GEOGRAPHY

GRADE X ICSE

NO FLUFF SHEET FOR SCORING 75+/80

MADE BY: u/Unlucky_Unit3049

Includes: Topography, Maps, and 5 single-chapter questions. Waste Management ***MAY*** be coming soon.

Made according to Total Geography 2025-26 Edition

For any questions pls ask in comments. I am sorry if the formatting is bad; I am not a professional.

Topography:

Symbols (given on the bottom of the toposheet)

Definitions:

1. *Scale*: Scale is the ratio between the distances of any two points on the map to its actual distance on the ground.
2. *Contours*: Contours are imaginary lines drawn on a map, which connect places with the same mean height above sea level.
3. *Contour Interval*: The vertical distance between two successive contour lines is contour interval.
4. *Triangulated Contour*: The height of a place which has been determined using trigonometry; represented by a small triangle, ‘Δ’.
5. *Spot Height*: Refers to the height of a point on the ground above the mean sea level.

6. *Relative Height*: Relative Height of a feature is with reference to the height of the surrounding land and not mean sea level.
7. *Fire Line:* A 5 metre wide path made in the forest consisting of no vegetation to prevent spreading of forest fires.
8. *Causeway:* A raised metalled road built across a minor stream.
9. *Brackish:* Well water that is salty and unfit for drinking
10. *Dep:* It is a deflation hollow of the land caused due to erosional action of the wind.
11. *Kiln:* A large outdoor furnace used for brick-baking.
12. *Siphon:* A tube immersed in the water of a canal, used for moving water to lower fields.
13. *Sluice:* A water channel with a gate at it's head to control the flow of water.
14. *Aqueduct:* An open channel raised on pillars to carry water over valleys or mountain regions, under gravitational force.
15. *Sand Dunes:* Mounds or Hills of Sand formed by deposition by wind.
16. *Tank:* Hollow region containing rainwater.
17. *Verbal Scale:* In this method, scale is stated using words. Easy to read, Changes with change in enlargement of map
18. *Linear Scale:* In this method, scale is represented by a straight line divided into equal parts to represent their markings on the actual ground. Does not change with change in enlargement of map, but takes time and skill to make
19. *Representative Fraction (R.F.):* In this method, scale is represented as a ratio of a length of a line on the map to the corresponding length on the ground. It changes with change in enlargement of map, but since it has no units, it is universal term of measurement.

Indications of Seasonal Rainfall:

1. Presence of Causeways
2. Presence of Dry River Bed with a perennial water channel
3. Presence of Dry Stream
4. Presence of Seasonal River
5. Presence of Broken ground

Indications Of Dry Region:

1. Presence of Deps
2. Presence of Sand Dunes

Indications of Irrigation:

1. Presence of Lined Perennial Wells
2. Presence of Perennial Tanks

Indications of Gentle Slope (may be used to find direction of flow of river too):

1. Presence of river with rocks and island (also indicates low flow speed of river).
2. Presence of meanders on main river of map extract

Indications of Rocky Terrain:

Presence of Tanks

Indications of Land unfit for cultivations:

Rock Outcrop

Occupations:

1. *Agriculture:* Presence of yellow wash, which indicates cultivable land. Presence of sources of irrigations, incl. lined perennial wells, perennial tanks, etc.
2. *Lumbering*: Presence of green wash, indicating forests and wooded areas.
3. *Mining:* Presence of mines

4. *Government Services:* Presence of Post offices, Police chauki, rest houses.

Formation of broken ground:

Broken ground forms in conditions of alternate wet and dry periods, where gully erosion occurs along the banks of rivers. The land seeps in, and during dry periods, evaporation occurs, causing cracks in the ground, ‘breaking it up’.

Drainage Pattern:

1. *Trellis*: Streams and distributaries originating from the river are perpendicular to the main river.
2. *Dendritic:* Streams and distributaries originating from the river are not perpendicular to the main river. They look like a tree-root like system.
3. *Radial:* Streams originating from a high place, indicated by spot height/Contour landform with great height. The streams formed go out from a common centre generally in the middle of the landform.
4. *Disappearing:* Found in arid regions. Streams end with ‘…..’ to indicate water drying up.

Settlement Patterns:

1. *Nucleated:* Permanent Huts are close together, often around some central feature, like Church, temple, police chowki, etc.
2. *Radial:* Permanent Huts are arranged in a way such that the edges of the settlement form a proper circle. Houses are generally in lines, around a central feature just like Nucleated.

3. *Dispersed:* Permanent Huts are far apart, generally because cattle-ranching is practiced there.
4. *Linear:* Permanent Huts are arranged in lines often parallel to a Metalled Road or Train Track.

Landforms indicated by Contours:

1. *Gentle Slope:* Contour lines spaced far apart
2. *Steep Slope:* “ ” close to each other.
3. *Conical Hills:* Slopes are uniform, contour lines form concentric circles.
4. *Plateau:* Slopes are uniform, contour lines from concentric ovals.
5. *Ridge:* Slopes are uniform, contour lines from concentric ovals up until second last contour, where inside the second-last contour’s oval, multiple smaller contour lines forming ovals are formed.
6. *Escarpment:* Slopers are non-uniform, steep on side, gentler on the other.
7. *Col or Saddle:* Similar to Ridge, but with only 2 concentric ovals formed. Col forms ‘V’ shape in real world, Saddle forms ‘U’ shape.
8. *Valley, Gorge or Spur:* Contours have ‘V’ shape with apex of V pointing upstream. For gorge, slopes are steeper.
9. *Cliff:* Very steep slope, shown by merging of 2 or more contour lines

Determining Direction Of Flow of river:

1. We can use black arrow mark given on the river to give its direction with respect to North being upwards on the river.
2. We can use nearby contour lines and spot heights to deduce direction of flow. For example, if in an upper grid square there is spot height = 220 m (near the river), and in a lower

grid square, triangulated height = 200 m (near the river), we can deduce that river flows from upper to lower grid square.

Four-Figure Grid:

1. First find the feature who's grid is to be found.
2. For the box, imagine 'L' shape. When we write L, we first make the vertical line '|', then the horizontal line '_'. Similarly, we have to find the grid no. of the vertical line first, then of the horizontal line, then write it in 4-Figure Grid

Six-Figure Grid:

1. First find 4-figure grid of feature, and fill it in at positions 1,2,4,5 (in order) of the 6-figure grid.
2. From the vertical line, take a 1 mm least count scale and place 0 cm mark on vertical line
3. Ensure scale is in line with the feature and its reading is at midpoint of the feature.
4. Mark and remember the distance (in mm) between the vertical line where 0cm mark is placed and the feature.
5. Take that distance, and divide by 2.
6. There is your third digit.
7. Do the same with the horizontal line, to get 6^{th} digit.
8. For decimal answers, round down to the nearest integers.

Finding Linear Distance/Thread Distance between two places:

- For linear distances:
    1. Take scale and measure map distance between the two places
    2. Divide result by 2 and add unit of km. In working, mention scale of Map.
- For thread distances:
    1. Line up thread between the two features along a metalled road (or as asked in question).

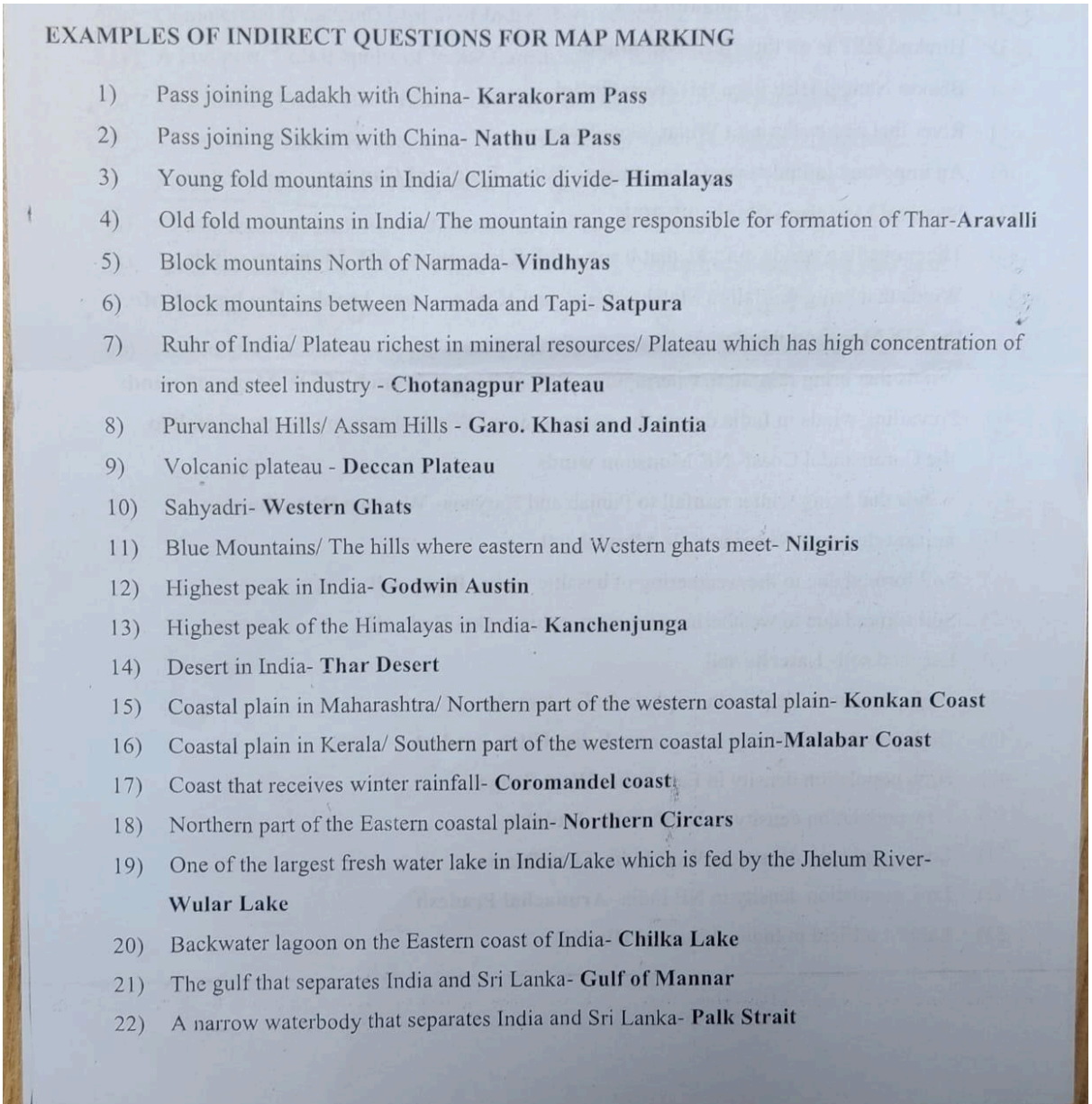
2. Be sure to pinpoint it at multiple points.
3. After ensuring thread is following the metalled road, unmetalled road, cart track, train track, etc., straighten out the thread and measure its length along a scale
4. Divide length by 2 and add unit km. Mention scale in working.

Finding area of a grid square(s):

1. Always remember, area of 1 grid square = 2cm * 2cm = 1 km * 1 km (according to map scale) = 1 km^2
2. Then, count no. of squares in given boundaries.
3. Multiply the no. of squares with area of 1 grid square (so 1)
4. Area found.

Map Marking:

Indirect Questions:



EXAMPLES OF INDIRECT QUESTIONS FOR MAP MARKING

1) Pass joining Ladakh with China- **Karakoram Pass**
2) Pass joining Sikkim with China- **Nathu La Pass**
3) Young fold mountains in India/ Climatic divide- **Himalayas**
4) Old fold mountains in India/ The mountain range responsible for formation of Thar-**Aravalli**
5) Block mountains North of Narmada- **Vindhyas**
6) Block mountains between Narmada and Tapi- **Satpura**
7) Ruhr of India/ Plateau richest in mineral resources/ Plateau which has high concentration of iron and steel industry - **Chotanagpur Plateau**
8) Purvanchal Hills/ Assam Hills - **Garo. Khasi and Jaintia**
9) Volcanic plateau - **Deccan Plateau**
10) Sahyadri- **Western Ghats**
11) Blue Mountains/ The hills where eastern and Western ghats meet- **Nilgiris**
12) Highest peak in India- **Godwin Austin**
13) Highest peak of the Himalayas in India- **Kanchenjunga**
14) Desert in India- **Thar Desert**
15) Coastal plain in Maharashtra/ Northern part of the western coastal plain- **Konkan Coast**
16) Coastal plain in Kerala/ Southern part of the western coastal plain-**Malabar Coast**
17) Coast that receives winter rainfall- **Coromandel coast**
18) Northern part of the Eastern coastal plain- **Northern Circars**
19) One of the largest fresh water lake in India/Lake which is fed by the Jhelum River- **Wular Lake**
20) Backwater lagoon on the Eastern coast of India- **Chilka Lake**
21) The gulf that separates India and Sri Lanka- **Gulf of Mannar**
22) A narrow waterbody that separates India and Sri Lanka- **Palk Strait**

) Largest coalfield in India- **Jharia**

55) Largest iron ore reserves in India- **Singhbhum**

56) The city located at the banks of river Jhelum- **Srinagar**

57) Capital of Punjab and Haryana/ city known for the rock garden-**Chandigarh**

58) Prayagraj/ Located at the confluence of Ganga and Yamuna-**Allahabad**

59) Gateway of Eastern India/ Riverine port/ Truncated port/ handles, major export of jute and tea/ City of Joy- **Kolkata** Jute.

60) Commercial (financial) capital of India/ Biggest natural harbour on the west coast – Mumbai

61) A hub port/ Cottonopolis of India/ Lancashire of India-**Mumbai**

62) City known for National Remote Sensing Agency (NRSA)- **Hyderabad**

63) IT capital of India/ Headquarters of ISRO (Indian Space Research Organization)/ Silicon Valley of India- **Bengaluru** Jute.

64) Oldest artificial harbour on the east coast of India- **Chennai**

65) Deepest landlocked natural harbour on east coast/ Shore based integrated steel plant- **Visakhapatnam** Jute Ship building industy.

66) Natural port located along the coast in Kerala/ port known for export of spices- **Kochi**

23) Largest river/ NW1- **Ganga River**

24) Largest tributary of Ganga/ Delhi is located at the banks of this river- **Yamuna**

25) River that arises from the Malwa plateau- **Chambal**

26) Sorrow of Bihar- **Kosi**

27) Sorrow of Bengal/ River that arises from the Chotanagpur plateau-**Damodar**

28) Red river/ Braided River/ sorrow of Assam/ NW2- **Brahmaputra**

Direct Questions (instructions as per my teacher):

❖ Rivers:

For rivers in North region (J&K, Uttarakhand, etc.)(top to bottom order)

Inspector – Indus

John – Jhelum

Cena – Chenab

Ravi – Ravi

Bhai – Beas

Ke
Saath – Sutlej

For Rivers in South region (Kerala, Andhra Pradesh, Tamil Nadu)(top to bottom)

NANDU → Narmada

TOPPER → Tapti

MAR → Mahanadi

GAYA → Godavari

KACHA → Krishna

TAMATAR → Tungabhadra

KHAYA → Kaveri

For Rivers in East Region and North-East region (U.P., Bihar, Haryana, etc.)(left to right)

Yamuna ne Ganga se kaha Gomti ka Ghaghra Gandhak Kyu (Kosi) hai

Remaining Rivers:
Chalo – Chambal

Beta – Betwa

Sona – Son

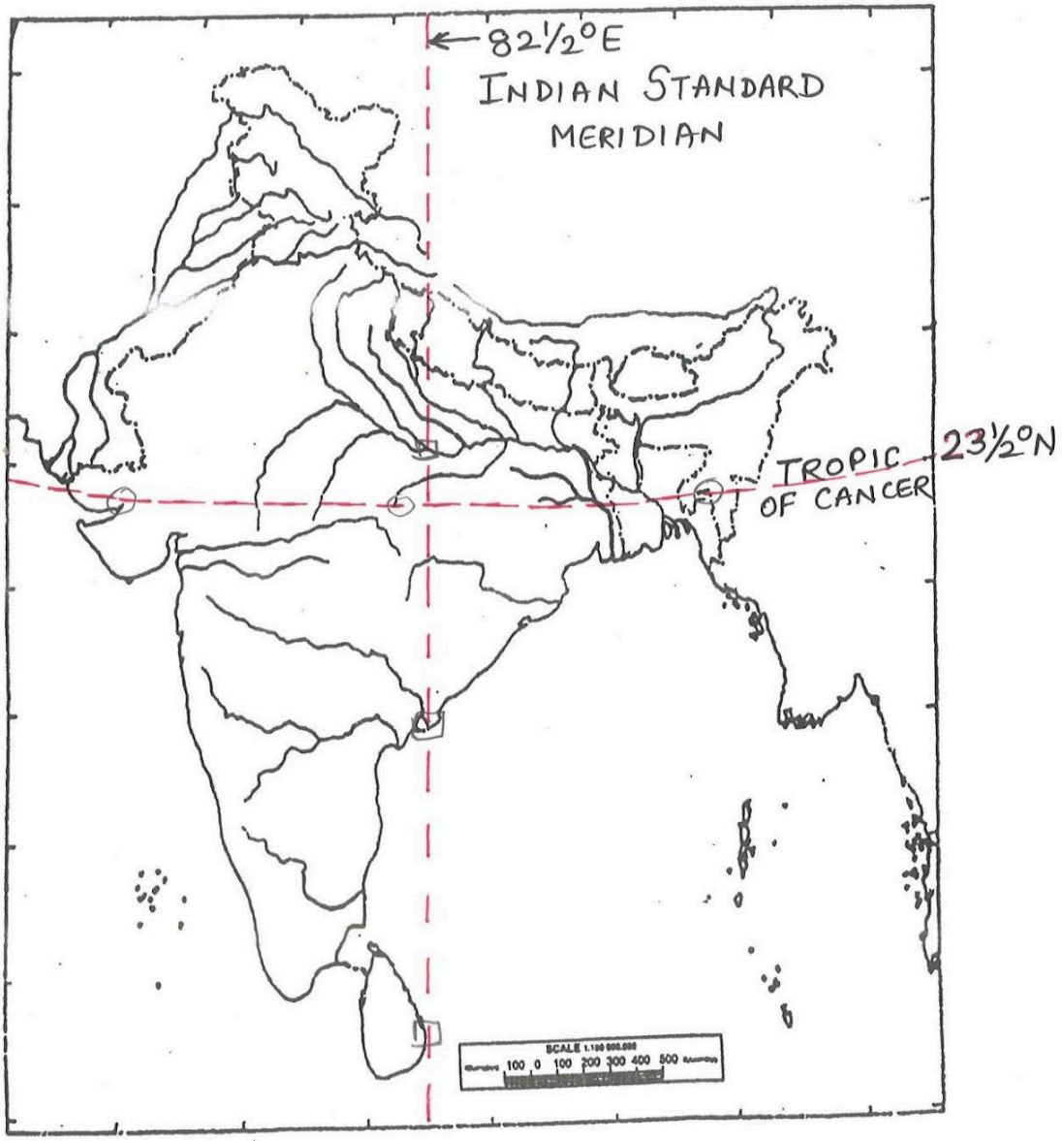
Dhundne – Damodar. For rivers above Maharashtra, Longer one is Narmada, Shorter one is Tapi.

MAP NO-1 INDIA - Important Latitude & Longitude

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



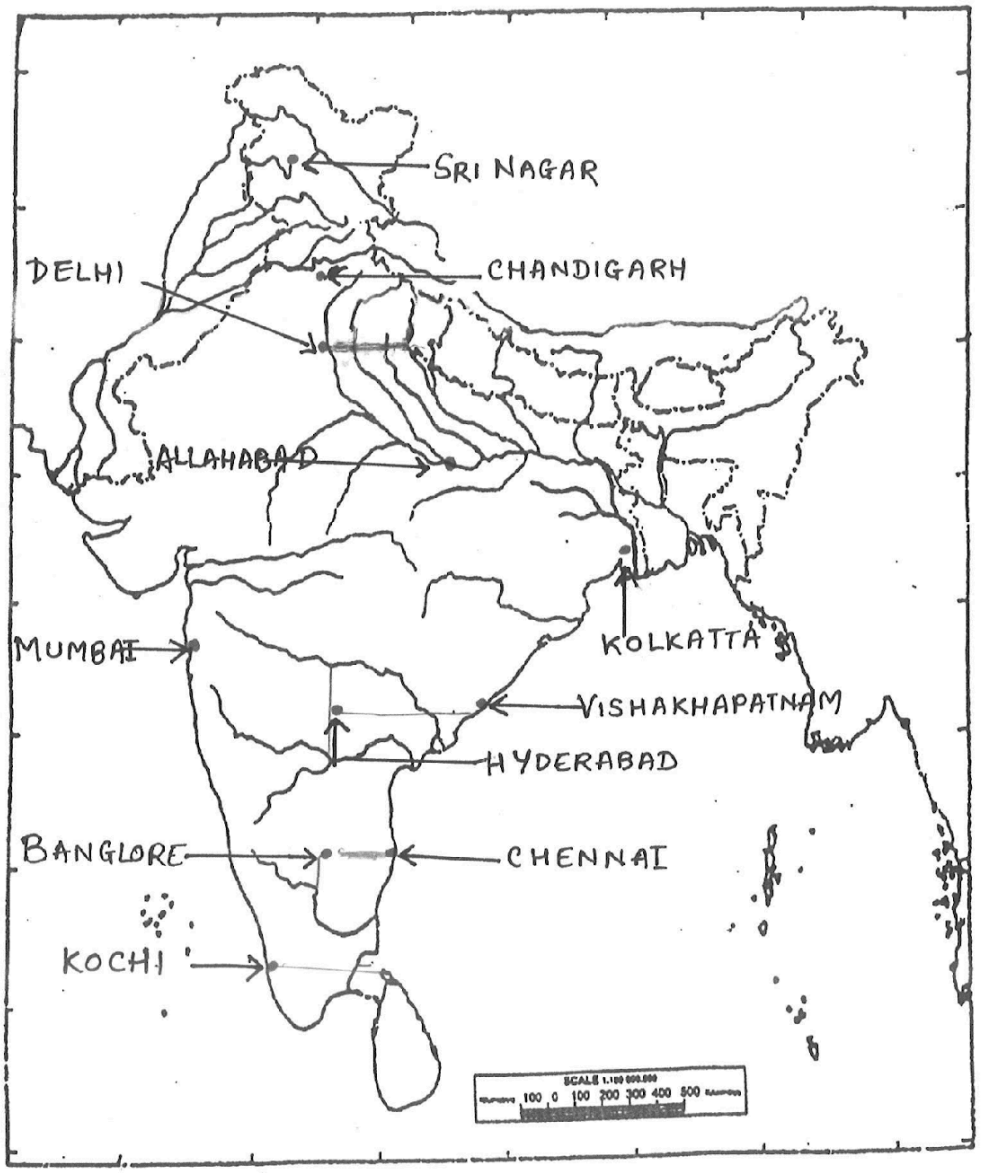
Note :- Tropic of Cancer should not touch River Narmada.

Map No-2 INDIA - CITIES

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.

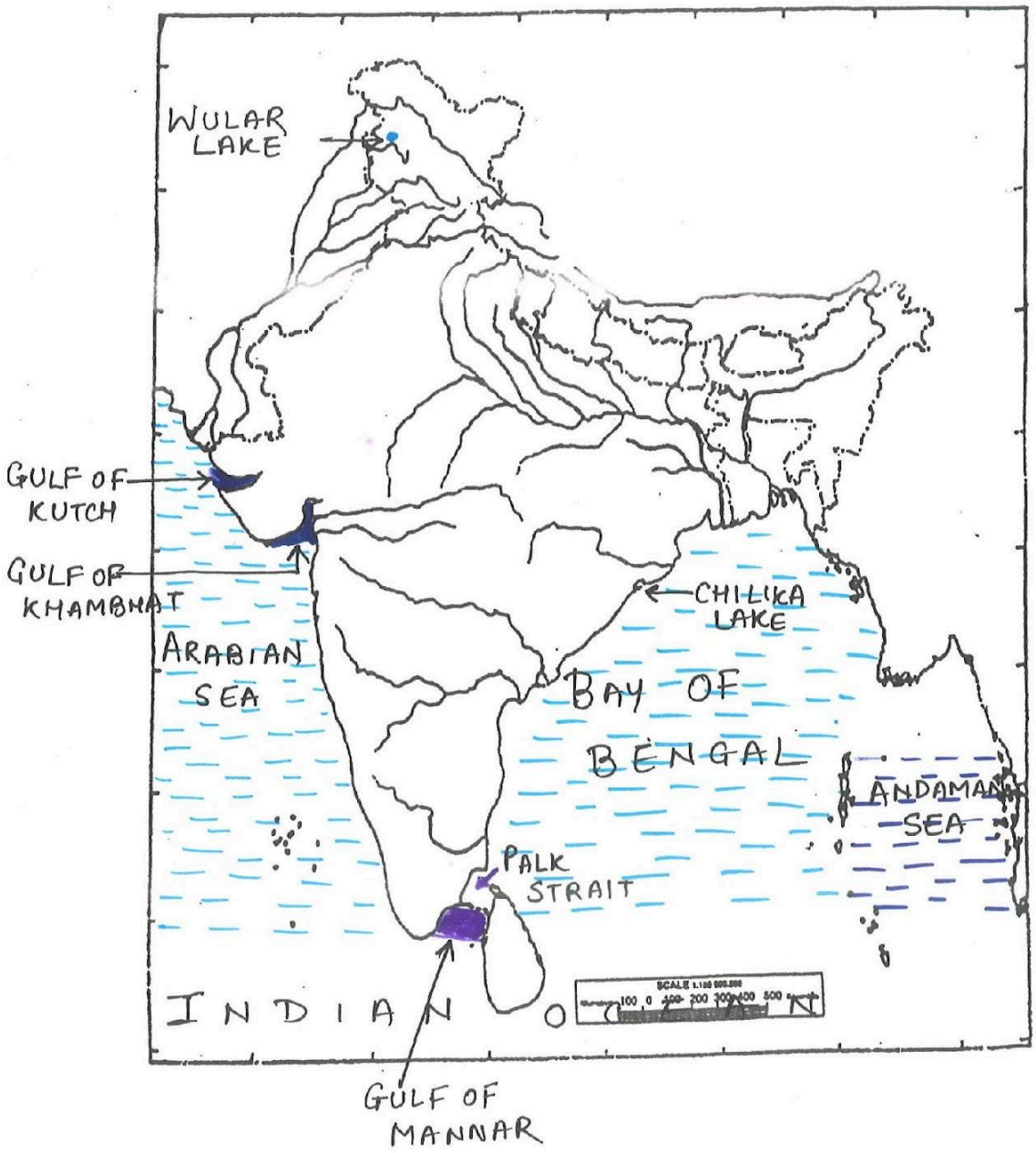


MAP NO-3 INDIA - WATER BODIES

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



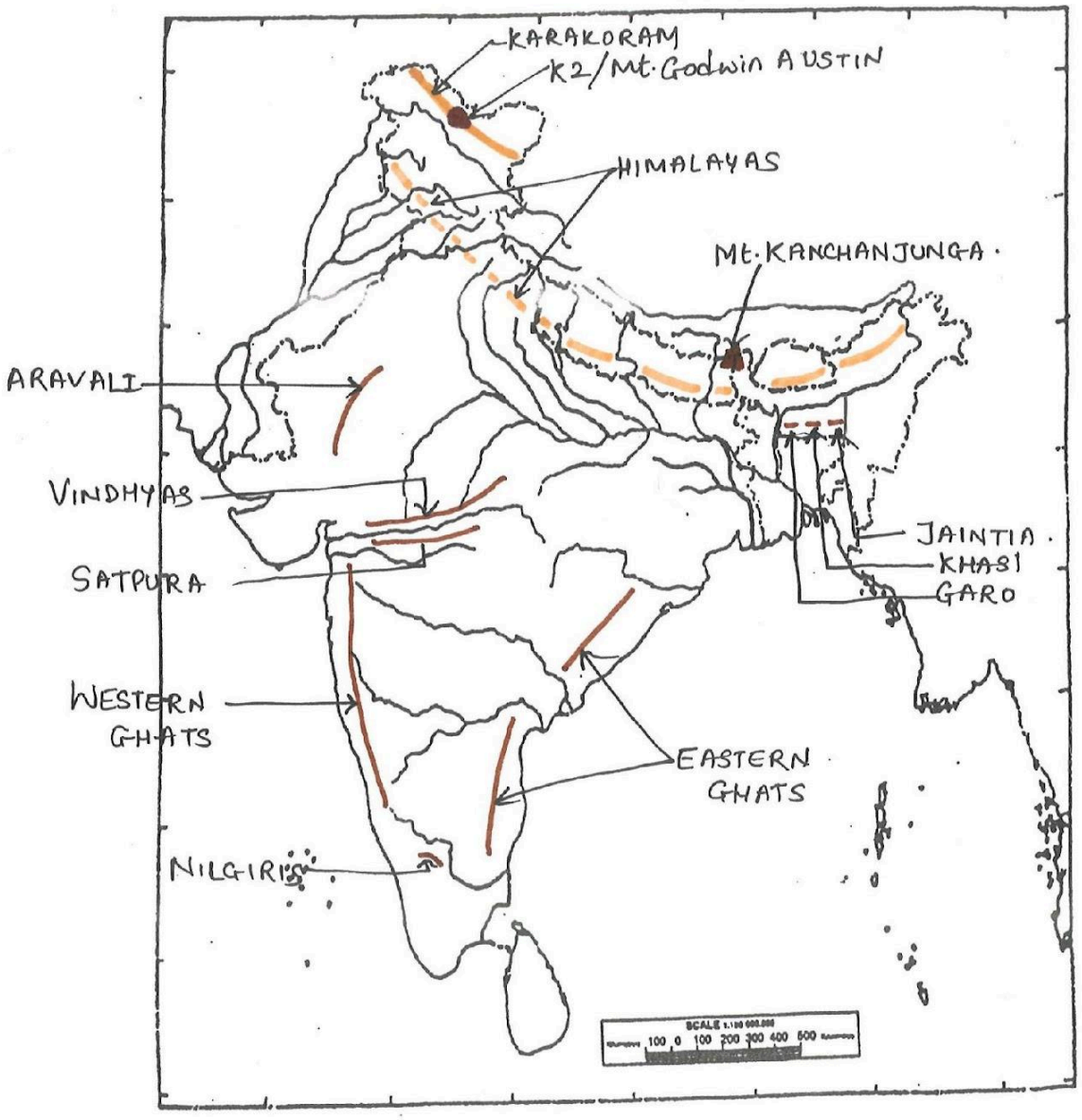
★ Use blue colour waterbodies

MAP NO-5 INDIA – Mountains & Peaks

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



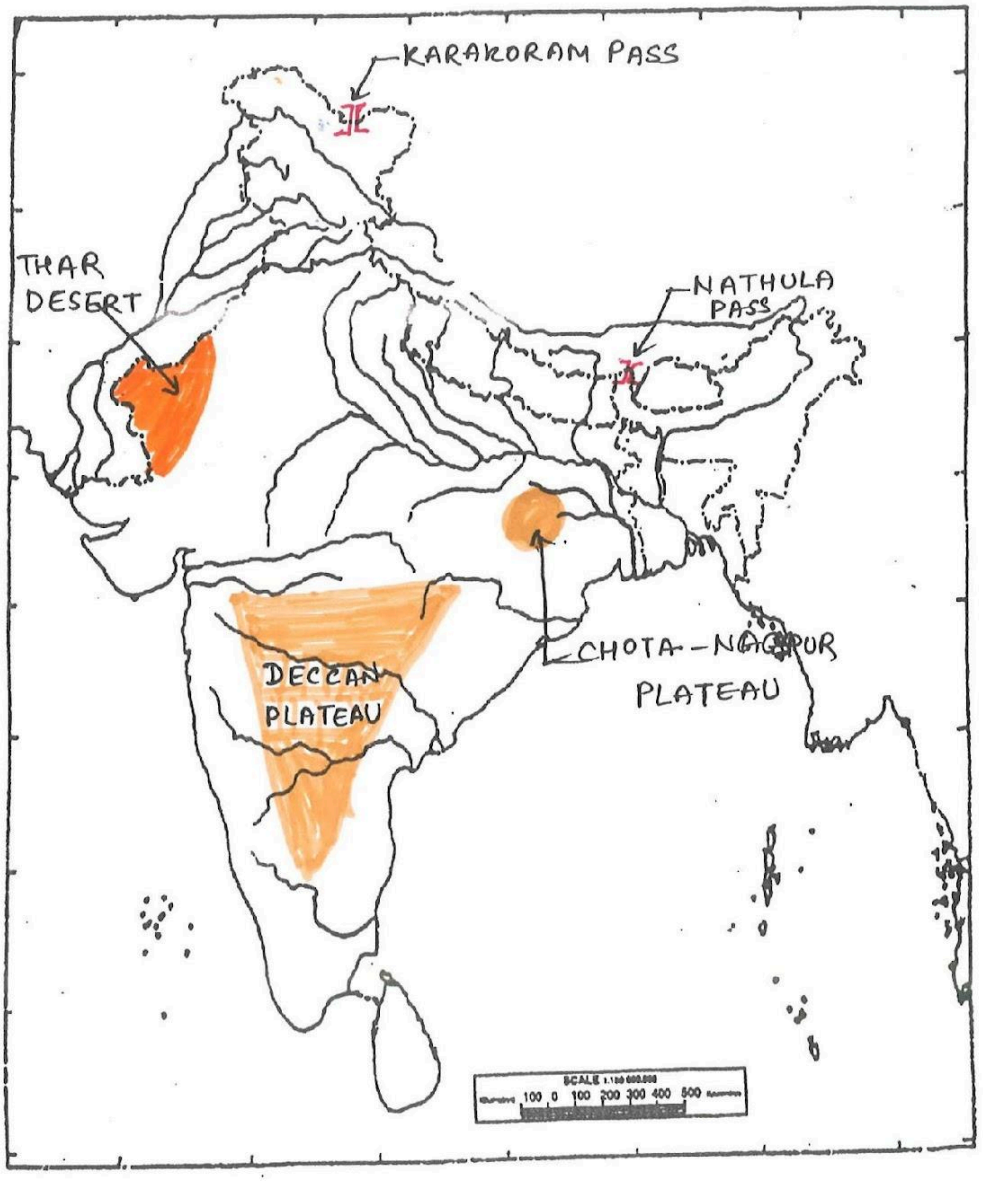
Use Brown colours for mountains and peaks.

MAP NO-6 INDIA - Plateaus, Passes & Desert

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



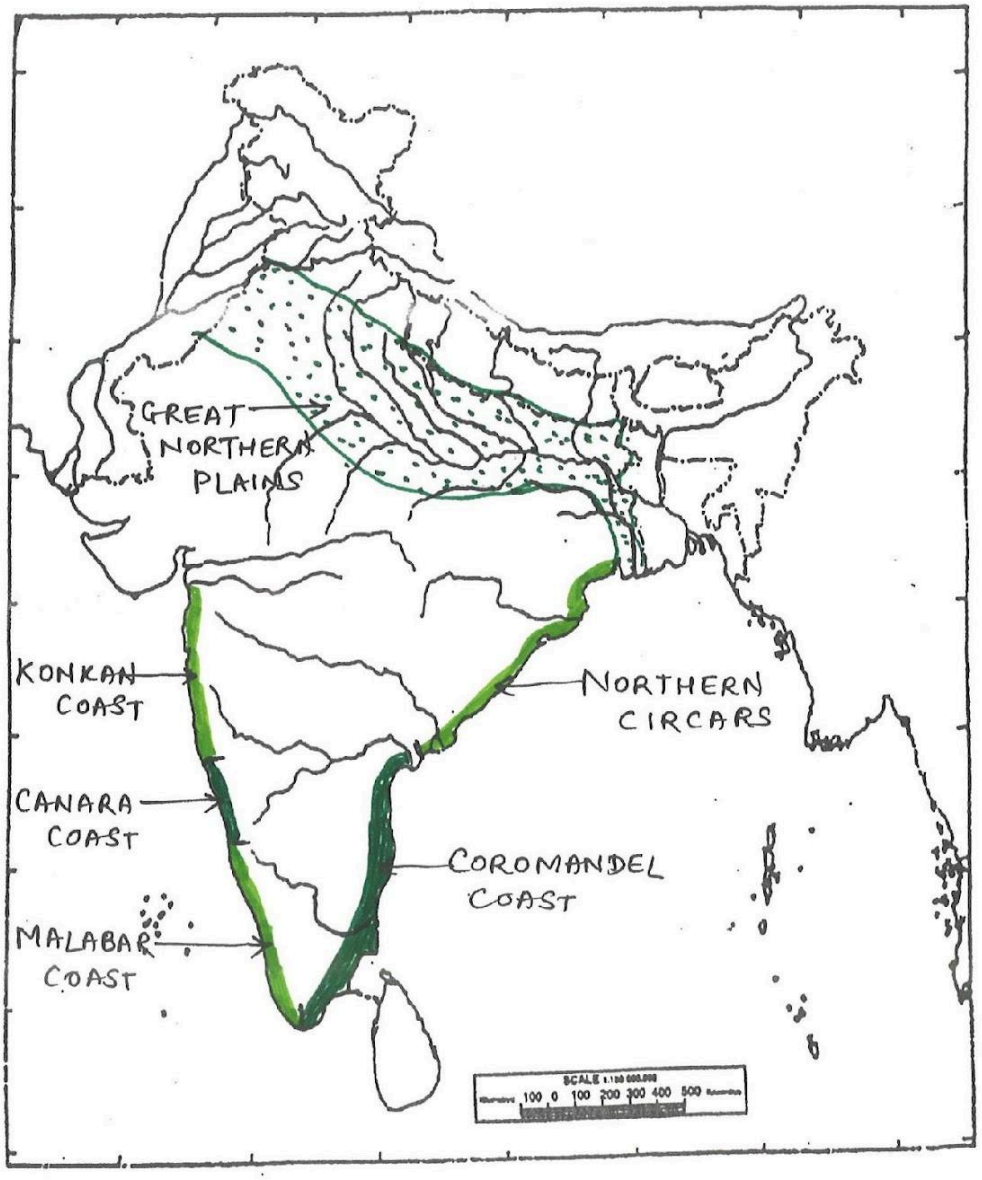
Use light brown and dark yellow for plateau & desert.

MAP NO - 7 INDIA - PLAINS & COASTS

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



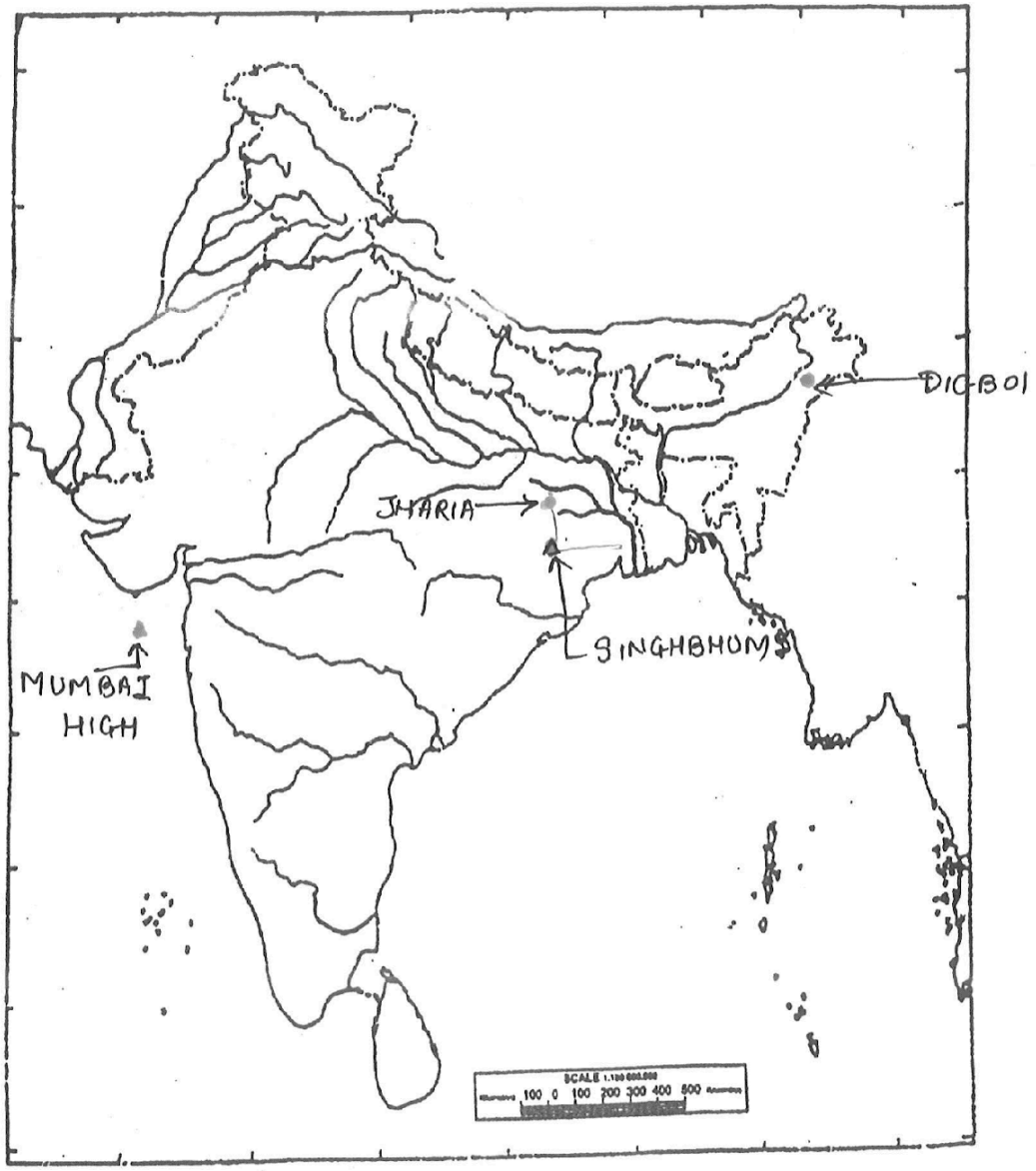
Use green colour to mark plains and coastal plains

MAP NO - 8 INDIA - MINERALS

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.

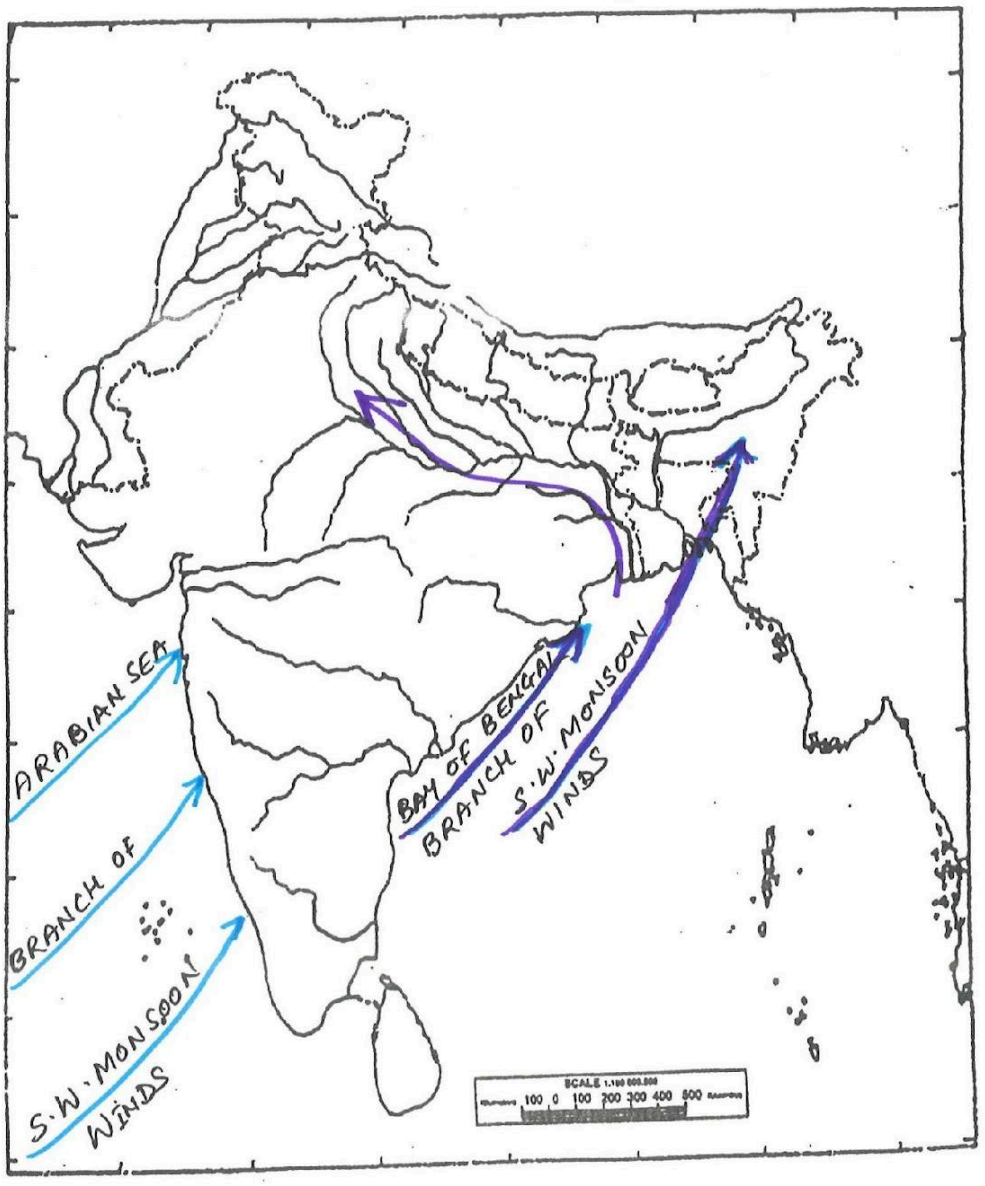


MAP NO : 9 INDIA – CLIMATE (I)

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.

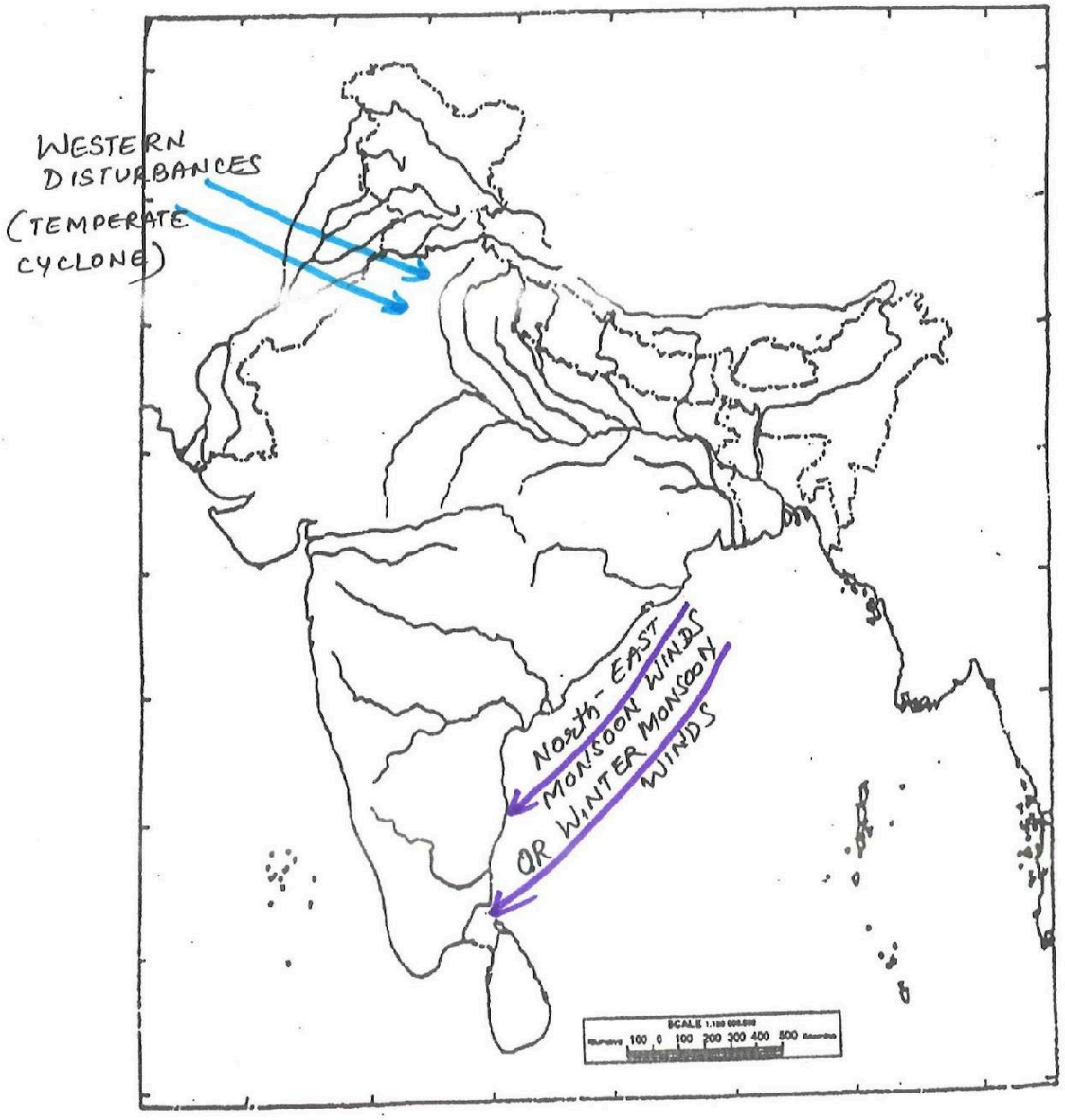


MAP NO : 10 INDIA : CLIMATE (II)

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



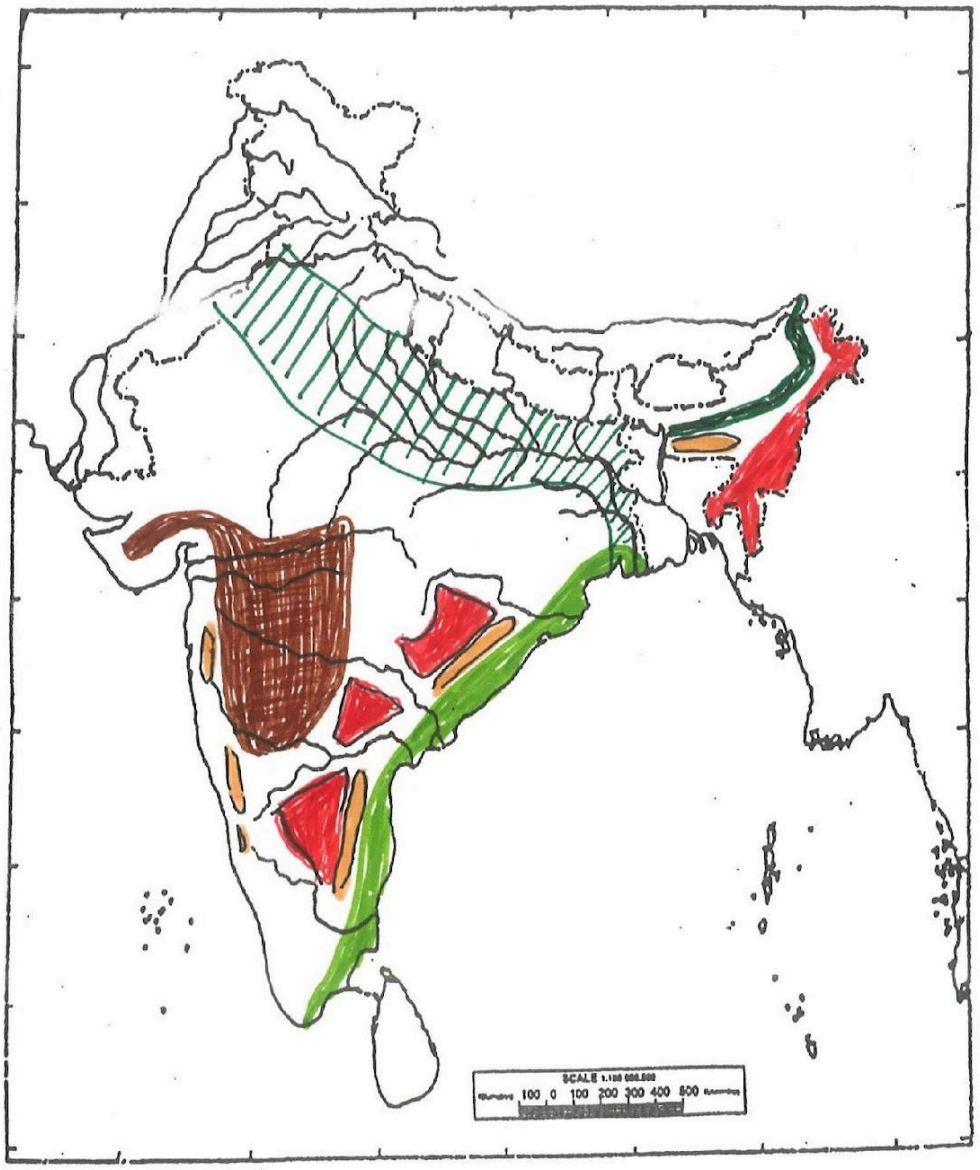
A Western Disturbances winds must enter in India.

Map No-II INDIA - SOILS

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



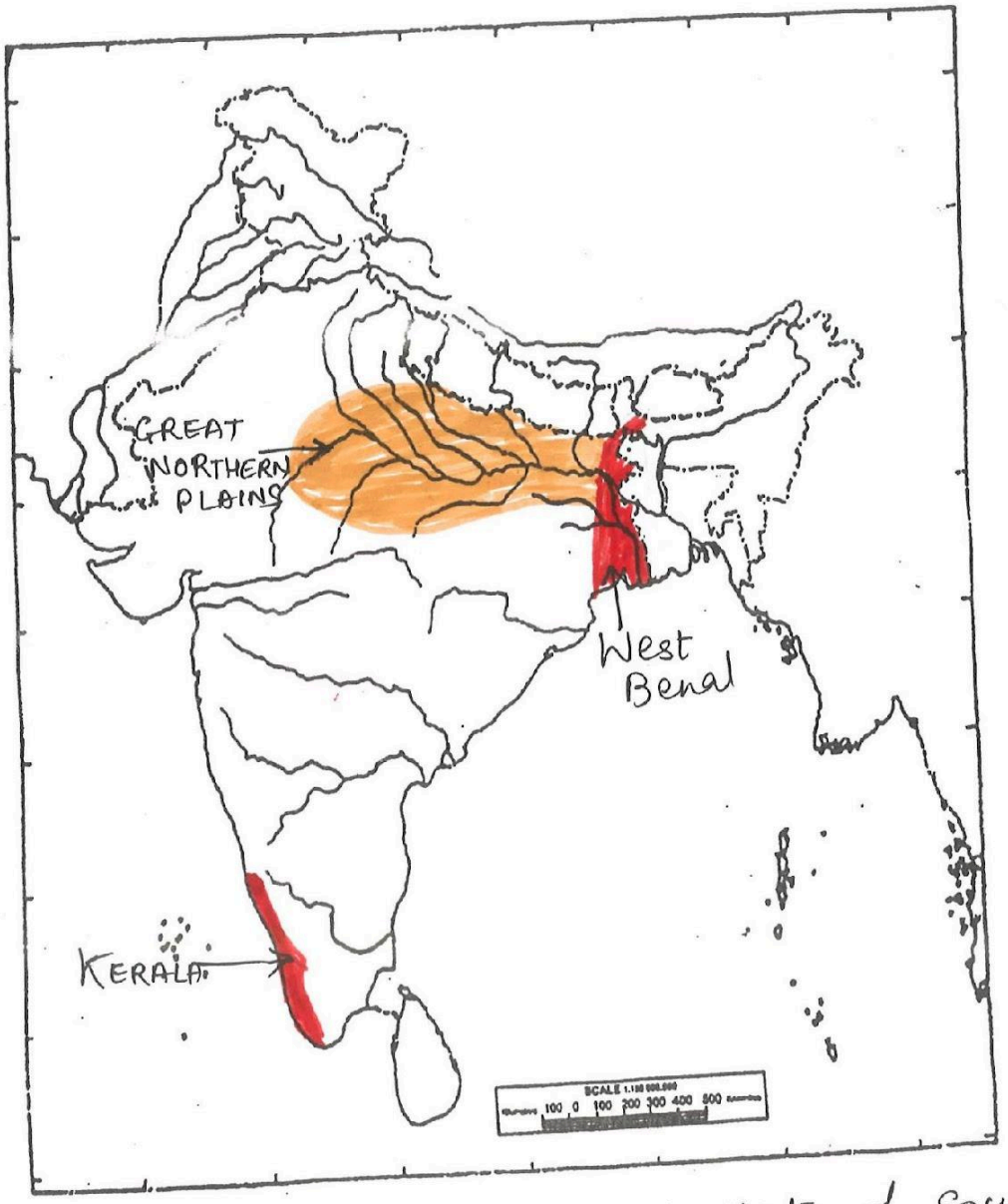
= Alluvial Soil Region
= Black Soil Region
= Red Soil Region
= Laterite Soil Region

Map No-12 INDIA - Densely Populated States and Region.

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



☐ - Kerala - Densely Populated state of South India with highest literacy rate

☐ - West Bengal - Densely Populated state of North or East India

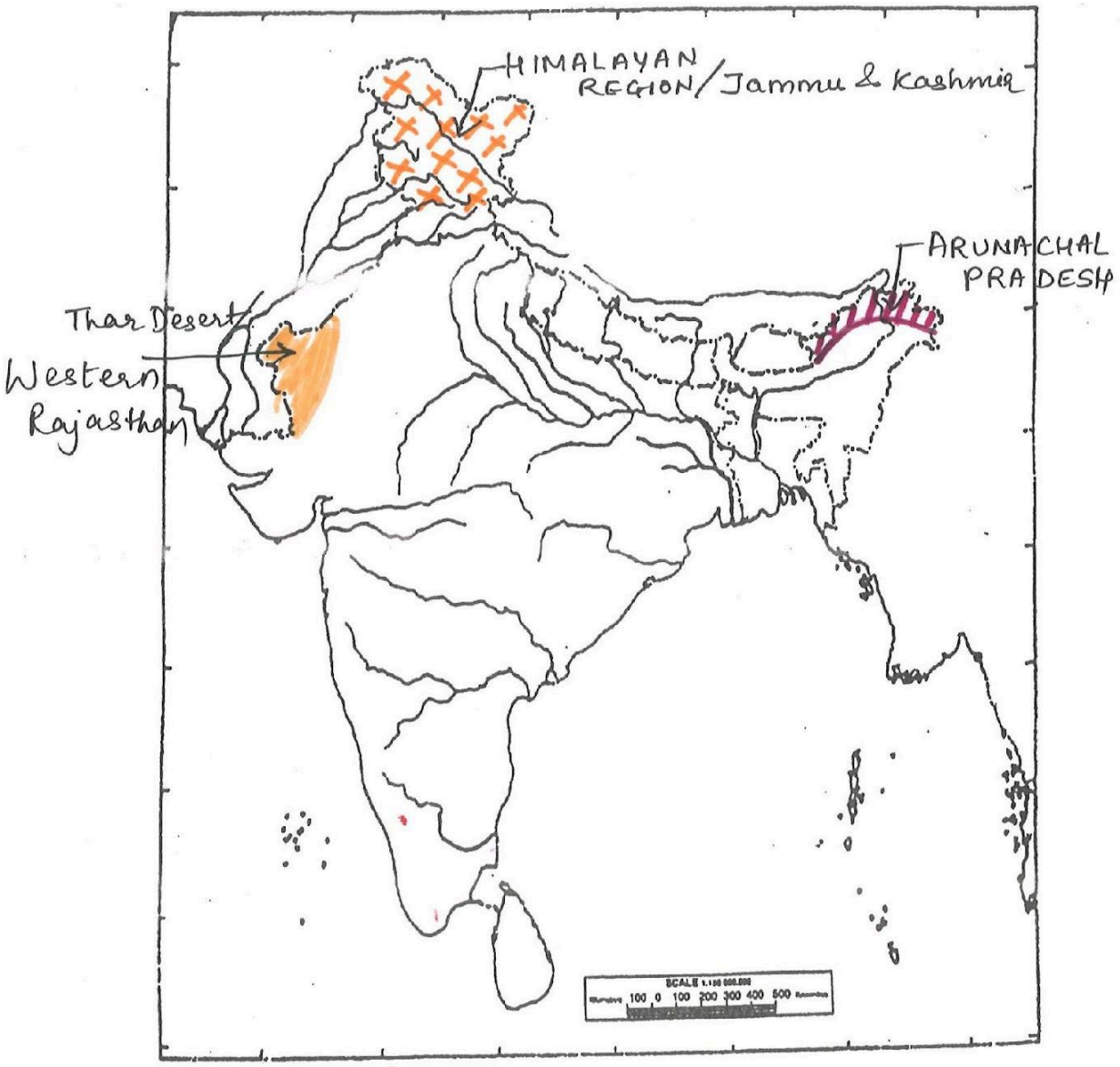
☐ - Great Northern Plains - Densely Populated Region of India.

Map No-13 India- Sparsely Populated State and Regions.

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



(1) Arunachal Pradesh - Sparsely Populated state of India.

(2) Jammu & Kashmir Northern Mountainious Region - Sparsely Populated state or Region of North India

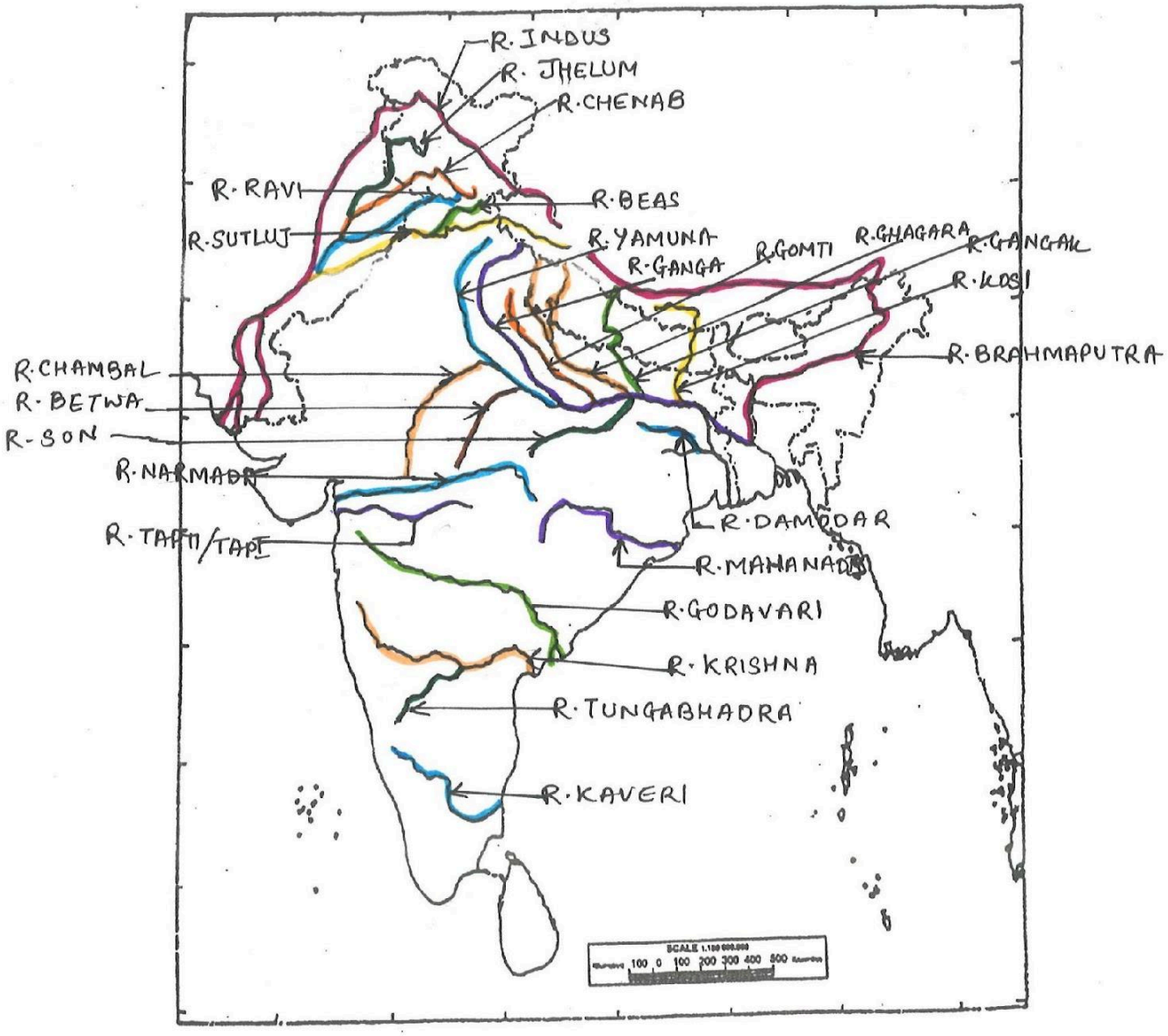
(3) Thar Desert/Western Rajasthan - Sparsely Populated state or Region of West India.

MAP NO-4 INDIA - RIVERS

Name ..... **Index No.** .....

(This map, if used, must be fastened with all other answers)

Map of India for Question 2.



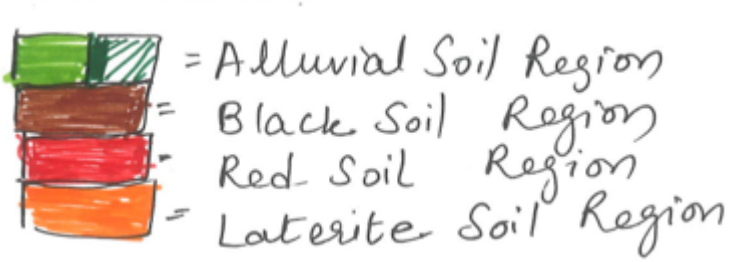
- Use blue colour pencil for marking rivers.
- Colour entire course of river but arrow should point in India.

For marking such as Cities, Minerals, Winds, Latitudes and Longitudes, always make use of other references in the map itself to mark them properly. **CLEARLY SHOW THAT YOU HAVE USED THESE REFERENCES IN MARKING THE FEATURE** (by making dotted lines towards the reference or circling the reference)

For coasts, plains and plateaus, clearly demarcate where they start and finish.

Color Coding Guide:

1. All water bodies – Blue
2. Plateaus – Orange
3. Coasts – Green
4. Mountain ranges and peaks – Brown
5. Cities, Minerals – In the question paper it will be given whether to mark them with a dot or a letter (for e.g. ‘S’ for Singhbhum). Use regular pencil to mark.
6. Soils, Population Region – Use some set colors for marking the soils (other than the colors used in the map extract), and then make a legend on the side of the map like this:



7. Latitudes and Longitudes – Red

In the examination, it is NOT COMPULSORY to use colour pencils.

Most repeated question of Geography class 10th Board exam (credit to u/Electronic_Cap6025):

1. Climate (Give Reasons)

Western Disturbances / Winter Rainfall in North-West India: This is a classic question asking why Punjab/Haryana receives rain in winter or the cause of it.

- 2025 Paper: "Name the local wind that causes rainfall in the states of Assam and West Bengal in the month of April. (Norwesters/Kalbaisakhi - related concept)." [1]
- 2024 Paper: "What causes snowfall in Kashmir during winter? (Western Disturbances)." [2]
- 2023 Paper: "Punjab receives rainfall in winter season. (Western Disturbances)." [3]
- 2020 Paper: "Name one state in the north western part of India that receives rainfall during winter. What is the source?" [4444]
- 2019 Paper: "Identify the wind... (Western Disturbance direction)." [5]
- 2018 Paper: "How is the winter rainfall of the northwest part of India different from the winter rainfall of the southeast part...?" [6]

Mumbai receives more rain than Pune (Windward vs. Leeward):

- 2025 Paper: "Assertion: Mumbai receives more rainfall than Pune. Reason: Mumbai gets rain from Arabian Sea branch..." [7]

- 2023 Paper: "Mumbai is warmer than Delhi in the month of December." [8]
- 2019 Paper: "Goa receives heavier rainfall than Puducherry." [9]
- 2018 Paper: "Central Maharashtra gets less rainfall than the coastal area of Maharashtra." [10]

Tamil Nadu / Coromandel Coast Winter Rainfall:

- 2024 Paper: "Differentiate between Southwest Monsoon and Retreating Monsoon." [11]
- 2023 Paper: "Which of the following areas receives rain from the North East Monsoon? (Coromandel Coast)." [12]
- 2020 Paper: "Tamil Nadu has more rainy months than Kerala, yet Kerala receives more rainfall..." [13]
- 2018 Paper: "Winter rainfall of southeast part of India..." [14]

2. Soil Resources

Black Soil (Regur) - Characteristics & Crops:

- 2025 Paper: "With reference to black soil... How is this soil formed? How is this soil able to retain moisture...?" [15]
- 2024 Paper: "Why is Black soil found suitable for the production of cotton?" [16]
- 2023 Paper: "Mention two characteristics of Black soil." [17]
- 2020 Paper: "Name a soil... good for cotton crop." [18]
- 2018 Paper: "With reference to black soil... Name one important crop... chemical property." [19]

Soil Erosion & Conservation (Terrace Farming):

- 2025 Paper: "What is meant by soil erosion? Name any two agents... Soil conservation is the need of the hour." [20]

- 2024 Paper: "Mention two causes of soil erosion... Mention a soil conservation method suitable for hilly area." [21]
- 2023 Paper: "Terrace farming is an ideal soil conservation method for hilly areas." [22]
- 2019 Paper: "Terrace farming is an ideal soil conservation method for hilly regions." [23]
- 2018 Paper: "What is soil erosion? Mention two causes..." [24]

3. Natural Vegetation

Tropical Evergreen vs. Deciduous Forests:

- 2025 Paper: "Mention the climatic condition suitable for the development of tropical evergreen forest." [25]
- 2024 Paper: "How is tropical monsoon forest useful for the Indian economy?" [26]
- 2023 Paper: "Why is the Tropical Deciduous Forest commercially the most exploited forest belt?" [27]
- 2020 Paper: "Why are Tropical Evergreen forests called 'Evergreen'? ... Deciduous commercially most important." [28]
- 2019 Paper: "Give two reasons... why Tropical Evergreen Forests are difficult to exploit." [29]

Adaptations of Desert/Mangrove Vegetation:

- 2025 Paper: "State any three differences between tropical deciduous and tropical desert vegetation." [30]
- 2024 Paper: "Stilt like/aerial roots are a typical feature of littoral forest." [31]

- 2023 Paper: "Mention two ways in which Tropical Desert vegetation has adapted..." [32]
- 2018 Paper: "Why do the trees in the [Littoral] forest grow aerial roots?" [33]

4. Water Resources

Irrigation Methods (Canal, Tank, Well):

- 2025 Paper: "Tank irrigation is NOT common in Northern India. Canal irrigation is important in Punjab." [34]
- 2024 Paper: "Mention one advantage and one disadvantage of using tank irrigation." [35]
- 2023 Paper: "Well irrigation is a popular means of irrigation in Northern India. Where is tank irrigation most widely used?" [36]
- 2020 Paper: "Name two states where Canal irrigation is extensively used." [37]
- 2019 Paper: "Mention two factors that favour the development of tube well irrigation in Punjab." [38]
- 2018 Paper: "Give a reason... traditional means of irrigation are still important." [39]

Rainwater Harvesting:

- 2025 Paper: "State any three objectives of rainwater harvesting." [40]
- 2024 Paper: "Name the water conservation practice shown... Why is water conservation necessary?" [41]
- 2023 Paper: "What is Rainwater Harvesting? Give two ways it is important." [42]
- 2019 Paper: "Briefly explain... Rooftop rainwater harvesting." [43]

- 2018 Paper: "What is rain water harvesting? What are the advantages...?" [44]

5. Agriculture

Crop Requirements & Processing Terms (Retting, Ginning, Ratooning):

- 2025 Paper: "A microbiological process... facilitates removal of fibre... (Retting)." "Cultivation of groundnut... Sugarcane in Maharashtra." [45]
- 2024 Paper: "With reference to tea cultivation, explain 'fine pluck'. Why is cotton grown as a Kharif crop?" [46]
- 2023 Paper: "What is 'Ginning'? What is meant by 'Retting'? Why is pruning necessary for tea?" [47]
- 2020 Paper: "Explain... Ginning. Ratooning." [48]
- 2019 Paper: "Ratoon cropping is gaining popularity among sugarcane cultivators." [49]
- 2018 Paper: "Jute is retted after it has been harvested. Why tea bushes have to be pruned?" [50]

6. Manufacturing Industries

Location Factors (Cotton, Sugar, Iron & Steel):

- 2025 Paper: "Factors responsible for growth of cotton textile in Kolkata. Karnataka leading for silk. Chhattisgarh Iron & Steel." [51]
- 2024 Paper: "Conditions that favour location of cotton textile in Ahmedabad. Advantage of Rourkela Steel Plant." [52]
- 2023 Paper: "What has made Mumbai an important centre for cotton textile? Problems of sugar industry." [53]

- 2020 Paper: "Why Mumbai developed into important cotton textile centre? Important factor for location of Sugar industries." [54]
- 2019 Paper: "Why sugar industries be located close to sugarcane growing areas? Ahmedabad important cotton centre." [55]
- 2018 Paper: "From where does Bhilai / Vishakhapatnam get Iron ore/Coal?" [56]

7. Transport

Comparison of Modes (Road vs. Rail vs. Air vs. Water):

- 2025 Paper: "Advantages of road transport. Airways... connect Northeast India. Rivers of peninsular India NOT ideal." [57]
- 2024 Paper: "Why is road transport important? Northern plain best suited for Railways. Inland water disadvantage." [58]
- 2023 Paper: "Airways is gaining popularity... Why South Indian rivers not ideal for inland water?" [59]
- 2020 Paper: "Why inland water transport not well developed? Road transport most popular." [60]
- 2019 Paper: "Railways is important... compared to airways. South Indian rivers not ideal." [61]

8. Waste Management

Methods (Segregation, Composting, 3Rs):

- 2025 Paper: "Give a term... (3Rs examples). Organic manure should replace chemical fertilisers." [62]
- 2024 Paper: "Give two uses of composting. Why are landfills set up far away?" [63]

- 2023 Paper: "How is segregation of waste helpful? Benefit of Composting." [64]
- 2020 Paper: "Why is segregation of waste essential? Benefit of Composting." [65]
- 2019 Paper: "Why must segregation of waste be done? How has composting proven to be a great help?" [66]
- 2018 Paper: "What do you mean by: Segregation, Composting, Dumping?" [67]

9. Topography (Survey Map) - Compulsory Section

Always Repeated Questions:

- 6-Figure Grid Reference: (e.g., spot height .437, temple).
- Direction: Compass direction of one settlement from another.
- Distance: Calculate direct distance in km
- Drainage Pattern: Identify Dendritic, Trellis, or Radial.
- Settlement Pattern: Identify Nucleated or Dispersed.
- Feature Identification: List two man-made and two natural features from a specific grid.
- Definitions: Meaning of contours, causeway, broken ground, fire line

In this document, I will only be including the 5 ‘single-chapter questions’, according to Total Geography Class 10 book, i.e., Climate, Natural Vegetation, Soil Resources, Water Resources, and Transport.

IF I get the time I will make some more for other chapters (except Agriculture I → IV not doing that at all).

Chapter 7: Climate

G.R.: India has a tropical monsoon type of climate. This is because India’s lies in the tropical belt, and its climate is heavily influenced by the monsoon winds which are largely confined to the Tropics, i.e., between 20◦ North and 20◦ South.

Characteristics of tropical monsoon type of climate:

Relatively high temperatures and dry winters.

Himalayas in the North protect India from the cold Siberian Winds, and from India turning into a cold wasteland.

The Indian Ocean in the South has a moderating influence on the climate of India, and gives the South region a hot monsoon climate.

Areas near the coast experience maritime type of climate due to moderating influence of seas. Maritime includes characteristics like low diurnal range of temperature, high amounts of rainfall, high humidity, and no distinct temperature differences between summer and winter.

Areas away from the sea coast experience continental type of climate, with characteristics opposite that of maritime.

❖ Distribution of temperature:

1. Barmer in Rajasthan may record day-temperatures of 48◦ C to 50◦ C during the summer (June), while it hardly reaches 22◦C in areas like Pahalgam in Kashmir.
2. Kerala has maritime type of climate with warm and moist air, while Punjab has continental type of climate with severe heat alternating with severe cold.
3. Temperatures touch -40◦ C in Dras near Kargil, the coldest place in India, while Kerala only experiences ~22◦ C.
4. Places near the coast experience low differences in day-night temperatures (diurnal range)(3-8◦C), while places away from the coast experience high differences in day-night temperatures (20-30◦C).

❖ Distribution of Rainfall:

1. Cherrapunji and Mawsynram in Meghalaya, the wettest places in the world, get ~1100 cm of rainfall every year, while Jaisalmer in Rajasthan gets only ~9cm rainfall annually.
2. Coromandel Coast remains dry in the months of July and August, whereas the Ganga delta and coastal

plains of Odisha are hit by strong storms almost every third or fifth day.

3. Most parts of India get rainfall during June-September, but coastal areas on eastern coast of India get rainfall in beginning of winter season.

❖ Factors affecting climate of India:

1. Himalayas:

- ❖ Act as a climatic barrier, shielding India from the harsh cold Siberian Winds, and prevent India from becoming a cold wasteland
- ❖ Force the moisture-laden South-West Monsoon Winds to shed their moisture in the Indian Subcontinent, and prevent from being a dry region

2. Varied Relief:

- ❖ The Western Ghats cause high amounts of orographic rainfall on the windward side, from the Arabian Sea Branch of South-West Monsoon Winds.
- ❖ Their leeward sides, such as Deccan plateau, get less rainfall as much of the moisture has already been shedded on the windward side.
- ❖ In Rajasthan, The Aravalli range lies parallel to the direction to the direction of the South-West Monsoon winds, and hence has no stopping effect on them, making Rajasthan a dry region.
- ❖ The southern hills of Assam get heavy rainfall as they lie on the windward side of the Garo, Khasi, and Jaintia mountain ranges.

3. Monsoon Winds:

- ❖ The South-West Monsoon Winds from the Arabian Sea and Bay of Bengal, move towards the low-pressure area of the North-west India. They cannot cross the Himalayas, leaving Tibet as a dry region.
- ❖ The SW Monsoon Winds start retreating from Punjab and U.P. by September, from Central India by October, and by the end of November from South India.
- ❖ This Retreating monsoon brings rain in the Coromandel Coast.
- ❖ During the winters, dry offshore North-East Monsoon Winds blow from land (Mongolia/West China) to sea (Bay of Bengal).
- ❖ They do not cause rainfall over most of India, however, some of these pass over the Bay of Bengal and gain some moisture, which they shed on the Coromandel Coast.

4. Latitude:

- ❖ India is divided into the two parts by the Tropic of cancer.
- ❖ The part above the tropics experiences moderate climates with cold winters and hot summers. It never has the mid-day directly over it at any point
- ❖ The part below the tropics experiences tropical climate, without a clear cut winter season. It has the mid day sun vertically overhead at least twice a year.

5. Altitude:

- ❖ For every 166 m in rise in altitude, there is a 1◦ C drop in temperature. This is called the Normal Lapse Rate. For this reason, hill stations (Shimla, Mahabaleshwar, Darjeeling, Ooty), have lower temperatures than other places.

6. Influence of the Surrounding Seas:

- ❖ India has three water bodies surrounding it, namely – Indian Ocean (south), Bay of Bengal (east), and Arabian Sea (west).
- ❖ These act as sources of moisture of for the monsoon winds, causing rainfall.
- ❖ They cause a moderating influence on the areas close to them

7. Western Disturbances:
   - ❖ These winds and cyclones arise from the Mediterranean Sea and reach India, causing rainfall in the Northern Plains and snowfall in Jammu and Kashmir.
8. Jet Streams:
   - ❖ Jet Streams are cold, fast blowing winds which develop in the upper layers of the atmosphere.
   - ❖ The westerly jet stream prevails over the Northern Plains during the winter months, steering the Western Disturbances towards India, and the easterly jet stream steers the tropical depression over India.
   - ❖ They affect the distribution pattern of rainfall in India, and most of the rainfall in India occurs along the track of these depressions.

9. Distance from the Sea:
   - ❖ Areas in the interiors have continental type of climate, while areas nearer the coast have maritime type of climate.
   - ❖ This is caused due to the effects of land and sea breezes, caused due to different amounts of heating of land and sea, which affects the temperature of air, causing winds.
   - ❖ On the Western coast, the western ghats do not allow such influences to go too inwards into the land. The moderating influence gets limited to the coastal areas.

10. El-Nino Effect:

- ❖ El-Nino refers to the abnormal warming of the Pacific region's surface waters.
- ❖ It affects movement of monsoon winds over India, causing drier monsoons and delay in their onset.

❖ Monsoon Phenomena and Mechanisms:

- <u>Summer Monsoons:</u>
  In the Summers, the land gets heated more than the Seas. This causes a low pressure to develop over the land. Over the adjoining sea, the air is comparatively cooler, and so a higher pressure is observed. Winds blow from higher to lower pressure, and hence the winds blow from sea to land. This is the Summer Monsoons.
  In May, June, and July the Indian plains are heated strongly by direct rays of the Sun, causing a low pressure to develop over them. The sea doesn't heat as much, causing a higher pressure there. So, the winds blow from the Indian Ocean into the subcontinent north and northward into Asia. As they blow from sea to land, they cause heavy amounts of rainfall. These winds blow from the south-west and are hence called the 'South-West Monsoon Winds'.

- <u>Winter Monsoons:</u>
  During the winters, a high-pressure area develops over the land, namely from Central Asia up to the Gangetic plains. At the same time, a low-pressure area develops over the Indian Ocean. As the winds blow from land to sea, they don't carry moisture and do not produce rain, EXCEPT, where they pass over the Bay of Bengal, where they gain some moisture, and cause rain over the Coromandel Coast. Since the winds blow from North-east, these winds are called 'North-East Monsoon Winds'.

❖ Four Seasons in India:

1. Hot and Dry Summer (March – May)
2. Hot and Wet or Rainy or the South-West Monsoon season (June – September)
3. Retreating Monsoon Season (October – November)
4. Cold and Dry winter or North-East Monsoon Season (December – February)

❖ Hot and Dry Summer:

❖ Temperature:

From March to May, due to apparent northward movement of the sun's vertical rays, the length of the day increases. Temperatures start rising all over the subcontinent. In most parts, temperature ranges between 30-32◦C. In the north-west India, temperatures of up to 48◦C are not uncommon
In south India, the effect is not as pronounced due to the moderating influence of the surrounding seas. Temperature ranges between 26-32◦C in these areas.
Plateaus and hills also don't have as high temperatures due to their altitude.

❖ Pressure Conditions:

The warmest area slowly shifts from the Deccan to North-west India, between Thar Desert and Chhota Nagpur Plateau. By the end of May, a high-pressure area develops near Cape Comorin extending towards the Arabian Sea. By June, the inland low-pressure system becomes more intense and moves northward with its center over the Indus lowlands and Baluchistan.

❖ Storms and Rainfall:

Weak winds and dryness. The low pressure over the northern plains draws winds from surrounding areas causing dusty thunderstorms, causing rains in Punjab, Haryana, and U.P.

❖ Local Winds:

1. Strong dusty winds, called ‘loo’ are formed which blow during the day in north and north-western parts of India. They have temperatures of up to 45-50◦ C, and can cause heat strokes.
2. Tornado-like dust storms in Punjab, Haryana, U.P.
3. Thunderstorms accompanied with strong winds and heavy rain occur in Assam and West Bengal. These winds are called ‘Kalbaisakhi’ in W.B. and ‘Bardoli Chheerha’ in Assam. They originate over the Chhota Nagpur Plateau and bring rainfall in Assam, W.B., and Odisha. They help in growing jute and rice in W.B. and tea in Assam.
4. Thunderstorms cause rainfall along Kerala and Karnataka coasts which are useful mango, coffee, and tea plants. So, they are called ‘mango showers’, as they help in early ripening of mango crop. Also called ‘cherry blossoms’ in Karnataka.

❖ South-West Monsoon Season:

The South-west monsoon winds are formed due to pressure differences between the land and sea in the Indian subcontinent. The low pressure in the north-western part of India causes the South East Trade Winds to get attracted towards India. the South-East Trade Winds to deflect after crossing the equator towards the right because of the Coriolis force, and reach the west coast as South-West Monsoon.

The sudden violent onset of rainfall in the first week of June is termed as ‘Burst of Monsoon’.

When rainfall doesn't occur for 2 or more weeks there is a dry period in the monsoon. This dry period is called 'Break of Monsoon'.

❖ Branches of the South-West Monsoon Winds:

1. Arabian Sea Branch
2. Bay of Bengal branch

❖ Arabian Sea Branch:

1. One branch is obstructed by the western Ghats. This branch causes rainfall on the windward sides of the Sahyadris.

2. One branch hits the coast just north of Mumbai. It continues further along the Narmada and Tapi rivers can causes some rainfall in Central India. It causes ~15 cm rainfall in Chhota Nagpur Plateau. After that, it enters the Ganga plains and mingles with the Bay of Bengal branch
3. One branch hits Saurashtra peninsula and Kutch. After that, it passes over west Rajasthan and causes scanty rainfall along the Aravallis. It joins the Bay of Bengal branch in Punjab and Haryana, causing rainfall in the north-west regions.

❖ Bay Of Bengal Branch:

1. Its mainly directed towards the coast of Myanmar, but due to the presence of the Arakan hills on the Myanmar coast, a large part of the branch is deflected towards India. The monsoon enter Bangladesh and West Bengal from the south and south-east instead of south-westerly direction.
2. This branch bifurcates into two branches, one along the Ganga plains and one along the Brahmaputra Valley and Garo Khasi hills of Meghalaya.

3. Cherrapunji and Mawsynram located on the southern crest of the Khasi hills, receive highest annual rainfall in the world.

The Tamil Nadu coast mainly remains dry during this season. This is because Tamil Nadu lies parallel to the Bay Of Bengal branch of the South West Monsoon Winds, and in the rain shadow of the Arabian sea branch of South West Monsoon Winds.

Arabian Sea Branch	Bay of Bengal Branch
It travels a larger distance and has a lot of moisture.	It travels a comparatively shorter distance and has less moisture
It blows over India	It blows over India, after being deflected by Arakan Hills in Myanmar
It hits the Western Ghats as soon as it blows over land	It has to travel a long distance over land before it hits any major mountains.

❖ Retreating Monsoons:

The reason for the retreat of South-West Monsoon is that the low-pressure area over the Ganga plains becomes weaker due to the apparent southward movement of the Sun.

The retreat of the monsoon is marked by clear skies and drop in night temperatures. The land remains moist. The combination of high temperatures and humidity gives rise to oppressive weather commonly called ‘October heat’. Day temperatures rise due to clear skies. It is a transition period between the hot, rainy, and cold, dry season.

The low-pressure conditions shift to the Bay of Bengal by early November. This shift is marked by cyclonic depressions originating over the Andaman Sea. Some of

these depressions cross the eastern coasts of the south peninsula resulting in heavy rainfall in Tamil Nadu and some parts of Odisha. Bulk of the rainfall received during this season is due to the cyclonic depressions.
Tropical cyclones, originating between 12-17◦ N cause great loss of life in states like Odisha, Tamil Nadu, and Andhra Pradesh.

Tropical Cyclones	Temperate Cyclones
Tropical cyclones are largely a summer phenomenon.	Temperate cyclones are largely a winter phenomenon.
They are generally smaller and more circular.	They are larger and oval in shape.
They develop over seas.	They develop over continents.
They develop in the tropical region of Bay of Bengal and influence Indian coastal climate.	They develop in the temperate region of the Mediterranean Sea.
They bring heavy rainfall with strong winds over the Coromandel Coast.	They bring light-moderate rain in northwestern India.

Sources of Rainfall for Punjab and Haryana:

1. Western Disturbances
2. Both branches of South-West Monsoon Winds

Sources of Rainfall for Coromandel Coast:

1. North East Monsoon Winds
2. Retreating Monsoon Winds

❖ North-East Monsoon Season:

January is usually the coldest month. Temperatures decrease from south to north. Dras Valley near Kargil is coldest place in India, recording temperatures of -45◦C.

The excessive cold in North India is for the following reasons

1. In February, cold winds from the Caspian Sea and Turkmenistan bring cold wave over the northwestern parts of India.
2. Punjab, Haryana, and Rajasthan experience continental type of climate as they are located far away from the sea to experience its moderating influence.
3. The snowfall in the nearby Himalayan ranges creates cold wave situations.

In Peninsular India, such cold conditions aren't observed, instead, diurnal range of temperatures remains low. This is due to the moderating influence of the surrounding sea on the land.

- Pressure:

  Feeble high-pressure conditions over north-western part of plains. This is because there are no vertical rays of the Sun hitting the plains, as they have moved to the Southern Hemisphere.

  During this season, North-East Trade Winds prevail over the country. These winds blow from land to sea and hence for the most parts of the country, it is a dry season. However, when they pass over the Bay of Bengal they pick up some moisture and cause some amount of rainfall on the Coromandel Coast. As these winds blow from the north-east direction, they are called 'North-East Monsoon Winds'

- Temperate Cyclones (Western Disturbances):

  These western disturbances bring much needed rainfall over the plains and snowfall in the mountains. 4-5 such depressions affect India every year, from December – February. The rainfall is of importance to rabi crops.

❖ Rainfall:

1. Central parts of India and northern parts of the Peninsula get some rainfall.
2. Western Disturbances cause rainfall in Delhi, Punjab, Haryana, and western U.P. Rainfall amount is small, but of importance to rabi crops.
3. North-eastern India gets 25-50 mm rainfall during winter
4. When the North-East monsoon winds pass over the bay of Bengal, they gain some moisture, which they shed when they hit land, at the Coromandel Coast in Tamil Nadu and southern tip of Andhra Pradesh.

❖ Distribution of Rainfall:

1. *Heavy Rainfall (>200 cm):* Windward sides of Western Ghats, southern slopes of Garo-Khasi-Jaintia hills.
2. *Moderate Rainfall(100-200 cm):* Northern parts of Andhra Pradesh, southern Tamil Nadu, eastern Maharashtra, Odisha, Madhya Pradesh.
3. *Low Rainfall(50-100 cm):* Parts of Deccan Plateau comprising regions of Karnataka, Andhra Pradesh, Tamil Nadu, Eastern Rajasthan, Punjab, Haryana.
4. *Scanty Rainfall(<50 cm):* Southern Punjab, Western Rajasthan, leeward side of Western Ghats.

❖ Features of Rainfall:

1. India is an agrarian economy dependent on rainfall. As such, rainfall has an impact on Indian economy.
2. Only a small amount of rainfall is received from other sources like convectional and cyclonic rainfall.
3. Rainfall is mainly of orographic type. Windward slopes get more rainfall than leeward slopes of mountains.

4. 70% of rainfall occurs in the rainy season.
5. The quantity and time of occurrence of rainfall can't be predicted. Hence, there are sometimes natural calamities such as floods, droughts, etc.

Chapter 8: Soil Resources

Soil: Soil is the thin layer of loose mixture of rock particles and rotting organic matter that cover the surface of the earth.

Soil supports forests, grasslands, and crops, from which all creatures get their energy.

❖ Constituents of Soil:

1. Sand
2. Silica
3. Clay

4. Humus (rotting organic matter, adds to fertility)

❖ Soil Fertility:

1. It contains adequate amount of moisture to supply essential nutrients to the plant
2. It has sufficient depth so as to allow the roots of the plant to grow freely.
3. It has organic matter which improves structure and fertility of the soil.

❖ Soil Classification:

❖ <u>Residual or Sedimentary Soils:</u>

1. Formed ‘in situ’, i.e., at the original position by breaking down of parent rocks
2. Have well-defined soil profile
3. E.g.: Black soil, Red Soil, Upland Laterite Soil

❖ <u>Transported Soils:</u>

1. Formed ‘ex situ’, i.e., transported by various agents of erosion and consist of sediments carried and deposited by them.
2. Do not have a well-defined soil profile.
3. E.g.: Alluvial soil, Lowland Laterite Soil

❖ Alluvial soil:

1. This soil is formed by sediments brought down by rivers.
2. Rich in chemical ingredients
3. Rivers deposit very fine particles called ‘alluvium’ in their plains during the course of their journey.
4. The resultant alluvial soil is called ‘riverine alluvial soil’, because it is mainly found in river basins.
5. It is a mixture of sand, silt, and clay, called ‘loam’.
6. Indus, Ganga, and Brahmaputra deltas have this soil, along with it being found in deltas of Mahanadi, Godavari, Krishna, and Kaveri Rivers.
7. On the basis of age, alluvial soil is divided into two ‘khadar’ and ‘bhangar’.

Bhangar Soil	Khadar Soil
Occupy largest part of northern plains	Area below flood levels in northern plains is made up of Khadar
Found above flood levels with a terrace-like structure	Khadar is younger alluvium as floodwater deposit new layers everyday
Full of lime nodules with clayey composition	Formed of fine silt and clay
Not very fertile	Very fertile and ideal for intense cultivation

8. Crops can be grown on old alluvial soil using manure.
9. Alluvial soils forms the largest and most important group as it contributes most to India's growth.

❖ Distribution:

1. Inland Alluvium: Indus, Ganga, Brahmaputra plains, Punjab, Haryana, U.P., Gujarat, West Bengal
2. Deltaic Alluvium: Deltas of Ganga-Brahmaputra, Mahanadi, Godavari, Krishna, Kaveri rivers
3. Coastal Alluvium: Coastal strips of Indian Peninsula

❖ Colour:

Light grey to deep black. Depends on texture, materials, and time given for maturity

❖ Texture:

1. In the Upper course of river, the soil is dry, coarse, porous, and sandy.
2. It has clay and organic matter, and the soil particles are large and non-uniform.
3. Such soil is seen in piedmont plains
4. As we move down the course of a river, soil particles become smaller, more moist and more uniform.
5. Loamy texture in lower courses of river.

❖ Minerals:

Rich in potash and lime, poor in nitrogen and humus) (PL-NO)

❖ Crops:

Alluvial Soil is light, porous, and therefore easily tillable. Used for growing rice, wheat, sugarcane, cotton, etc.

❖ Black Soil:

1. Also called Black Cotton Soil, Regur Soil, Lava soil.
2. Formed by denudation of lava rocks, called ‘basalt’.

❖ Distribution:

Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu

❖ Colour:

Black in colour, as it is formed of weathered lava rocks

❖ Texture:

1. Clayey composition (up to 50% clay content), and therefore highly retentive of water.
2. Because of high retentivity, it expands when wet, and contracts on drying, causing cracks to form in the soil, for a sort of ‘self-ploughing’ ability.
3. Black soil retains moisture for a long time, and can be used for Dry farming.
4. Dry farming refers to the crops which are grown without irrigation during the dry season as the crops use the moisture left over in the soil from the rains.

❖ Minerals:

Rich in lime, magnesium, poor in phosphorus, nitrogen, and organic matter (LM-PNO)

❖ Crops:

Cotton, Cereals, Sugarcane, Vegetables

❖ Red Soil:

1. It forms due to prolonged weathering by rainfall of ancient crystalline and metamorphic rocks.
2. It differs from place to place depending on parent rock composition and climatic materials

❖ Distribution:

Second largest soil group. Tamil Nadu, Karnataka, Andhra Pradesh

❖ Colour:

Red due to Iron Oxide. Yellow when hydrated

❖ Texture:

Ranges from sandy to clayey. Porous, loose, and aerated. Generally shallow. pH from 6.6-8

❖ Minerals:

Rich in Iron. Poor in phosphorus, Nitrogen, and organic Matter (I-PNO)

❖ Crops:

Vegetables, rice, ragi, tobacco

❖ Laterite Soil:

1. Formed as a result of atmospheric weathering of rocks under conditions of high rainfall and temperature with alternate wet and dry periods.
2. Leaching is commonplace in laterite soil.
3. Leaching or desilication is the process in which nutrients get percolated down below the top soil during heavy rainfall, leaving the topsoil infertile.
4. Lime and silica get leached, while heavy aluminium compounds remain.
5. Humus content is removed by bacteria which survive well in high temperatures.

6. Two types of Laterite Soils: Upland Laterites (formed over hills and uplands), and Lowland Laterites (formed by transportation of upland laterite soil down hills towards lowlands by streams).

❖ Distribution:

Andhra Pradesh, Karnataka, Tamil Nadu.

❖ Colour:

Red due to iron oxide

❖ Texture:

Coarse texture, soft, friable.

❖ Minerals:

Rich in iron oxide, poor in lime, nitrogen, potassium, and organic matter (I-LPNO)

❖ Crops:

Tapioca, cashew nuts, tea, coffee and with manure and rice, ragi, and sugarcane. It is infertile due to its high acidity and low moisture retentivity. Hence manure is required to grow some crops.

❖ Soil Erosion:

The removal of topsoil cover by water, wind or human activity, is called soil erosion.

❖ Soil Erosion By Water:

1. *Sheet Erosion:* Gentle slopes; slow removal of a thin layer of soil when vegetation is destroyed.
2. *Rill Erosion*: When sheet erosion continues for long, the silt-laden runoff forms finger-shaped ‘rills’ or ‘grooves’ in the soil. Intermediate stage between sheet and gulley erosion.

3. *Sheet Erosion:* During heavy downpour, deep gullies are made on account of erosion of bare soils by water run-off. It removes nutrients and heavy load of loose soils, making it unproductive. Occurs in Chambal valley region
4. *Leaching:* After farming, farmers leave soil bare for some time. Leaching occurs due to heavy rainfall.
5. *Sea or Shore Erosion:* Powerful sea-waves crash into the coast and break cliff rocks. Broken material is removed by retreating sea-waves. Seen in Eastern and Western coastal plains.
6. *Stream Bank Erosion:* Streams and rivers change their courses by cutting one bank and depositing loads on another (forming meanders).

❖ Soil Erosion by human action:

Loss of vegetation cover on hilly slopes leads to sheet erosion because water instead of percolating down, washes the soil down. Then rill and gully erosion may occur during heavy rainfall.

The Outer Himalayas (Shiwaliks), Western, and Eastern Ghats are subjected to deforestation. They also receive heavy rains. This causes heavy erosion.

Local populations practice shifting cultivation. Heavy rainfall washes away the bare soils.

Another cause for erosion is uncontrolled grazing by animals leading to loss of vegetation cover in valleys and upper slopes.

❖ Soil Erosion by Wind:

It occurs when soil devoid of vegetation is exposed to high velocity wind. Wind moves particles 0.1-0.5 mm in size by bouncing fashion, and particles >0.5 mm by rolling them on the ground. The former is called saltation, and the latter is called soil creep.

Particles <0.1 mm in size detach into suspension.

It reduces productive capacity of soil.

❖ Causes of Soil Erosion:

1. *Heavy Population Pressure on Land:* Only 21.54% of India's land area is covered in forests. More are being cut down to facilitate the growing population. This deforestation causes soil erosion.
2. *Nature of Rainfall:* India receives 80-90% of rainfall in the monsoon season. Heavy downpour causes high amounts of erosion.
3. *Overgrazing:* Overgrazing of farm animals causes loss of vegetation cover facilitating soil erosion. This is prevalent in Rajasthan.
4. *Bad Farming Techniques:* Farmers plough fields in traditional ways. Absence of techniques like terrace farming, contour ploughing, implementing shelter belts, increases erosion.
5. *Topography:* Northeastern hills, Himalayas, Western, and Eastern Ghats are affected by soil erosion due to steep slopes and heavy rainfall.
6. *Deforestation:* Forests are destroyed so that more land can be used for agriculture. Cutting of trees exposes topsoil causing erosion.

❖ Regions of Soil Erosion in India:

Chambal valley region, Regur soil area of Maharashtra, Chhota Nagpur plateau, Piedmont zone of western Himalayas.

❖ Prevention of Soil Erosion:

1. *Terrace Farming:* On hilly slopes terraces act as bunds and prevent soil from being washed away by running water.
2. *Shelter Belts:* Farmers plant trees in rows to check soil erosion by wind.
3. *Contour Ploughing:* Ploughing along contour lines on a slope prevents soil being washed away by rainwater or by surface run off. Terraces act as bunds, and levelled into small step-like fields.
4. *Strip Cropping:* Planting of crops in alternate strips of land reduces erosion.
5. *Construction Of Dams:* Reduces soil erosion by controlling water flow and speed.

6. *Planting trees:* Trees like in case of shelter belts, are planted along field edges and steep slopes so that their roots hold the soil together and reduce erosion.

❖ Soil Conservation:

Soil Conservation means prevention of soil erosion or reduced fertility of the soil due to over usage, acidification, salinisation, or other types of soil contamination.

Adverse effects of not conserving soil:

1. Silting of river and canal beds
2. Lowering of water table and reduction of groundwater
3. Loss of fertile topsoil along with its nutrients.
4. Recurrence of landslides

Chapter 9: Natural Vegetation

Natural Vegetation refers to the plant community which has been growing on its own for a long time without any human intervention so as to allow its individual species to adapt themselves fully to the soil and climatic conditions.

The type of vegetation is determined by climate, particularly rainfall and temperature of the place. Soil type and topography also play important roles. Natural vegetation supports biodiversity by acting as habitat for multiple species.

❖ Importance Of Forests:

1. Productive Functions:

   Provide us with various products such as timber, fruits, leaves, flowers, roots, and tubers of plants. Wood is used as a source of heat and energy. Bamboo pulp is used in making paper and paper boards. Forests also produce fibres, essential oils, oilseeds, and edible plants. Bamboo is used in rayon manufacturing.

2. Protective Functions:

   Forests control the water cycle. Thick layer of humus on soil prevents evaporation. It also acts as a natural sponge, and helps soak the rain water in the soil. The forest with its

complex root system also binds the soil together and prevents soil erosion.

3. Regulatory Functions:

The trees utilise CO_2 and give out O_2. The oxygen released is essential for life. Thus, the trees perpetuate the cycles of oxygen and carbon dioxide in the atmosphere. They also regulate the water cycle. They absorb water from the ground and give it out in the form of vapour via transpiration.'

4. Accessory Functions:

Forests provide habitat for the wildlife and recreation to humans in the form of National Parks, Wildlife Sanctuaries, and Biosphere Reserves.

5. Carbon Sink:

India's forests serve as a major carbon sink of CO_2. Around $120 Billion or 6 Lakh Crore rupees worth of Carbon Dioxide is absorbed by the trees.

❖ Types Of Vegetation:

India has a variety of forests and natural vegetations due to variations in climatic conditions, soil types, and relief features. The Western Ghats and Andaman-Nicobar Islands have tropical evergreen rain forests, the Himalayas have temperate vegetation. The desert and semi-desert regions of Rajasthan have a wide variety of bushes and thorny vegetation.

❖ Tropical Evergreen or Rain Forest:

Climatic Conditions: Rainfall >200 cm, Humidity >77%, Temperature 25-27◦C

Distribution: Western slopes of Western Ghats, Andaman and Nicobar Islands, Lakshadweep Islands

Trees: Rosewood, Ebony, Mahogany

Economical Value: Due to thick growth of climbers, ferns, bamboo, canes and palms, along with lack of means of transport, these forests haven't been fully exploited yet.

Characteristic Features:

1. Trees have heights greater than 60 m

2. Trees do not have a set time period for shedding their leaves, to flower, or fruition, hence giving the forest an ‘evergreen’ look.
3. The carpet or bottom layer and grasses cannot grow because barely any sunlight reaches down there due to thick canopy of the forests.

❖ Moist Tropical Deciduous or Monsoon Forests:

Climatic Conditions: Rainfall 100-200 cm, Humidity 50-80%, Temperature 24-27◦C.
Distribution: Eastern slopes of Western Ghats, Maharashtra, Karnataka Uttar Pradesh
Trees: Teak, sal, Mahua, sandalwood
Economical Value: Most economically exploited forests in India. They provide valuable timber and other products too, like oils, fruits, flowers, oilseeds, etc.
Characteristic Features:

1. Commercially most exploited forests in India.
2. Trees shed their leaves during early summer and spring when there is shortage of water for 6-8 weeks.
3. A particular species can be found over a large area.

❖ Dry Deciduous or Monsoon Forests:

Climatic Conditions: Rainfall 70-100 cm, Humidity 51-58%, Temperature 23-27◦C.
Distribution: Rainier parts of Deccan plateau, plains of Bihar and U.P.
Trees: Teak, sal, rosewood.
Economical value: Same as above
Characteristic Features:

1. They thrive between moist deciduous forests and tropical Desert Forests
2. They become moist deciduous forests on the wetter margins
3. They degrade into Tropical Thorn Forests on the drier margins

4. They act as transitions between the 2 types of forests.

❖ Tropical Desert or Thorn Forests

Climatic Conditions: Rainfall less than 50 cm, Humidity <47%, Temperature 25-28◦C.
Distribution: Rajasthan, Uttar Pradesh, Maharashtra, Karnataka
Trees: Acacia, cactus, date palm, neem
Economical Value (not just for tropical desert forests, but for trees in general):

1. Ber fruit is eaten raw or made into pickle or beverages.
2. Ber timber is hard, strong, tough, and durable.
3. Rosewood is used for making furniture, floorboards, wagon parts, etc.
4. Ebony is used for ornamental carving and decoration.
5. Teak wood is moderately hard, durable, and easy to work with. It is used for construction, shipbuilding, furniture, and railway carriages.
6. Sandalwood is used for making statues, ornamental objects, aromatic substances, and sandalwood oil.
7. Palas leaves are used for rearing shellac worms
8. Babool's bark and gum have medicinal properties.
9. Date palm is eaten raw as an astringent, as a decoction, for sore throat, cold, fever, etc.
10. Neem's bark and roots have medicinal properties. Neem oil, leaves, and extracts are used for making beauty products. Neem is used as an insecticide. Neem is used to treat, allergies, ulcers, etc.
11. Deodar is a medium weight durable wood used for construction work and for making railway sleepers and windows frames.
12. Sundari trees provide hard durable timber for construction purposes and boat making.

Characteristics:

1. These forests have xerophytic vegetation. Due to less rainfall, trees are stunted with patches of coarse grasses.
2. Forests have trees which have adapted themselves to survive in desert conditions. They are called xerophytes.

Acacia and babool trees have developed long tap roots for accessing deep stores of groundwater. Acacia trees have long thorns and a symbiotic relationship with stinging ants. If an animal bites it leaves, the stinging ants attack the animal, while the ants eat the nectar produced by its leaves.

3. Plants remain lifeless and look like scrub vegetation for most of the year.

❖ Littoral or Tidal Forests

Climatic Conditions: Rainfall ≤ 200 cm, temperature 26-29◦C, Very High Humidity.

Distribution: Found in Sundarbans in West Bengal, coastal area of Andhra Pradesh and Odisha, and found in wetlands, which are areas between terrestrial and aquatic systems where the water table is above or at the land.

Trees: Sundari, Keora, Amur, Rhizophora, Canes, Palms. Forests have Sundari trees after which the name of these forests has been given Sundarbans.

Economical Value: Sundari trees produce hard durable timber for construction purposes and boat making

Characteristic Features:

1. Mainly evergreen species with varying density and height
2. Tree trunks are supported on stilt-like roots which remain submerged during high tide, and can be seen during low tide.
3. Forests have breathing roots called pneumatophores. Because of waterlogged conditions, roots are deprived of oxygen during high tides. So, some roots extend vertically above the water level which enables the trees to breathe when other roots are submerged.

❖ Mountain Forests:

Climatic Conditions: Rainfall 100-300 cm, Humidity 56-65%, Temperature 12-13◦C, Relief 1000-4000 metres.
Distribution: Himalayan Zone, Western Ghats, Vindhyas
Trees: Oak, Spruce, Chir Pine, Blue Pine, Magnolia
Characteristic Features:

1. At foothills of Himalayas, deciduous forests are found.
2. In the hilly areas of West Bengal and Uttarakhand, broad-leafed evergreen trees like chestnut and oak are found.
3. Between the altitude of 1500-1750 m, coniferous Chir pine is found.
4. Between 2250-3000 m altitude, Blue pine and spruce are found.
5. Alpine forests and grass, followed by mosses and lichens are found up to the snowline.
6. No vegetation beyond the snowline.

❖ Forest Conservation:

❖ Need for forest conservation:

1. Due to rapid population growth, forests are being cut down to make more residential and agricultural areas.
2. Forests have been converted into pasture lands for animals to graze upon, expanding dairy farming, and cattle ranching.
3. Overgrazing in forests has resulted in large scale degradation of natural vegetation.

❖ Effects of Decline in forests:

1. Decline in forests has led to decline in forest productivity.
2. Lack of forest cover reduces precipitation, causing droughts.
3. Forests act as a sink for carbon dioxide, that the trees use for photosynthesis. Decrease in forests lead to increased carbon dioxide concentration. This raises temperature of the Earth's surface and of the atmosphere.

❖ Forest Conservation Measures:

1. Increasing Area Under Forests:
   Loss of forests can be remedied by massive tree plantation programmes. Planting trees on degraded lands relieves harvesting pressure from forests.
2. Afforestation Around Industrial Units:
   Level of pollution is much higher near industrial areas. In cities having Iron and Steel Plants, pollutants generated are more. During manufacture of steel, the manufacturing plants emit particulate matter, sulphur oxides, nitrogen oxides, hydrogen fluoride, hydrocarbons, etc. They also emit ~20kg of dust per metric ton of steel produces. Trees help reduce such effects.
3. Stopping Indiscriminate Felling:
   There should be a strict ban on illegal felling of trees. A 1:10 ratio (1 tree cut to 10 trees planted) must be maintained.
4. Using Alternative Energy Sources:
   Use non-conventional or renewable energy sources like solar, tidal, hydel, wind, etc.
5. Developing Badlands and barren wastelands into vegetation belts

❖ Social Forestry:

Social Forestry refers to the management and protection of forests and afforestation in barren lands with the purpose of promoting social, environmental, and rural development.

Objectives Of Social Forestry:

1. Providing fuel wood, fodder for cattle, and minor forest products to rural people.
2. Giving employment to rural people.
3. Improving aesthetic scenes of the area.

❖ Agro-Forestry:

Agro-Forestry refers to the sustainable system of managing a piece of land by combined production of agricultural and forest crops, and animal rearing, to ensure most efficient land use under a management system in accordance with the socio-cultural practices of the local people.

Objectives Of Agro-Forestry:

1. To make most efficient use of all available resources like manpower, food stock, cattle, etc.
2. To reduce pressure on natural forests for producing timber and non-timber products.
3. To check soil erosion and maintain natural fertility of soil.

❖ Miyawaki Method:

Founded by Akira Miyawaki.

Features of Miyawaki Method:

1. Native trees are planted close to each other.
2. Only indigenous species are used, divided into 4 layers (shrub, sub-tree, tree and canopy).
3. Soil is enriched with organic matter.
4. Forest becomes self-sustaining in 3 years with 10x growth.

❖ Van Mahotsav:

Runs during first week of July.

Objectives of Van Mahotsav:

1. Providing fodder for cattle.
2. Preventing soil infertility.
3. Encouraging soil conservation.

Chapter 10: Water Resources

❖ Sources of Water:

Water Resource refers to any of the entire range of natural waters that occur on the earth and are of potential use to living beings.

❖ Surface Water:

Water on land as a result of precipitation or seepage from underground forming lakes, ponds, and rivers, which drain into seas and oceans.

❖ Ground Water:

Water which seeps through the cracks and crevices of land and is stored down below the ground at the water table is called groundwater.

An underground stream which is saturated with water and transmits water readily is called an aquifer.

Brackish Water of the oceans, although cant be used for drinking, is used for fishing, and irrigation of crops like paddy, coconut, etc.

❖ Need to Conserve Water:

1. The overexploitation of ground water resources has resulted in lowering of water table.
2. Irrigation utilises >90% of total available freshwater.
3. Overpopulation results in water scarcity.

❖ Conservation Practices:

Rainwater Harvesting is the process of capturing and storing rainwater in sub-surface water reservoirs to increase groundwater recharge or for domestic use. Rooftop rainwater harvesting is the process in which rainwater falling on a roof is diverted through drain pipes to a storage container.

It includes activities aimed at:

1. Harvesting surface and groundwater.
2. Prevention of loss of water through evaporation and seepage.
3. All other hydrological studies and engineering interventions aimed at conservation and efficient usage of water.

❖ Objectives Of Rainwater Harvesting:

1. Reducing Groundwater pollution
2. Improving Groundwater quality
3. Reducing soil erosion
4. Meeting increasing demand for freshwater

❖ Ancient Water Storage Mechanisms:

1. Western Himalayas (north India, J&K) – Khatri/Kuhl

2. Gangetic Plains (U.P., Bihar, Haryana, Delhi) – Baolis/Dighis
3. Central India (M.P., Chattisgarh, Odisha) – Johads
4. Deccan Plateau (Telangana, Karnataka) – Bhandaras/Kere
5. Rajasthan – Tankas
6. Western Ghats (Maharashtra, Karnataka) – Surangam
7. Eastern Ghats (Andhra Pradesh, Odisha) – Korambu
8. Ladakh – Zing

❖ Need for Water Harvesting:

India gets 1170 mm of annual rainfall, compared to 800 mm for the rest of the world. However, rainfall in India occurs in short spells of high intensity. Due to such intensities coupled with short duration of heavy rain, most of the falling rain tends to flow away rapidly, leaving very little for groundwater recharge. This makes most parts of the country lack water for even domestic purposes.

❖ Water Harvesting Mechanisms:

1. *Catchments:* Surface on which receives rainfall directly. Paved area like a terrace or courtyard of a building, or unpaved area like an open ground
2. *Conduits:* Pipelines which carry water from the catchment to the harvesting system. Pipes may be made of PVC (Polyvinyl chloride), or GI (Galvanized Iron)
3. *Storage Facility:* To store collected rainwater
4. *Recharge Facility:* To recharge groundwater aquifers, through dugwells, borewells, recharge trenches, permeable surfaces, porous tiles, recharge pits, or percolation pits.

Watershed refers to a geographical area that drains to a common point, which makes it ideal for soil and water conservation.

Watershed management refers to efficient management and conservation of surface and groundwater resources.

❖ Irrigation:

Irrigation refers to the process of watering of agricultural plants by artificial means like wells, tubewells, canals, tanks, etc.

Water usage distribution:

1. Agricultural purposes – 92%
2. Industries – 2%
3. Drinking – 6%

❖ Need for increasing irrigation potential:

1. Uncertainty Of Rainfall:
   Rainfall is highly irregular in place and time. Sometimes monsoon comes early and sometimes it comes late. Rainfall is not regular throughout the monsoon season too, leading to water scarcity, droughts, or on the other end, floods.
2. Uneven Distribution Of Rainfall:
   Rainfall distribution is uneven. Most parts of the country receive 80% rainfall from June-September via South-West Monsoon Winds. In some places rainfall is low and in some places very high. This inadequacy must be met by irrigation.
3. Crop Requirements:
   a. Most crops don't require water when maturing, but grains require more water when ear heads form.
   b. Kharif crops are monsoon crops, and where irrigation facilities are unavailable, these crops are grown as rainfed crops

Rabi crops are grown on soil moisture leftover from harvest of kharif crops
Zaid/Summer crops are exclusively irrigated.
These differences in crop requirements means that a single plan for irrigation across the country is not feasible.

c. Rapidly rising population demands more food, so farmers need to grow High-Yielding Varieties (HYV), which require more fertilizers, and moisture, supplied only through irrigation.

4. Nature Of Soil:

Clayey soils have higher moisture retention and need less irrigation, while sandy loams have less moisture retention and need more irrigation.

5. To Utilise River Water Effectively:

Many rivers are in India are seasonal and carry insignificant flows during winters. There is also wide disparity in water flow annually. Many rivers of Central and South India have water for 4 months and remain dry for 8 months. Hence, river water needs to be used effectively.

6. To Maximise Production:

To obtain maximum production, irrigation is a must.

❖ Conventional/Traditional Means of Irrigation:

❖ Wells:

A well is a small hole dug in the surface of the Earth to obtain water from the water table.
Two types of wells: Lined and Unlined.
Lined are man-made, and protected by walls made of bricks.
Unlined are natural and unprotected.
It is practised where depth of water table is <15 m.

Well irrigation is mainly confined to Alluvial plains, where owing to the soft nature of the soil, wells can be easily dug, and the yield of crops after irrigation is high.

Well irrigation is practised in Punjab, U.P., Haryana, Bihar, Maharashtra, etc.

Ways in which water is extracted from wells:

a. *Persian Wheel Method:* Used in Punjab, Haryana, and West Rajasthan. A geared horizontal wheel, powered by draught animals, is turned to turn a partly submerged vertical wheel, with buckets at its circumference. The buckets get filled and empty their contents into troughs
b. *Lever Method:* Used in Bihar, Andhra Pradesh. Used to lift water 3.5-4.5 m deep. Lift consists of a strong load laid across a fulcrum, a bucket attached to the long arm by means of bamboo or rope. When the bucket is full, the rope is released and the bucket comes up, while the load goes down.
c. *Inclined Plane Method:* Also called ‘mhote’. A pair of bullocks go up and down a slope, pulling a bucket or leather from behind. The rope goes through the pulley in this process. After discharging the water, the bullocks go up the slope by which time the bucket has refilled.

Advantages of Well Irrigation:

1. Can be dug at low costs, affordable for farmers.

2. Draught animals kept for ploughing land can be used to pull up water from the wells.
3. Cheap, simple, dependable source of irrigation.
4. Using pumps and tubewells, water can be drawn from great depths.

Disadvantages of Well Irrigation:

1. Dependent on groundwater resources.
2. Over usage may lead to depletion of groundwater resources.
3. Difficult to dig in peninsular and northern hilly areas where land is rocky and stony.

❖ Tubewells:

A tubewell is a deeper well of depth 20-30 m from which water is pulled up using electrical pumps.
Used in Punjab, Haryana, Uttar Pradesh.

Ideal Conditions for digging tubewells:

1. Availability of cheap, regular electricity
2. Land in its immediate vicinity to be irrigated
3. Availability of plentiful water at great depths.

Advantages of Tubewell Irrigation:

1. Independent irrigation source.
2. Brings up clean water.
3. Irrigate large area of agricultural land.

Disadvantages of Tubewell Irrigation:

1. Useless if water is brackish.
2. Requires cheap and regular electricity to run.
3. Over usage may lead to depletion of groundwater resources.

❖ Canals:

Longest Canal – Indira Gandhi Canal – 650 km – Rajasthan
Two types of canals – Inundation and Perennial
Used in U.P., Rajasthan, Bihar, Punjab, Haryana.

a. *Inundation Canals:* Directly taken out from river without building a proper barrage or dam. Only operational during time of floods and rainy season. As the beds of these canals lie at a higher level than those of the rivers, they get water supply only when the rivers are flooding. Therefore, they have limited use.

b. *Perennial Canals:* These are taken out from perennial rivers by constructing dams or barrages to control the flow of water. They can irrigate year-round.

Advantages Of Canal Irrigation:

1. Its because of canal irrigation that Rajasthan, an arid area's, sandy patches are yielding good agricultural harvests.
2. Its because of canal irrigation that Punjab and Haryana are called 'granaries of the country', and nucleus of Green Revolution.
3. Major parts of Tamil Nadu experience winter rainfall, while summer remains dry. Hence, summer crops need irrigation to grow, supplied through canals.

Disadvantages of Canal Irrigation:

1. At some places, where perennial unlined canals flow at ground level and between raised banks, the water table

may reach the surface and waterlog the soil, which may give rise to swamps.
2. In canal irrigation, where the water table is just a few feet below the ground, alkaline salts may come to the surface, mix with the soil, and make it unproductive.
3. Due to waterlogging, capacity of soil to absorb water decreases. A few cm of excess rain covers the land with a sheet of rainwater, which without proper draining ruins standing crops, houses, and even stored grains.

❖ Tanks:

Tanks refer to a small bund of Earth or stones built across a stream to impound water which is then led through narrow channels to cultivate fields.
Used in Peninsular India + Maharashtra and Gujarat. It is used in peninsular India for the following reasons:

1. Rivers of the deccan are dependent on rainwater, which is irregular.
2. Terrain of the deccan plateau is uneven with many natural depressions where tanks can be built.
3. The hard rocks in the area do not absorb water, so wells cannot be made there. But tanks can be made by making dams in hollow spaces.

Advantages of Tank Irrigation:

1. In the rocky peninsula, where rainfall is seasonal, tank irrigation is useful.
2. In the Deccan plateau, due to rocky terrain, wells, tubewells and canals are difficult to construct, hence only tank irrigation is feasible.

3. Tank irrigation stores abundant rainwater which otherwise would have acted as run-off.

Disadvantages of Tank Irrigation:

1. Due to large area and shallow depth, lot of water is lost due to evaporation, or seepage underground.
2. Tanks occupy a large fertile area which could otherwise be used for growing crops.
3. When monsoons fail, tanks go dry. Hence, they are a dependent irrigation source.
4. Tanks require regular desilting to make them suitable for irrigation.

❖ Drawbacks of Traditional Means of Irrigation:

1. They do not efficiently utilise water.
2. In fields, about 10-15% of the land is utilised for preparing channels, distribution facilities, etc. This reduces effective area of cultivation.
3. Fields in lowlands always get excess water causing waterlogging of soil, resulting in poor yields.

❖ Modern Means of Irrigation:

❖ Furrow Irrigation:

Water is poured in fields and directed to flow through narrow channels dug between crop rows. Furrows must have equal dimensions to distribute water equally. It is useful in areas where water is easily available.

❖ Spray Irrigation:

A long hose is set to a water source one side and water is released through spray guns on the other side. It is expensive

and requires complex machinery, but utilises water effectively, reducing the amount needed to irrigate a field. However, water is lost through evaporation, and plant diseases caused due to over-watering are common.

❖ Sprinkler Irrigation:

A pipe fitted with a nozzle sprays water over plants directly. There is no loss of water from evaporation and seepage, but it is expensive, only helpful for a small area, and for crops needing less water.

❖ Drip Irrigation:

Most advanced and efficient irrigation method. Used to irrigate fruits and vegetables. It consists of perforated pipes placed between crop rows or root lines with holes in them from which water drops. Evaporation is drastically reduced, and water is conserved. The farmer can customize an irrigation program unique to each crop.

Chapter 20: Transport

❖Importance Of Transport:

1. Aids in process of industrialization and urbanization.
2. Removes scarcity of goods during an crisis.
3. Helps in minimising effects of natural disasters.

❖Roadways:

❖ National Highways:

Main roads constructed and maintained by the Central Government. Main highways running through length and breadth of country. Longest NH is NH-7, at length of 7770 km. They represent 1.7% of the total road network, yet handle 40% of its traffic. National Highway Authority of India (NHAI) is responsible for management, development, and maintenance of highways. Formed in 1988.

Freeways are highest class of controlled access highways designed for high-speed vehicular traffic, and to reduce traffic

congestions. NHAI has only 2 freeways: Western (Coastal) and Eastern Freeway. Bandra-Worli Sea Link is part of the Western Freeway.

❖ Expressways:

Highways planned for high-speed traffic, having few intersections, limited points of access or exit, and a divider between lanes for traffic moving in opposite directions. Usually have 6-8 lanes. Major difference between highway and expressway is access control. Expressways have facilities like CCTV cameras, telephone booths, access ramps, and mobile radars. Expressways provide higher safety, convenience, high speed, and lower costs.

Some expressways in India:

1. *Bundelkhand Expressway:* 296 km long, connects Gonda village in Chitrakoot district to Kudrail village on Agra-Lucknow Expressway in Etawah district.
2. *Purvanchal Expressway:* India's longest expressway, at 341 km.
3. *Yamuna Expressway:* Six-lane controlled access highway, connecting Greater Noida with Agra. It has reduced travel time from Delhi to Agra to 2 hours. It enables farmers in Western U.P. to move their agricultural, horticulture, and dairy products to major cities.
4. *Ahmedabad-Vadodara Expressway:* India's first expressway. First 4-lane dual carriageway expressway project.
5. *Mumbai-Pune Expressway:* India's first 6-lane, concrete, high-speed, tolled expressway.
6. *Panipat Expressway:* Decongests traffic on busy Delhi-Amritsar Route.

❖ State Highway:

Constructed and maintained by state governments. Provide linkages with National Highways, district headquarters, important towns, and tourist centres. Provide connectivity to important towns and cities, as well as National Highways or State Highways.

❖ District Roads:

Roads within districts connecting areas of production with markets. Connect small towns with one another or with higher highways.

❖ Rural Roads:

Constitute 80% of road network in India. Provide vital links in moving agricultural produce and finished small-scale products.

❖ Border Roads:

Border Road Organisation (BRO) was established in 1960 for strengthening defence preparedness and accelerating economic development through improvement of roads along the northern and north-eastern boundary of the country.
It constructed world's highest road from Manali (Himachal Pradesh) to Leh (Ladakh) at an avg. altitude of 4270 m. It also takes part in maintenance of roads in strategically important areas.

❖ Advantages Of Roadways:

1. Offer door-to-door services, and reduce cost of loading and unloading.
2. It is through roadways that every village and hamlet can be reached.
3. Roadways are supplementary to all other forms of transport.
4. Construction cost of roads is much smaller than railway lines

❖ Disadvantages of Roadways:

1. Many roads are unsurfaced and unsuitable for regular traffic.
2. Roads aren't properly maintained, which causes losses in terms of vehicular wear and tear.
3. There are multiple octroi-duty collection points, toll tax, and check-posts which reduce convenience for travellers and increase travel time.

❖ Golden Quadrilateral Project:

Largest Expressway project in India connecting 4 metrocities – Mumbai, Chennai, Delhi, Kolkata. It forms a quadrilateral of sorts.

❖ Economic Benefits of GQP:

1. Interconnects many major cities and roads.
2. Provides an impetus to truck transport throughout India.
3. Enables the industrial growth of all the towns and villages it passes through.

❖ North-South and East-West Corridor:

North-South: Srinagar-Kanyakumari (4000 km)
East-West: Porbandar-Silchar (3300 km)
Junction of two corridors is Jhansi
Delhi-Agra, and Bengaluru-Krishnagiri are common stretches of GQP and N-S Corridor.
Akbarpur-Kanpur and Udaipur-Chittorgarh are common stretches of GQP and E-W Corridor.

❖ Railways:

First introduced in 1853 when a line was constructed from Mumbai to Thane covering a distance of 34 km. Indian Railways is world's largest employer with more than 1.4 million employees. The central unit of management has been divided into 18 zones for better management.

❖ Track System:

Broad Gauge: Distance between rails is 1.676 m. 85% of all rail tracks in the country, and also handles 85% of goods in tonnes-km. Also called India Gauge. Konkan Railway line is an engineering marvel. 760 km long rail route connecting Roha in Maharashtra to Mangalore in Karnataka. Passes through 6.5 km long Asia's largest tunnel.
Metre Gauge: Distance between rails is 1 m. Accounts for 11% of total route length
Narrow Gauge: Distance between rails is 0.762 m and 0.61 m. Accounts for 4% of total route length. Mainly confined to hilly areas.
Many cities have their own suburban networks. Currently, Mumbai, Chennai, Kolkata, Delhi, Hyderabad, Lucknow and Pune have it. The last 3 share tracks with long-distance trains. New Delhi, Kolkata, Mumbai, and Chennai have their own metro networks. Suburban trains have EMUs (Electric Multiple Units). 9 or 12 coaches during rush hour. Indian Railway has begun formal privatization of railways, to reduce transit time, boost in job creation, and provide world-class level travel experience to passengers. Tejas Express is
India's first semi-high speed fully air-conditioned train introduced on May 24, 2017, at CSMT by Indian Railways.

❖ Advantages of Railways:

1. Reduce sufferings during natural calamities
2. Rail travel is safer and comfortable for families with babies and elders
3. Railways facilitate easy movement of police troops and defence equipment.

❖ Disadvantages of Railways:

1. Cannot cross oceans. Can't be used for intercontinental travel.
2. Trains which run on coal produce a lot of noise and air pollution.
3. Train travel can be very long and tedious, when compared to air travel.

□ Airways:

Started with a 10km air mail operation between Allahabad and Naini in 1911. Airways are handled by Airports Authority Of India.

Air India – India's flagship carrier and premier full-service airline

Air India Express – low-cost carrier serving short and medium-haul international destination

AISATS – comprehensive suit of ground-handling and cargo-handling services.

Pawan Hans Helicopters Limited (PHHL) was established to provide helicopter support services to off-shore oil refineries, operate in inaccessible areas, and make available chartered flights for tourism.

❖ Advantages of Airways:

1. The ease with which airplanes can cross natural barriers like mountains and oceans makes them indispensable.
2. They can be used to airlift people out of natural calamities
3. It is the fastest and most comfortable mode of transport. Connects far flung areas of the country.

❖ Disadvantages of Airways:

1. Costly
2. Depends on weather conditions
3. Airplanes run on petroleum, which is expensive and non-renewable source of energy.

Waterways:

❖ Inland Waterways:

They include rivers, canals, backwaters, and creeks which are deep enough to allow ships and boats to navigate safely. They must be free of obstacles like rapids and waterfalls.

Inland Waterways Authority of India (IWAI) is the statutory authority in charge of managing Inland Waterways.

India first multi-model terminal was inaugurated by PM Modi on the river Ganga in November 2018. Its objective is to promote

inland waterways as a cheap and eco-friendly means of transportation.

The rivers of Peninsular India are not navigable for the following reasons:

1. They are not perennial. They are rain-fed, seasonal rivers.
2. They are short compared to the Northern rivers.
3. These rivers have lots of obstacles like waterfalls.

Ganga is navigable from its mouth right up to Allahabad for the following reasons:

1. It has a gentle slope, and its riverbed is free of stones and silt.
2. It is joined by tributaries like Yamuna, Son, Ramaganga, Gomti, Ghaghara, Gandak, and Kosi, which add to its water volume and increase its depth which becomes more than 10 m at Allahabad.
3. It is a perennial river fed by rains in the monsoon and by the Gangotri glacier during the dry season.

Major problems for Inland Waterways:

1. Seasonal fluctuation of water.
2. Shallow depth
3. Undulating riverbeds
4. Silting of riverbeds
5. Reduction in water level due to irrigation

❖ National Waterways:

National Waterway No.1: 1620 km of potentially navigable waterways, from Ganga-Bhagirathi-Hooghly river system which connects Haldia to Allahabad.

National Waterway No.2: River Brahmaputra, connecting Dhubri to Sadiya stretching 891 km. It connects north-east region with Kolkata and Haldia Ports.

National Waterway No.3: Kollam to Kottapuram. 168 km. One of the most navigable and tourism potential area in India.

National Waterway No.4: Connect Andhra Pradesh, Tamil Nadu, and Puducherry. 1028 km.

National Waterway No.5: Talcher-Dhamra stretch of Brahmani River. Geonkhali-Charbatia stretch of East Coast Canal, and Charbatia-Dhamra stretch of Matai river along with Mahanadi delta system. 585 km. Coal from Talcher to Dhamra and Paradip port is its most important cargo.

❖ Oceanic Waterways:

Coastline of 7517 km. 12 Major ports (80% of traffic), 187 Minor and Intermediate Ports.

Oceanic Waterways constitute an important part of India's economy

1. They handle 95% of India's foreign trade by volume, and 70% by value.
2. They are used for transportation between India and other parts of the country.

❖ Major Ports:

1. *Kolkata (West Bengal):* Riverine port on bank of Hooghly
2. *Haldia (West Bengal):* Developed on Hooghly to reduce pressure on Kolkata
3. *Vishakhapatnam (Andhra Pradesh):* India's deepest landlocked port
4. *Chennai (Tamil Nadu):* Second largest port in terms of volume of traffic handled, and oldest artificial harbour on east coast of India.
5. *Kandla (Gujarat):* Tidal port and free trade zone located at eastern end of Rann of Kutch.
6. *Jawaharlal Nerhu (Nhava Sheva) Port (near Mumbai):* Biggest ultra-modern sea port off the coast of Mumbai. Equipped with modern facilities having mechanised container berths.
7. *Mumbai (Maharashtra):* Natural harbour on west Coast and India's biggest port. Handles maximum traffic (>20%).
8. *Ennore Port:* North of Chennai port. First port in India which is a public company. It is a corporate entity (Ennore Port Ltd.) and not a port trust. It is a satellite port meant to

decongest and improve environmental quality at the busy Chennai port.

❖ Advantages of Waterways:

1. Inland Water transport is environment friendly and cost-effective.
2. Compared to rail and road transport, Inland Water transport is fuel-efficient. One litre fuels moves 24 tonne-km on road, 95 tonne-km on rail, and 215 tonne-km on Inland Water Transport.
3. Most suitable for carrying heavy and bulky material.
4. Fuel efficient and eco-friendly mode of transport.

❖ Disadvantages of Waterways:

1. Depends on weather condition
2. Requires long travelling hours which causes sea sickness
3. Limited to areas where rivers are navigable and oceanic routes exist