges from **1,000-2,000 m**.

#### **PHYSIOGRAPHY**

'**Physiography**' of an area is the outcome of structure, process and the stage of development.

India can be divided into the following physiographic divisions:

- (1) The Northern and North-eastern Mountains
- (2) The Northern Plain
- (3) The Peninsular Plateau
- (4) The Indian Desert
- (5) The Coastal Plains
- (6) The Islands.

#### **The North and Northeastern Mountains**

1. The North and Northeastern Mountains consist of the Himalayas and the Northeastern hills.
2. The Himalayas consist of a series of parallel mountain ranges.  
Some of the important ranges are the **Greater Himalayan range**, which includes the **Great Himalayas and the Trans-Himalayan range**, the **Middle Himalayas and the Shiwalik**.
3. The general orientation of these ranges is from **northwest to the southeast direction** in the **northwestern part** of India. Himalayas in the Darjeeling and Sikkim regions lie in an **east west direction**, while in Arunachal Pradesh they are from **southwest to the northwest direction**. In Nagaland, Manipur and Mizoram, they are in the **north south direction**.
4. The approximate length of the Great 2500 km, width is 160 to 400 km
6. Himalayas are not only the physical barrier, they are also a climatic, drainage and cultural divide.

#### **THE HIMALAYAS CAN BE DIVIDED INTO THE FOLLOWING SUB-DIVISIONS:**

- (i) Kashmir or Northwestern Himalayas
- (ii) Himachal and Uttaranchal Himalayas
- (iii) Darjiling and Sikkim Himalayas
- (iv) Arunachal Himalayas
- (v) Eastern Hills and Mountains.

#### **Kashmir or Northwestern Himalayas**

1. It comprise a series of ranges such as the **KARAKORAM, LADAKH, ZASKAR AND PIR PANJAL**.
2. It is a cold desert, which lies between the Greater Himalayas and the Karakoram ranges.
3. The world famous valley of Kashmir and the famous Dal Lake are found.
4. Important glaciers **Baltoro and Siachen** are also found in this region.
5. The Kashmir Himalayas are also famous for **Karewa** formations, which are useful for the cultivation of **Zafran**, a local variety of saffron.
6. Some of the important passes of the region are **ZojiLa** on the Great Himalayas, **Banihal** on the **Pir Panjal**, **Photu La** on the Zaskar and **Khardung La** on the Ladakh range.
7. Some of the important fresh lakes such as **Dal and Wular** and **salt water lakes** such as **Pangong Tso and Tso Moriri** are also in this region.
8. This region is drained by the river **Indus**, and its tributaries such as the **Jhelum and the Chenab**.
9. The landscape of Himalayas is a major source of attraction for adventure tourists. some famous places of pilgrimage such as **Vaishno Devi, Amarnath Cave, Charar -e-Sharif**.
10. The southernmost part of this region consists of longitudinal valleys known as '**duns**'. Jammu dun and Pathankot dun are important examples.

#### **The Himachal and Uttarakhand Himalayas**

The northernmost part of the Himachal Himalayas is an extension of the Ladakh cold desert, in which

all the three ranges of **Himalayas** are prominent. These are the Great Himalayan range, the Lesser Himalayas (which is locally known as **Dhaoladhar** in Himachal Pradesh and **Nagtibha** in Uttarakhand) and the **Shivalik** range from the North to the South 0

2. In this section of Lesser Himalayas, the altitude between **1,000-2,000m**

3. The important hill stations such as **Dharamshala, Mussoorie, Shimla, Kaosani** and the **cantonment towns and health resorts** such as **Shimla, Mussoorie, Kasauli, Almora, Lansdowne and Ranikhet**, etc.

4. The two distinguishing features of this region from the point of view of physiography are the **'Shivalik' and 'Dun formations'**. Some important duns located in this region are the places of pilgrimage such as the **Gangotri, Yamunotri, Kedarnath, Badrinath and Hemkund Sahib** are also situated in this part.

5. The region is also known to have five famous Prayags (river confluences)

#### **The Darjeeling and Sikkim Himalayas**

1. They are flanked by Nepal Himalayas in the west and Bhutan Himalayas in the east.

2. It is relatively small but is a most significant part of the Himalayas.

3. Known for its fast-flowing rivers such as Tista,

4. It is a region of high mountain peaks like Kanchenjunga (Kanchengiri), and deep valleys.

5. The higher reaches of this region are inhabited by Lepcha tribes while the southern part, particularly 6. Tea plantation is done

7. Absence of siwaliks

8. Duar formations are important .

#### **The Arunachal Himalayas**

1. These extend from the east of the Bhutan Himalayas up to the Diphu pass in the east.

2. The general direction of the mountain range is from southwest to northeast.

3. Some of the important mountain peaks of the region are Kangtu and Namcha Barwa.

4. These ranges are dissected by fast-flowing rivers from the north to the south, forming deep gorges. 5. The important river is Brahmaputra flows through a deep gorge after crossing Namcha Barwa. Some of the important rivers are the Kameng, the Subansiri, the Dihang, the Dibang and the Lohit.

6. These are perennial with the high rate off all, thus, having the highest hydro-electric power potential in the country.

7. The important tribes are the Monpa, Daffla, Abor, Mishmi, Nishi and the Nagas. Most of these communities practise *Jhumming*. It is also known as shifting or slash and burn cultivation.

#### **The Eastern Hills and Mountains**

1. These are part of the Himalayan mountain system having their general alignment from the north to the south direction.

They are known by different local names. In the north, they are known as **Patkai Bum, Naga hills, the Manipur hills** and in the south as **Mizo or Lushai hills**.

(i) These are low hills, inhabited by numerous tribal groups practicing Jhum cultivation.

(ii) Most of these ranges are separated from each other by numerous small rivers.

(iii) The Barak is an important river in Manipur and Mizoram.

(iv) The physiography of Manipur is unique by the presence of a large lake known as **'Loktak'** lake at the centre, surrounded by mountains from all sides.

(v) Mizoram which is also known as the **'Molassis basin'** which is made up of soft unconsolidated

#### **The Northern Plains**

1. The northern plains are formed by the alluvial deposits brought by the rivers - the Indus, the Ganga and the Brahmaputra.

2. These plains extend approximately 3,200 km from the east to the west.

3. The average width of these plains varies between 150-300 km.

4. The maximum depth of alluvium deposits varies between 1,000-2,000 m. From the north to the south

5. these can be divided into three major zones: the *Bhabar*, the *Tarai* and the alluvial plains.

6. The alluvial plains can be further divided into the *Khadar* and the *Bhangar*.

7. *Bhabar* is a narrow belt ranging between 8-10 km parallel to the Shivalik foothills at the break-up of the slope.

8. The streams and rivers coming from the mountains deposit heavy materials of rocks and boulders, and at times, disappear in this zone.

9. South of the *Bhabar* is the *Tarai* belt, with an approximate width of 10-20 km where most of the streams and rivers re-emerge without having any properly demarcated channel,

10. Marshy and swampy conditions known as the *Tarai*.

11. This has a luxurious growth of natural vegetation and houses a varied wild life.
12. The south of *Tarai* is a belt consisting of old and new alluvial deposits known as the *Bhangar* and *Khadar* respectively.

### **The Peninsular Plateau**

1. Irregular triangle in shape
2. Rising from the height of 150 m above the river plains up to an elevation of 600-900 m
3. Delhi ridge in the northwest, (extension of Aravalis), the Rajmahal hills in the east, Gir range in the west and the Cardamom hills in the south constitute the outer extent of the Peninsular plateau. northeast, Shillong and Karbi-Anglong plateau.
3. The Peninsular India is made up of a series of patland plateaus such as the Hazaribagh plateau, the Palamu plateau, the Ranchi plateau, the Malwa plateau, the Coimbatore plateau and the Karnataka plateau, etc.
4. This is one of the oldest and the most stable landmass of India.
5. The general elevation of the plateau is from the west to the east, .
6. Narmada, tapti ,Mahanadi, Godavari, Krishna, and cauvery are some of the important rivers
7. Some of the important physiographic features of this region are tors, block mountains, rift valleys, spurs, bare rocky structures, series of hummocky hills and wall-like quartzite dykes offering natural sites for water storage.
8. The western and northwestern part of the plateau has an emphatic presence of black soil.
9. The northwestern part of the plateau has a complex relief of ravines and gorges. The ravines of Chambal, Bhind and Morena are some of the well-known examples.

On the basis of the prominent relief features, the Peninsular plateau can be divided into three broad groups:

- (i) The Deccan Plateau
- (ii) The Central Highlands
- (iii) The Northeastern Plateau.

### **The Deccan Plateau**

1. This is bordered by the Western Ghats in the west, Eastern Ghats in the east and the Satpura, Maikal range and Mahadeo hills in the north.
2. Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri hills in Karnataka and Tamil Nadu and Anaimalai hills and Cardamom hills in Kerala.
3. Western Ghats are comparatively higher in elevation and more continuous than the Eastern Ghats. Their average elevation is about 1,500 m with the height increasing from north to south.
4. 'Anaimudi' (2,695 m), the highest peak of Peninsular plateau is located on the Anaimalai hills of the Western Ghats followed by Dodabetta(2,637 m) on the Nilgiri hills.
5. Most of the Peninsular rivers have their origin in the Western Ghats. Eastern Ghats comprising the discontinuous and low hills are highly eroded by the rivers such as the Mahanadi, the Godavari, the Krishna, the Kaveri, etc.
6. Some of the important ranges include the Javadi hills, the Palkonda range, the Nallamala hills, the Mahendragiri hills, etc.
7. The Eastern and the Western Ghats meet each other at the Nilgiri hills.

### **The Central Highlands**

1. They are bounded to the west by the Aravali range.
2. The Satpura range is formed by a series of scarped plateaus on the south, generally at an elevation varying between 600-900 m above the mean sea level.
3. This forms the northernmost boundary of the Deccan plateau.
4. It is a classic example of the relict mountains which are highly denuded and form discontinuous ranges.
5. This region has undergone metamorphic processes in its geological history, which can be corroborated by the presence of metamorphic rocks such as marble, slate, gneiss, etc.
6. The general elevation of the Central Highlands ranges between 700-1,000 m
7. Banas is the only significant tributary of the river Chambal that originates from the Aravalli in the west.
8. An eastern extension of the Central Highland is formed by the Rajmahal hills, to the south of which lies a large reserve of mineral resources in the Chotanagpur plateau.

### The Northeastern Plateau

1. It is an extension of the main Peninsular plateau.
2. It is believed that due to the force exerted by the northeastward movement of the Indian plate at the time of the Himalayan origin, a huge fault was created between the Rajmahal hills and the Meghalaya plateau. Later, this depression got filled up by the deposition activity of the numerous rivers.
3. The Meghalaya and Karbi Anglong plateau stand detached from the main Peninsular Block.

The Meghalaya plateau is further sub-divided into three:

(i) The Garo Hills; (ii) The Khasi Hills; (iii) The Jaintia Hills, named after the tribal groups inhabiting this region.

4. An extension of this is also seen in the Karbi Anglong hills of Assam.
5. Rich in mineral resources like coal, iron ore, sillimanite, limestone and uranium.
6. The Meghalaya plateau has a highly eroded surface.
7. Cherrapunji displays a bare rocky surface devoid of any permanent vegetation cover.

### The Indian Desert

1. Located at the north west of India
2. It is a land of undulating topography dotted with longitudinal dunes and *barchans*.
3. This region receives low rainfall below 150 mm per year; hence,
4. It has arid climate with low vegetation cover.
5. It is because of these characteristic features that this is also known as *Marusthali*.
- 7 It is believed that during the Mesozoic era, this region was under the sea.
  8. This can be corroborated by the evidence available at wood fossils park at Aakal and marine deposits around Brahmsar, near Jaisalmer (The approximate age of the wood fossils is estimated to be 180 million years).

### WEST COAST PLAIN

1. Narrow
2. Extend from Gujarat to Kerala
3. It is named as Katch and Kathiawad in Gujarat, Konkan in Goa and Maharashtra Malabar in Karnataka and Kerala
4. Estuaries are common
5. Back waters are common
6. Suitable for fisheries
7. Erosion is prominent

### EAST COAST PLAIN

- Broad  
Extend from West Bengal to Tamilnadu  
It is named as circar in A.P Orissa  
Coramandal in Tamilnadu
- Deltas are common  
Suitable for agriculture  
Deposition is prominent

### DIFFERENCE BETWEEN LAKSHADWEEP AND ANDAMAN NICOBAR ISLANDS

1.

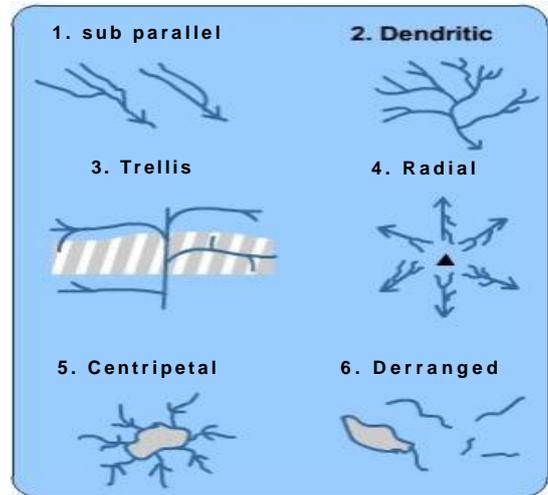
by the Eleventh degree channel, north of which is the Amini Island and to the south of the Canannore Island. The Islands of this archipelago have storm beaches consisting of

active volcano in India Some important mountain peaks in Andaman and Nicobar islands are Saddle peak (North Andaman - 738 m), Mount Diavolo (Middle Andaman - 515 m), Mount Koyob (South Andaman - 460 m) and Mount Thuiller (Great Nicobar - 642 m).

## CHAPTER -3 DRAINAGE SYSTEM

The flow of water through well-defined channels is known as 'drainage'. The network of such channels is called a 'drainage system'.

The drainage pattern of an area is the outcome of the geological time period, nature and structure of rocks, topography, slope, amount of water flowing and the periodicity of the flow.



### Drainage system

- (i) The drainage pattern resembling the branches of a tree is known as –dendritic|| the examples of which are the rivers of northern plain.
- (ii) When the rivers originate from a hill and flow in all directions, the drainage pattern is known as 'radial'. The rivers originating from the Amarkantak range present a good example of it.
- (iii) When the primary tributaries of rivers flow parallel to each other and secondary tributaries join them at right angles, the pattern is known as 'trellis'.
- (iv) When the rivers discharge their waters from all directions in a lake or depression, the pattern is known as 'centripetal'.

The boundary line separating one drainage basin from the other is known as the watershed.

The catchments of large rivers are called river basins while those of small rivulets and rills are often referred to as watersheds.

There is, however, a slight difference between a river basin and a watershed. Watersheds are small in area while the basins cover larger areas.

They are accepted as the most appropriate micro, meso or macro planning regions.

**Indian drainage system may be divided on various bases.**

**On the basis of discharge of water**

(orientations to the sea), it may be grouped into:

- (i) the Arabian Sea drainage; and
- (ii) the Bay of Bengal drainage.

They are separated from each other through the Delhi ridge, the Aravalis and the Sahyadris (water divide is shown by a line in Figure 3.1). **river basin**

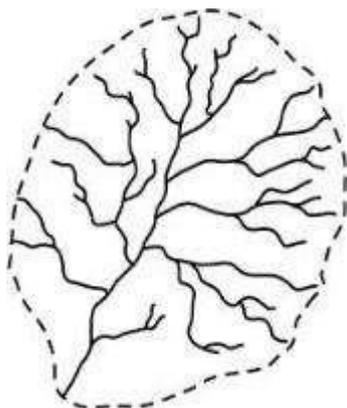
77 per cent of the drainage area consisting of the Ganga, the Brahmaputra, the Mahanadi, the Krishna, etc. is oriented towards the Bay of Bengal

23 percent comprising the Indus, the Narmada, the Tapi, the Mahi and the Periyar systems discharge their waters in the Arabian Sea.

**On the basis of the size of the watershed,**

the drainage basins of India are grouped into three categories:

- (i) Major river basins with more than 20,000 sq. km of catchment area. It includes 14 drainage basins such as the Ganga, the Brahmaputra, the Krishna, the Tapi, the Narmada, the Mahi, the Pennar, the Sabarmati, the Barak, etc.



(ii) Medium river basins with catchment area between 2,000-20,000 sq. km incorporating 44 river basins such as the Kalindi, the Periyar, the Meghna, etc.

(iii) Minor river basins with catchment area of less than 2,000 sq. km include fairly good number of rivers flowing in the area of low rainfall.

North Indian rivers are originating from Himalayas peninsular rivers are originating from Western ghats

The Narmada and Tapi are two large rivers which are exceptions originating from central highlands.

**the Indian drainage may also be classified into the Himalayan drainage and the Peninsular drainage.**

### **THE HIMALAYAN DRAINAGE**

1. The Himalayan drainage system has a long geological history.
2. the important rivers are Ganga, the Indus and the Brahmaputra rivers.
3. Since these are fed both by melting of snow and precipitation, rivers of this system are perennial.
4. rivers form giant gorges V-shaped valleys, rapids and waterfalls in their mountainous course.
5. While entering the plains, they form depositional features like flat valleys, ox-bow lakes, flood plains,

### **EVOLUTION OF THE HIMALAYAN DRAINAGE**

1. Geologists believe that a mighty river called Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and onwards to Sind, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period some 5-24 million years ago

2. The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay, boulders and conglomerates support this viewpoint.

in due course of time Indo- Brahma river was dismembered into three main drainage systems:

- (i) the Indus and its five tributaries in the western part;
- (ii) the Ganga and its Himalayan tributaries in the central part; and
- (iii) the stretch of the Brahmaputra in Assam and its Himalayan tributaries in the eastern part.

The dismemberment was probably due to the Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems.

Likewise, the down thrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period, diverted the Ganga and the Brahmaputra systems to flow Towards the Bay of Bengal.

### **THE RIVER SYSTEMS OF THE HIMALAYAN DRAINAGE**

#### **The Indus System**

1. It is one of the largest river basins of the world, covering an area of 11,65,000 sq. km (in India it is 321, 289 sq. km and a total length of 2,880 km (in India 1,114 km).

2. The Indus also known as the Sindhu, is the westernmost of the Himalayan rivers in India.

3. It originates from a glacier near Bokhar Chu (31° 15' N latitude and 81° 40' E longitude) in the Tibetan region at an altitude of 4,164 m in the Kailash Mountain range.

4. In Tibet, it is known as *Singi Khamban*; or Lion's mouth. After flowing in the northwest direction between the Ladakh and Zaskar ranges, it passes through Ladakh and Baltistan.

5. It cuts across the Ladakh range, forming a spectacular gorge near Gilgit in Jammu and Kashmir.

6. It enters into Pakistan near Chillar in the Dardistan region. Find out the area known as Dardistan.

7. tributaries such as the Shyok, the Gilgit, the Zaskar, the Hunza, the Nubra, the Shigar, the Gasting and the Dras.

9. It finally emerges out of the hills near Attock where it receives the Kabul river on its right bank.

10. The other important tributaries joining the right bank of the Indus are the Khurram, the Tochi, the Gomal, the Viboa and the Sangar. They all originate in the Sulaiman ranges.

11. The river flows southward and receives 'Panjnad' a little above Mithankot. The Panjnad is the name given to the five rivers of Punjab, namely the Satluj, the Beas, the Ravi, the Chenab and the Jhelum. It finally discharges into the Arabian Sea, east of Karachi. The Indus flows in India only through the Leh district in Jammu and Kashmir.

#### **The Ganga System**

1. The Ganga is the most important river of India both from the point of view of its basin and cultural significance.
2. It rises in the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand.

3. Here, it is known as the Bhagirathi.
4. It cuts through the Central and the Lesser Himalayas in narrow gorges. At Devprayag, the Bhagirathi
5. meets the Alaknanda; hereafter, it is known as the Ganga.
6. The Alaknanda has its source in the Satopanth glacier above Badrinath. The Alaknanda consists of the Dhaulti and the Vishnu Ganga which meet at Joshimath or Vishnu Prayag.
7. The other tributaries of Alaknanda such as the Pindar joins it at Karna Prayag while Mandakini or Kali Ganga meets it at Rudra Prayag.
8. The Ganga enters the plains at Haridwar. From here, it flows first to the south, then to the south-east and east before splitting into two distributaries, namely the Bhagirathi and the Hugli. The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh(1,450 km), Bihar (445 km) and West Bengal (520 km).
9. The Ganga basin covers about 8.6 lakh sq. km area in India alone.
10. The Ganga river system is the largest in India having a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south, respectively.
11. The Son is its major right bank tributary.
12. The important left bank tributaries are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahananda.
13. The river finally discharges itself into the Bay of Bengal near the Sagar Island.

### **The Brahmaputra System**

1. The Brahmaputra, one of the largest rivers of the world, has its origin in the Chemayungdung glacier of the Kailash range near the Mansarovar lake.
2. From here, it traverses eastward longitudinally for a distance of nearly 1,200 km in a dry and flat region of southern Tibet, where it is known as the Tsangpo, which means 'the purifier.'
3. The Rango Tsangpo is the major right bank tributary of this river in Tibet.
4. It emerges as a turbulent and dynamic river after carving out a deep gorge in the Central Himalayas near Namcha Barwa (7,755 m).
5. The river emerges from the foothills under the name of Siang or Dihang. It enters India west of Sadiya town in Arunachal Pradesh.
6. Flowing southwest, it receives its main left bank tributaries, viz., Dibang or Sikang and Lohit; thereafter, it is known as the Brahmaputra.
7. The Brahmaputra receives numerous tributaries in its 750 km long journey through the Assam valley.
8. Its major left bank tributaries are the Burhi Dihing and Dhansari (South) whereas the important right bank tributaries are the Subansiri, Kameng, Manas and Sankosh.
9. The Brahmaputra enters into Bangladesh near Dhubri and flows southward. In Bangladesh, the Tista joins it on its right bank from where the river is known as the Yamuna.
10. It finally merges with the river Padma, which falls in the Bay of Bengal. The Brahmaputra is well-known for floods, channel shifting and bank erosion.
11. This is due to the fact that most of its tributaries are large, and bring large quantity of sediments owing to heavy rainfall in its catchment area.

### **THE PENINSULAR DRAINAGE SYSTEM**

1. The Peninsular drainage system is older than the Himalayan one.
2. This is evident from the broad, largely-graded shallow valleys, and the maturity of the rivers.
3. The Western Ghats running close to the western coast act as the water divide between the major Peninsular rivers, discharging their water in the Bay of Bengal and as small rivulets joining the Arabian Sea.
4. Most of the major Peninsular rivers except Narmada and Tapi flow from west to east.
5. The Chambal, the Sind, the Betwa, the Ken, the Son, originating in the northern part of the Peninsula belong to the Ganga river system. The other major river systems of the Peninsular drainage are - the Mahanadi the Godavari, the Krishna and the Kaveri.
6. Peninsular rivers are characterised by fixed course, absence of meanders and non-perennial flow of water.
7. The Narmada and the Tapi which flow through the rift valley are, however, exceptions.

### **The Evolution of Peninsular Drainage System**

Three major geological events in the distant past have shaped the present drainage systems of Peninsular India:

(i) Subsidence of the western flank of the Peninsula leading to its submergence below the sea during the early tertiary period. Generally, it has disturbed the symmetrical plan of the river on either side of the original watershed.

(ii) Upheaval of the Himalayas when the northern flank of the Peninsular block was subjected to subsidence and the consequent trough faulting. The Narmada and The Tapi flow in trough faults and fill the original cracks with their detritus materials. Hence, there is a lack of alluvial and deltaic deposits in these rivers.

(iii) Slight tilting of the Peninsular block from northwest to the southeastern direction gave orientation to the entire drainage system towards the Bay of Bengal during the same period.

**Table 3.1 : Comparison between the Himalayan and the Peninsular River**

SL.No.	Aspects	Himalayan River	Peninsular River
1.	Place of origin	Himalayan mountain covered with glaciers	Peninsular plateau and central highland
2.	Nature of flow	Perennial: receive water from glacier and rainfall	Seasonal; dependent on monsoon rainfall
3.	Type of drainage	Antecedent and consequent leading to dendritic pattern in plains	Super imposed, rejuvenated resulting in trellis, radial and rectangular patterns
4.	Nature of river	Long course flowing through the rugged mountains experiencing headward erosion and river capturing; In plains meandering and shifting of course	Smaller. Old river with well-adjusted valleys
5.	Catchment area	Very large basins	Relatively smaller basin
6.	Age of the river	Young youthful, active and deepening in the valleys	Old rivers with graded profile, and have almost reached their base levels

### The River Regime

1. The pattern of flow of water in a river channel over a year is known as its regime.
2. The north Indian rivers originating from the Himalayas are perennial as they are fed by glaciers through snow melt and also receive rainfall water during rainy season.
3. The rivers of South India do not originate from glaciers and their flow pattern witnesses fluctuations.
4. The flow increases considerably during monsoon rains. Thus, the regime of the rivers of South India is controlled by rainfall which also varies from one part of the Peninsular plateau to the other.
5. The discharge is the volume of water flowing in a river measured over time. It is measured either in cusecs (cubic feet per second) or cumecs (cubic metres per second).
6. The Ganga has its minimum flow during the January-June period. The maximum flow is attained either in August or in September. After September, there is a steady fall in the flow. The river, thus, has a monsoon regime during the rainy season.
7. There are striking differences in the river regimes in the eastern and the western parts of the Ganga Basin.
8. The Ganga maintains a sizeable flow in the early part of summer due to snow melt before the monsoon rains begin. The mean maximum discharge of the Ganga at Farakka is about 55,000 cusecs while the mean minimum is only 1,300 cusecs.

**What are the factors responsible for such a large difference?**

### EXTENT OF USABILITY OF RIVER WATER

River Water can be used in the following way

1. Construction of dams
2. Interlinking of rivers
3. Construction of check dams
4. Construction of canals parallel to the river
5. Lift irrigation

## PROBLEMS OF RIVER WATER USABILITY

- (i) No availability in sufficient quantity
- (ii) River water pollution
- (iii) Load of silt in the river water
- (iv) Uneven seasonal flow of water
- (v) River water disputes between states
- (vi) Shrinking of channels due to the extension of settlements towards the thalweg

### **Why are the rivers polluted?**

**Have you seen the dirty waters of cities entering into the rivers?**

**Where do the industrial affluent and wastes get disposed of ?**

Most of the cremation grounds are on the banks of rivers and the dead bodies are sometimes thrown in the rivers. On the occasion of some festivals, the flowers and statues are immersed in the rivers. Large scale bathing and washing of clothes also pollute river waters.

**How can the rivers be made pollution free?**

**Have you read about Ganga Action Plan, or about a campaign for cleaning the Yamuna at Delhi?**

**Collect materials on schemes for making rivers pollution free and organise the materials into a write up.**