**4.CLIMATE**

**Introduction**

* The natural environment is made of landforms, drainage systems and atmospheric conditions. The atmospheric conditions are dictated by various parameters like geographic location of an area, or month of the year.
* The Atmospheric condition has two aspects-
* Weather refers to the state of the atmosphere over an area at any point of time. Weather conditions may fluctuate often.
* Climate refers to the sum total of atmospheric conditions and variations over a large area for a long period of time (over 30 years).
* The elements of weather and climate are:
* Temperature
* Atmospheric pressure
* Wind,
* Humidity and
* Precipitation.
* On the basis of the generalised monthly atmospheric conditions, the year is divided into seasons such as winter, summer or rainy seasons.
* The world is divided into climatic regions, which may vary from region to region and also from one season to another.

**Climatic conditions in India:**

* In India, we have the ‘monsoon’ type of climate which refers to the seasonal reversal in the wind direction during a year.
* South and the southeast parts of Asia generally have this type of climate.
* Despite an overall unity in the general pattern, there are perceptible regional variations in climatic conditions within the country.

1. In summer, the temperature rises up to 50°C in some parts of the Rajasthan desert, whereas it may be around 20°C in Pahalgam in Jammu and Kashmir.
2. Drass in Jammu and Kashmir experiences temperatures as low as minus 45°C on a winter night. On the other hand, at the same time the temperature at Thiruvananthapuram may be around 22°C.
3. In certain places there is a wide difference

even between day and night temperatures. In the Thar Desert the day temperature may rise to 50°C, and drop down to 15°C the same night.

1. Areas like Meghalaya have an annual precipitation of over 400 cm whereas it is only 10 cm in Ladakh and western Rajasthan.
2. Most parts of the country receive rainfall from June to September. But the Tamil Nadu coast gets a large portion of its rain during October and November.
3. There is decrease in rainfall generally from east to west in the Northern Plains.

* These variations have given rise to variety in lives of people – in terms of the food they eat, the clothes they wear and also the kind of houses they live in.

**CLIMATIC CONTROLS**

Climate is controlled by six major factors. They are:  
  
**1. Latitude**: The solar energy varies according to latitude at different parts of the earth due to its curvature. Due to this, air temperature decreases from equator to the poles.

**2. Altitude:** The density of the atmosphere is less at higher altitudes and the temperature also decreases.  
**3. Pressure and wind system:** This depends on the latitude and altitude of the place and influences temperature and rainfall patterns.  
**4. Distance from the sea:** The sea moderates the climate.

* People who stay far away from the sea experience extreme weather conditions, like extremely hot summers and cold winters.
* Such extreme weather conditions are known as continentality.

**5. Ocean currents:** Ocean currents along with onshore winds affect the climate of coastal areas.  
**6. Relief features:** The sheltered side of mountains are drier.

* This is because high mountains act as barriers for hot or cold winds and may cause precipitation if they lie in the path of rain bearing winds.

**FACTORS AFFECTING INDIA’S CLIMATE**

**Latitude**

* India’s climate has characteristics of tropical as well as subtropical climates.
* The Tropic of Cancer runs through the middle of the country from the Rann of Kuchchh to Mizoram.
* The areas lying to the south of the Tropic of Cancer belong to the tropical area.
* while the other areas lie in the subtropics.

**Altitude**

* The average elevation in the coastal areas of India is about 30 meters, whereas the average elevation in the mountains in the north is about 6,000 meters.
* So, the Himalayas act like a barrier that prevents the cold winds of Central Asia to enter the Indian subcontinent.
* That is why the Indian subcontinent gets comparatively milder winters as compared to Central Asia.

**Pressure and wind**

Major atmospheric conditions that govern the Indian climate and its associated weather conditions are:

* Pressure & surface winds;
* Upper air circulation;
* Western Cyclonic disturbances; and
* Tropical cyclones.
* The Indian subcontinent lies in the region of north-easterly winds.  
  These winds originate from the subtropical high-pressure belt of the northern hemisphere and blow towards south.
* They get deflected to the right due to the Coriolis force and then move towards the low pressure area near the equator.  
    
  **Coriolis force**:
* An apparent force caused by the earth’s rotation. The Coriolis force is responsible for deflecting winds towards the right in the northern hemisphere and towards the left in the southern hemisphere.  This is also known as ‘Ferrel’s Law’.

The north-easterly winds carry little moisture and bring little or no rain as they originate and blow over the land-

* The uniqueness of the pressure and wind conditions over India lies in the fact that:
* During winter, there is a high-pressure area at the north of the Himalayas.
* Cold dry winds blow from this region to the low-pressure areas over the oceans to the south.
* During summer, low-pressure area develops over interior Asia and also over northwestern India.
* This results in a complete reversal of the direction of winds during summer.
* Air, from the high-pressure area moves over the southern Indian Ocean in a south-easterly direction.
* Then, it crosses the equator and turns right towards the low-pressure areas over the Indian subcontinent.
* These winds known as the Southwest Monsoon winds collect moisture from the warm oceans and bring widespread rainfall over the mainland of India.

The upper air circulation in this region is dominated by a westerly flow.

* An important component is the Jet Stream which blows south of the Himalayas, except in summer. These are a narrow belt of high altitude usually above 12,000 m, westerly winds in the troposphere. Their speed varies from about 110 km/h in summer to about 184 km/h in winter. The mid-latitude and the sub-tropical jet streams are the most constant ones.
* The jet streams which are located over 27-30° north latitude are known as subtropical westerly jet streams.
* n summer, it moves north of Himalayas with the apparent movement of the sun.
* It is responsible for western cyclonic disturbances in the north and north western India.
* The sub-tropical easterly jet stream blows over 14°N over peninsular India, during summer.

**Western Cyclonic Disturbances**

* The westerly flow from the Mediterranean region brings in the western cyclonic disturbances during the winter months.
* They usually influence the weather of the north and north-western regions of India.
* Tropical cyclones occur during the monsoon, as well as, in October – November, and are part of the easterly flow.
* These disturbances affect the coastal regions of the country.  
     
    
  **THE INDIAN MONSOON**
* The seasonal reversal of the wind system was termed ‘monsoon’ by the Arab traders.
* The phenomenon of monsoon was first noticed by sailors who came to India in historic times.
* The tropical area that lies between 20° N and 20° S experience monsoon.

**The following facts help to understand the mechanism of monsoon:**

**1. Differential heating and cooling of land and water:** In India, this causes low pressure on the landmass and comparatively higher pressure in the seas around.

**2. Shift of the position of Inter Tropical Convergence Zone (ITCZ)**:  
  
 The Inter Tropical Convergence Zone (ITCZ,) is a broad trough of low pressure in equatorial latitudes.

This is where the northeast and the southeast trade winds converge.

This convergence zone lies more or less parallel to the equator but moves north or south with the apparent movement of the sun.

This takes place over the Ganga plains in summer.

The Ganga plain is in the equatorial trough positioned at 5°N of equator, known as monsoon trough during monsoon season.  
  
**3. Presence of high pressure area, east of Madagascar:**

The intensity and position of this high pressure area at 20° S over the Indian Ocean affects monsoon  
**4. Intense heating of the Tibetan plateau:**

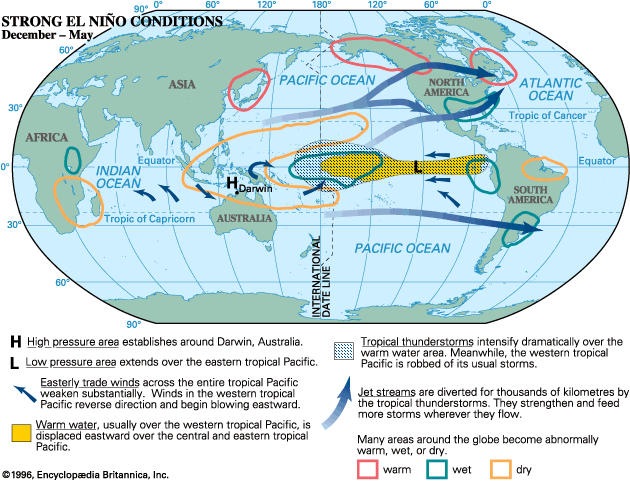
During summer, this heating results in strong vertical currents and formation of low pressure over the plateau at 9km above sea level.  
**5. The movement of the westerly Jet Stream:**

The westerly jet stream moves to the north of the Himalayas and tropical easterly jet stream is present over the Indian peninsula during summer.  
**6. Southern Oscillation (SO)**:

* This is the periodic change in pressure over the southern oceans, which affects the monsoons.
* When the tropical eastern South Pacific Ocean experiences high pressure the tropical eastern Indian Ocean experiences low pressure.
* But in certain years, there is a reversal in the pressure conditions and the eastern Pacific has lower pressure in comparison to the eastern Indian Ocean.
* Negative pressure indicates below average and late monsoons.
* For example, pressure over Tahiti (Pacific Ocean, 18°S/149°W) and Darwin in northern Australia (Indian Ocean, 12°30’S/131°E) is computed to predict the intensity of the monsoons.

**El Nino**

* is  a phenomenon in which a warm ocean current that flows past the Peruvian Coast, in place of the cold Peruvian current, every 2 to 5 years.
* It is a name given to the periodic development of a warm ocean current along the coast of Peru as a temporary replacement of the cold Peruvian current.



* The presence of the El Nino leads to an increase in sea-surface temperatures and weakening of the trade winds in the region.
* The changes in pressure conditions which are connected to the El Nino are known as El Nino Southern Oscillations (ENSO).

**The Onset of the Monsoon and Withdrawal**

* The monsoon are pulsating and affected by various atmospheric conditions encountered by it while moving over the warm tropical seas.
* As monsoon arrives, the normal rainfall increases suddenly and continues constantly for several days. This is known as the ‘burst’ of the monsoon.
* Monsoon arrives at the southern tip by first week of June.
* It branches to Arabian Sea and Bay of Bengal.
* The Arabian Sea branch reaches Mumbai in around 10th June.
* It arrives over Saurashtra-Kuchchh and the central part of the country by mid-June.
* Assam receives the first showers from the Bay of Bengal branch in the first week of June.
* It reaches Delhi by 29th June tentatively.
* The two branches merge over the north-western part of the Ganga plains.
* By first week of July, monsoon reaches western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan.
* The rest of the country experience monsoon by mid-July.  
    
  Withdrawal or the retreat of the monsoon
* By early September, monsoon starts to withdraw from the north-western states.
* It withdraws completely from the northern peninsula by mid-October.
* The rest of the country stops experiencing monsoon by early December.
* The islands receive monsoon from the last week of April to the first week of May from south to north.
* The withdrawal is from north to south from the first week of December to the first week of January.
* The rest of the country starts experiencing winter monsoon by then.

The Seasons  
  
In India, there are 4 main seasons with some variations due to geography of a region. They are:-  
  
The cold weather season,  
  
The hot weather season,  
  
The advancing monsoon and  
  
The retreating monsoon  
  
Winter: The Cold Weather Season

* In northern India, the cold weather season is experienced from mid-November and till February. Here the coldest months are December and January.
* The temperature is lower in the north than in the south.Chennai experiences an average temperature of 24°-25°C while the northern plains experience 10°-15°C.
* The northern areas experience frost and the higher slopes of Himalayas experience snowfall.
* The northeast trade winds blow from land to sea and so winter is a dry season in most parts of India.Tamil Nadu, however experiences rainfall when these winds blow from sea to land.
* Clear sky, low temperatures and humidity and feeble and variable winds are characteristics of a typical day.
* Another characteristic feature of the cold weather season over the northern plains is the inflow of cyclonic disturbances from the west and the northwest.
* The winter rains over the plains and snowfall in the mountains are caused by low pressure systems.
* The total amount of winter rainfall called Mahawat locally is essential for cultivation of ‘rabi’ crops.
* The sea has moderating influence over the peninsular region and hence it does not have a well- defined cold season.

Summer: The hot weather season

In India, this season lasts from March to May.

* The global heat belt shifts northward due to apparent northward movement of the sun
* Due to this the Deccan plateau records a temperature as high as 38°C in March.
* Gujarat and Madhya Pradesh record 42°C in April.
* The north-western parts of the country experience 45°C in May.
* The sea has moderating influence over the peninsular region and temperatures remain comparatively lower.
* Summer is characterized by rising temperature and falling air pressure in the northern part of the country.
* A low pressure area extends from the Thar Desert to Patna and Chotanagpur plateau, towards the end of May.  
    
  Circulation of air begins to set in around this trough.
* The north and north-western regions experience strong, gusty, hot, dry winds blowing during the day, or till the evening which is known as the Loo.
* Such winds may be fatal due to direct exposure.
* Dust storms are another common feature which bring temporary relief in May owing to the light rains and cool breeze that they carry.
* Some areas also experience violent winds, torrential downpours and hail. This is locally known as Kaal Baisakhi in West Bengal.
* Pre-monsoon showers known as Mango showers aid in early ripening of mangoes. These showers in Karnataka and Kerala mark the close of the summer seasons.

Rainy Season: Advancing monsoon

* The northern plain experiences intense low pressure conditions in early June. Due to this the south east trade winds originate over the warm subtropical areas of the southern oceans and bring abundant moisture.
* They blow at 30 km/hour over the entire country, except extreme northwest, in about a month.
* They enter the peninsula as south west monsoon after they cross the equator and blow south westerly.
* Due to the south west monsoon the windward side of the Western Ghats receive very heavy rainfall of more than 250 cm.
* Although they lie in the rain shadow area, the Deccan Plateau and parts of Madhya Pradesh receive some amount of rain.
* Mawsynram in the southern ranges of the Khasi Hills receives the highest average rainfall in the world.
* Rainfall in the Ganga valley decreases from the east to the west whereas Rajasthan and parts of Gujarat get scanty rainfall.
* Monsoon also has the tendency to have ‘breaks’ in rainfall. Thus, it has wet and dry spells.
* This means the monsoon rains take place only for a few days at a time with rainless intervals.
* The trough and its axis keep on moving northward or southward, which determines the spatial distribution of rainfall.
* Whenever the axis shifts closer to the Himalayas, there are longer dry spells in the plains, and widespread rain occur in the mountainous catchment areas of the Himalayan rivers.
* These heavy rains bring devastating floods causing damage to life and property in the plains.
* The frequency and intensity of tropical depressions too, determine the amount and duration of monsoon rains.
* These depressions form at the head of the Bay of Bengal and cross over to the mainland.
* The depressions follow the axis of the “monsoon trough of low pressure”.
* Uncertain monsoon may cause heavy floods in one part and droughts in the other.
* It is often irregular in its arrival and its retreat. Hence, it sometimes disturbs the farming schedule of millions of farmers all over the country.

Transition Season: Retreating/ Post Monsoon

* The transition from hot rainy season to dry winter conditions takes place during October-November.
* The monsoon or low pressure weakens in the northern plain and is replaced by a high pressure system.
* The trough moves towards the south with the apparent movement of the sun during October-November.
* The monsoon withdraws from the northern plains by the beginning of October.
* The retreat is marked by clear skies and increase in temperature during the day known as ‘October heat’.
* The temperature decreases rapidly in the second half of October.
* A transition occurs by early November when low pressure conditions over north-western India, gets transferred to the Bay of Bengal.
* This causes destructive cyclonic depressions, originating over the Andaman Sea.
* The major rainfall in the Coromandel Coast is due to these depressions and cyclones.
* The major areas affected are the deltas of Godavari, the Krishna and the Kaveri.
* They cross the eastern coasts of India through Odisha and West Bengal into Bangladesh.

Distribution of Rainfall

* The distribution of rainfall in our country is determined by direction of the rain-bearing winds and relief features.
* The world’s heaviest rainfall is recorded around Mawsynram near Cherrapunji in Meghalaya which is about 1,142 cm per annum.

1. Areas of heavy rainfall (over 200 cm of annual rainfall):

* The southern slopes of the eastern Himalaya, Assam, West Bengal and east coast receives heavy rainfall.

1. Areas of Moderately Heavy Rainfall: (100-200 cm)-

* The mid Ganga valley, the Western Ghats, eastern Maharashtra, Madhya Pradesh and Orissa receives moderately heavy rainfall.

1. Areas of Moderate Rainfall: (50-100 cm)-

* The upper Ganga Valley, eastern Rajasthan and Punjab, southern plateaus of Karnataka, Andhra Pradesh and Tamil Nadu.

1. Areas of Scanty Rainfall: (less than 50 cm)-

* Northern part of Kashmir, western Rajasthan and Punjab, rain- shadow areas of Western Ghats of Deccan Plateau.

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**Monsoon as a Unifying Bond**

* The Himalayas act as a barrier and protect India from the cold winds of central Asia.
* Thus northern India has higher temperature as compared to other areas on similar latitudes.
* Similarly, due to moderating influences of the sea, the peninsular plateau has moderate temperature.
* Due to seasonal alterations of the wind systems and associated weather conditions, a rhythmic cycle of seasons exist.
* Uncertainties and uneven distribution of rain are characteristics of monsoon.
* The Indian landscape and various life forms, agricultural activities and festivities depend on and are bound by monsoon rains.
* These monsoon winds bind the whole country by providing water to set the agricultural activities in motion.
* Similarly, the river valleys which carry the rains form a single unit.

Exercises:

**I Give reasons**-

1. Why the houses in Rajasthan have thick walls and flat roofs?

Ans.

1. In Rajasthan, the weather is very hot, there is less rainfall and it is covered with desert.
2. Thick walls insulate people from extreme heat in summer and extreme cold in winter.
3. Flat roofs are easier to construct as well as to collect rooftop rainwater.

2. Why is it that the houses in the Tarai regions and Goa and Mangalore have slopping roofs?

Ans.

1. The Tarai regions and in Goa and Mangalore get heavy rainfall during the monsoon.
2. Rainwater can easily flow off towards the ground.
3. Water is collected in the receptive units instead of collecting on the roof.

3. Why houses in Assam built in stilts?

Ans.

1. The state of Assam receives abundant rainfall due to which there are chances of floods.
2. In case of floods, the water might get inside the houses if it is built on the ground level.
3. So, in order to avoid flooding of houses, houses are built on stilts and above the ground level.

4. Why most of the world’s deserts are located in the western margins of continents in the subtropics?

Ans.

1. The tropical easterly winds are the prevailing winds in the western margins of continents.
2. These winds become dry by the time they reach the western margins.
3. Thus, these regions become devoid of moisture causing dry condition leading to formation of deserts.

5. India has a monsoon type of climate.Why ?

Ans.

1. The occurrence of seasonal reversal of wind system makes Indian climate monsoon type.
2. During summer the winds blow from sea to the land.
3. In winter the winds blow from the land to the sea.

II Define the following-

1. Monsoon
2. Weather
3. Climate
4. Coriolis Force
5. Jet steams
6. Western Cyclonic Disturbances
7. Southern Oscillation
8. Burst of Monsoon
9. Mahawat
10. Mango Showers
11. Kaal Baisakhi
12. October Heat

Ans. 1. Monsoon: The word monsoon is derived from Arabic word ‘Mausim’. It refers to seasonal reversal in wind direction throughout the year.

Ans.2. Weather: Weather refers to the state of the atmospheric condition over an area at any point of time.

Ans. 3.Climate: Climate refers to the sum total of weather conditions and variations over a large area for a long period of time.

Ans.4. Coriolis Force: An apparent force that is a result of the Earth’s rotation, deflects moving object like air currents to the right in the northern hemisphere and to the left in the southern hemisphere. This is known as Ferrel;s Law.

Ans. 5. Jet Streams: These are a narrow belt of high altitude (above 12,000 m) westerly winds in the troposphere. Their speed varies from about 110km/h in summer to about 184km/h in winter.

Ans. 6. Western Cyclonic Disturbances: The Western Cyclonic Disturbances are weather phenomena of the winter months brought in by westerly flow from the Mediterranean region. They generally influence the weather of the north and north-western regions of India.

Ans. 7. Southern Oscillation: . Southern Oscillation is the reversal of pressure condition and vice-versa in Southern Pacific Ocean and Eastern Indian Ocean.

Ans. 8. Burst of Monsoon: The sudden onset of moisture –laden winds is associated with violent thunder, lightning and heavy downpour. This sudden onset of rain is termed as the monsoon burst.

Ans. 9. Mahawat: The total amount of winter rainfall is locally known as ***Mahawat****.* They are of immense importance for the cultivation of *‘rabi crops’.*

Ans. 10. Mango Showers: Mango- Showers or pre-monsoon showers occur in South India during April-May. They bring a little rain which is important for mango, tea and coffee plants. Hence, they are termed as mango-shower.

Ans.11. Kaal Baisakhi: In West Bengal the local hot winds in summer are called kaal Baisakhi meaning ‘***the calamity of the month of Baisakhi’* .** These local winds are associated with thunderstorms and bring rainfall.

Ans. 12. October Heat: The retreating monsoon is marked by clear sky and rise in temperature. During this period humidity is very high. Due to high temperature and humidity the weather becomes rather oppressive. This is commonly known as October heat.

III Very short answer type Questions-

1. Who introduced the word ‘Monsoon’ first?

Ans. The Arab traders introduced the word ‘Monsoon’ first.

1. Name the place that experiences the coldest winter night in India.

Ans. Drass in Jammu & Kashmir experiences the coldest winter night in India.

1. Which areas experience less contrasts in temperature condition in India?

Ans. The coastal areas experiences less contrast in temperature condition in India.

1. What is responsible for deflecting winds towards the right in the northern hemisphere?

Ans. Coriolis force is responsible for deflecting winds the right in the northern hemisphere.

1. From where the word ‘El Nino’ derived? Write the meaning.

Ans. The word ‘El Nino’ is derived from Spanish word meaning ‘the child’ refers to baby Jesus.

1. Name the winter rainfall having immense importance for the cultivation of ‘rabi’ crops.

Ans. Mahawat.

1. Which state of India is remarked as receiving winter rainfall?

Ans. Tamil Nadu

1. Which parts of India receives some amount of rain in spite of lying in the rain shadow area?

Ans. The Deccan Plateau and parts of Madhya Pradesh receive some amount of rain in spite of lying in the rain shadow area.

1. Name the plain where the Arabian sea branch and the Bay of Bengal branches of the monsoon merge over.

Ans. Ganga Place.

1. Name four elements of climate or weather.

Ans. The elements of weather and climate are:

* Temperature
* Atmospheric pressure
* Wind,
* Humidity and
* Precipitation.

IV Answer the following questions briefly-

1. Why is monsoon considered a unifying bond?

Ans.

1. The life of the Indian people including the agricultural activities revolves around the monsoon.
2. India is an agricultural land. Monsoon plays an important role in agricultural production.
3. Despite climatic contrasts and variations from region to region, the monsoon provides a rhythmic cycle of seasons year after year.
4. The Indian landscape, its animal and plant life, its entire agricultural calendar and the life of the people, including their festivals, revolve around this phenomenon year after year.
5. People from India from north to south and from east to west , eagerly await the arrival of the monsoon.
6. These monsoon winds bind the whole country by providing water to set the agricultural activities in motion.
7. Why the Tamil Nadu coast receives winter rainfall?

Ans.

1. During the months of October and November, the low pressure area over North-Western India gets transferred to the Bay of Bengal.
2. This shift is associated with the occurrence of cyclonic depressions, which originate over the Andaman Sea.
3. These cyclones generally cross the eastern coasts of India and cause heavy and widespread rain.
4. Describe the regional variations in the climatic conditions of India with the help of suitable examples.

* Ans. Despite an overall unity in the general pattern, there are perceptible regional variations in climatic conditions within the country.

1. In summer, the temperature rises up to 50°C in some parts of the Rajasthan desert, whereas it may be around 20°C in Pahalgam in Jammu and Kashmir.
2. Drass in Jammu and Kashmir experiences temperatures as low as minus 45°C on a winter night. On the other hand, at the same time the temperature at Thiruvananthapuram may be around 22°C.
3. In certain places there is a wide difference even between day and night temperatures. In the Thar Desert the day temperature may rise to 50°C, and drop down to 15°C the same night.
4. Areas like Meghalaya have an annual precipitation of over 400 cm whereas it is only 10 cm in Ladakh and western Rajasthan.
5. Most parts of the country receive rainfall from June to September. But the Tamil Nadu coast gets a large portion of its rain during October and November.
6. There is decrease in rainfall generally from east to west in the Northern Plains.
7. Describe about the Inter Tropical Convergence Zone.

Ans.

1. The Inter Tropical Convergence Zone (ITCZ,) is a broad trough of low pressure in equatorial latitudes.
2. This is where the northeast and the southeast trade winds converge.
3. This convergence zone lies more or less parallel to the equator but moves north or south with the apparent movement of the sun.
4. This takes place over the Ganga plains in summer. The Ganga plain is in the equatorial trough positioned at 5°N of equator, known as monsoon trough during monsoon season.
5. What are the Western Cyclonic Disturbances? How do they affect the climate of India?

Ans.

1. The Western Cyclonic Disturbances are weather phenomena of the winter months brought in by the westerly flow from the Mediterranean region.
2. They usually influence the weather of the north and north-western regions of India.
3. The Tropical cyclones occur during the monsoon as well as in October November, and are part of the easterly flow which affect the coastal regions of the country.
4. Describe any three features of advancing monsoon.

Ans.

1. It brings a total change in weather conditions.
2. Early in the season of advancing monsoon, the windward side of Western Ghats receives very heavy rainfall. The maximum rainfall of this season occurs in North- Eastern India.
3. It has wet and dry spells. The intervening dry period is called ‘Breaks’ in monsoon.
4. The monsoon is known for its uncertainties, and the spatial distribution of rainfall is uneven.
5. Describe three types of winds blowing during the hot weather season.

Ans.

1. The north and north-western regions experience strong, gusty, hot, dry winds blowing during the day, or till the evening which is known as the Loo. Such winds may be fatal due to direct exposure.
2. Dust storms are another common feature which bring temporary relief in May owing to the light rains and cool breeze that they carry.
3. Some areas also experience violent winds, torrential downpours and hail. This is locally known as Kaal Baisakhi in West Bengal.
4. Pre-monsoon showers known as Mango showers aid in early ripening of mangoes. These showers in Karnataka and Kerala mark the close of the summer seasons.
5. Describe how the relief features play a great role in determining the climate of a place.

Ans. The relief features play a great role in determining the climate of a place-

1. High mountains act as barriers for cold or hot winds.
2. They may also cause precipitation if they are high enough and lie in the path of rain-bearing winds.
3. Whereas the leeward side of the mountains remains relatively dry.

V Distinguish between the following-

1. Weather and Climate.

Ans.

|  |  |
| --- | --- |
| **Weather** | **Climate** |
| 1. It refers to short-run atmospheric conditions that exist for a given time in a specific area. | 1. Climate is the aggregated of day to day weather conditions over a long period of time. |
| 2. Weather refers to a particular place. | 2. Climate refers to a large area. |
| 3.Weather may change at a very short interval of time. | 3. Climate remains more or less unchanged year after year. |
| 4. Weather is influenced by any one of its predominant elements i.e. temperature, humidity etc. | 4. Climate is the collective effect of all its elements. |

1. Summer monsoon(Advancing monsoon) and Winter monsoon(Retreating monsoon).

Ans.

|  |  |
| --- | --- |
| **Summer Monsoon(Advancing monsoon)** | **Winter Monsoon(Retreating monsoon)** |
| 1. They blow during the months of June to September. | 1. They blow during the months of October to February. |
| 2. These winds blow from the high pressure area on the sea to the low pressure area on the land. | 2. These blow from the high pressure area on the land to low pressure area on the sea. |
| 3. These bring rain to the greater parts of India. | 3. These bring a little rain to the Tamil Nadu coast. |
| 4. These blow into India in two branches, i.e. the Arabian sea branch and the Bay of Bengal branch. | 4. These have only one branch. |
| 5. These are associated with oppressive heat and humidity known as ‘October Heat’. | 5. These are charachterised by pleasant season with low temperature, low humidity and clear skies. |

VI Long answer type questions-

1. Explain major factors affecting India’s climate.

Ans.

**FACTORS AFFECTING INDIA’S CLIMATE**

**1. Latitude**

* India’s climate has characteristics of tropical as well as subtropical climates.
* The Tropic of Cancer runs through the middle of the country from the Rann of Kuchchh to Mizoram.
* The areas lying to the south of the Tropic of Cancer belong to the tropical area.
* while the other areas lie in the subtropics.

**2. Altitude**

* The average elevation in the coastal areas of India is about 30 meters, whereas the average elevation in the mountains in the north is about 6,000 meters.
* So, the Himalayas act like a barrier that prevents the cold winds of Central Asia to enter the Indian subcontinent.
* That is why the Indian subcontinent gets comparatively milder winters as compared to Central Asia.

**3. Pressure and wind**

Major atmospheric conditions that govern the Indian climate and its associated weather conditions are:

**3.1 Pressure & surface winds**:

* The uniqueness of the pressure and wind conditions over India lies in the fact that:
* During winter, there is a high-pressure area at the north of the Himalayas.
* Cold dry winds blow from this region to the low-pressure areas over the oceans to the south.
* During summer, low-pressure area develops over interior Asia and also over northwestern India.
* This results in a complete reversal of the direction of winds during summer.
* These winds known as the Southwest Monsoon winds collect moisture from the warm oceans and bring widespread rainfall over the mainland of India.

**3.2 The upper air circulation**:

* These are a narrow belt of high altitude usually above 12,000 m, westerly winds in the troposphere. Their speed varies from about 110 km/h in summer to about 184 km/h in winter. The mid-latitude and the sub-tropical jet streams are the most constant ones.
* The jet streams which are located over 27-30° north latitude are known as subtropical westerly jet streams.
* It is responsible for western cyclonic disturbances in the north and north western India.
* The sub-tropical easterly jet stream blows over 14°N over peninsular India, during summer.

**3.3 Western Cyclonic Disturbances:**

* The westerly flow from the Mediterranean region brings in the western cyclonic disturbances during the winter months.
* They usually influence the weather of the north and north-western regions of India.
* Tropical cyclones occur during the monsoon, as well as, in October – November, and are part of the easterly flow.

These disturbances affect the coastal regions of the country.

1. Explain the important factors to understand the mechanism of India’s climate.

Ans. **The following facts help to understand the mechanism of monsoon:**

**1. Differential heating and cooling of land and water:**

In India, this causes low pressure on the landmass and comparatively higher pressure in the seas around.

**2. Shift of the position of Inter Tropical Convergence Zone (ITCZ)**:  
  
 The Inter Tropical Convergence Zone (ITCZ,) is a broad trough of low pressure in equatorial latitudes.

This is where the northeast and the southeast trade winds converge.

This convergence zone lies more or less parallel to the equator but moves north or south with the apparent movement of the sun.

This takes place over the Ganga plains in summer.

The Ganga plain is in the equatorial trough positioned at 5°N of equator, known as monsoon trough during monsoon season.  
  
**3. Presence of high pressure area, east of Madagascar:**

The intensity and position of this high pressure area at 20° S over the Indian Ocean affects monsoon  
**4. Intense heating of the Tibetan plateau:**

During summer, this heating results in strong vertical currents and formation of low pressure over the plateau at 9km above sea level.  
**5. The movement of the westerly Jet Stream:**

The westerly jet stream moves to the north of the Himalayas and tropical easterly jet stream is present over the Indian peninsula during summer.  
**6. Southern Oscillation (SO)**:

* This is the periodic change in pressure over the southern oceans, which affects the monsoons.
* When the tropical eastern South Pacific Ocean experiences high pressure the tropical eastern Indian Ocean experiences low pressure.
* But in certain years, there is a reversal in the pressure conditions and the eastern Pacific has lower pressure in comparison to the eastern Indian Ocean.
* Negative pressure indicates below average and late monsoons.
* For example, pressure over Tahiti (Pacific Ocean, 18°S/149°W) and Darwin in northern Australia (Indian Ocean, 12°30’S/131°E) is computed to predict the intensity of the monsoons.

**El Nino**

* is  a phenomenon in which a warm ocean current that flows past the Peruvian Coast, in place of the cold Peruvian current, every 2 to 5 years.
* It is a name given to the periodic development of a warm ocean current along the coast of Peru as a temporary replacement of the cold Peruvian current.
* The presence of the El Nino leads to an increase in sea-surface temperatures and weakening of the trade winds in the region.
* The changes in pressure conditions which are connected to the El Nino are known as El Nino Southern Oscillations (ENSO).

1. Explain the major features of the Indian monsoon.

Ans.

1. Most parts of the country get rainfall from South-West monsoon wind.
2. The rainfall from the monsoon winds is variable and quite undependable.
3. Much of the rainfall is received in 3-4 months.
4. The distribution of rainfall is highly uneven.
5. Indian rainfall is controlled by orography i.e. most of the rainfall is caused due to the obstruction of moisture bearing winds.
6. Explain the cold weather season or the winter season under the following points-
7. Major characteristics.
8. Temperature
9. Pressure and winds.
10. Western Disturbances.
11. Precipitation.

Ans.

**Cold Weather season**-

1. **Major characteristics**-

Cold weather season is charachterised by clear sky, pleasant weather, low temperature and humidity, high range of temperature, cool and slow winds.

1. **Temperature**-

* The northern two thirds of the country has mean temperature below 21°C.
* January is the coldest month when the temperature in the Ganga plain varies from 10°C to 15°C.
* The southern one third has rather warmer conditions and does not have distinctively defined winter season

1. **Pressure and winds**-

* As the temperature in the northern plain is low so a high pressure prevails there.
* North-East trade winds prevail over the country.
* They blow from land to the sea over most parts of the country and do not cause much rainfall.

1. **Western Disturbances**-

* The fine weather conditions which prevail during this season, sometimes get disturbed by shallow cyclonic depressions are known as Western Disturbances.
* They originate over the Mediterranean sea and travel eastward across West Asia, Iran- Afghanistan and Pakistan before reaching the north- western parts of India.
* The western disturbances cause light rainfall that is beneficial to the rabi crops especially wheat.

1. **Precipitation**-

* The winds blow from land to the sea and do not cause much rainfall.
* These winds pick-up some moisture while crossing the Bay of Bengal and cause winter rainfall in Tamil Nadu, south Andhra Pradesh, south-east Karnataka and south-east Kerala.

1. Describe in detail about the hot weather season under the following points-
2. Main characteristics.
3. Temperature.
4. Pressure and wind.
5. Local winds.

Ans. The Hot weather season-

1. **Main characteristics**.
2. The hot weather season begins in March and ends in May.
3. This is the period of rising temperature and falling air pressure.
4. There is steady increase in temperature from south to north with the highest temperature in the interior parts of the country.
5. **Temperature.**
6. Temperature begins to rise in March and the highest temperature reaches by the month of May.
7. In March, the highest day temperature is found in the Deccan Plateau about 38°C.
8. In April, the heat belt moves further north to Gujarat and Madhya Pradesh.
9. The average temperature ranges from 42°C to 43°C.
10. In May, the heat belt moves still further north leading to 48°C temperature in the north-western parts of the country.
11. **Pressure and wind**.
12. Almost the whole country has high temperature so the pressure conditions develop over land.
13. On the other hand, the surrounding seas are cooler hence high pressure prevails in the seas.
14. The north-east trade winds which blow from south-east to north-west in southern hemisphere are attracted towards the mainland of India.
15. This marks the end of summer season and south-west monsoon sets in the month of June.
16. **Local winds.**

**Kaal Baishakhi**-

* In West Bengal, these local winds are called Kaal Baishakhi meaning “the calamity of the month of Baishakh”.
* These local winds are accompanied by thunder storms and bring rainfall.

**Loo**-

* Loo is the name given to the hot , dry wind which blows particularly in the month of May and June in the northern plain.
* Loo is common in Bihar, Punjab, Haryana and Uttar Pradesh.

**Mango Shower or pre- Monsoon shower**-

* These occur in south India during April-May.
* They bring a little rain which is important for mango, tea and coffee plants.
* Hence, this is known as mango-shower or pre- monsoon shower.

1. Describe in detail about the rainy season under the following points-
2. Temperature.
3. Pressure and wind.
4. Rainfall.
5. Arabian sea Branch
6. Bay of Bengal Branch
7. Breaks in rainfall.

Ans. The Rainy Season-

1. Temperature

* Temperature all over the country begins to fall as the monsoon rainfall intensifies.
* The north- western parts and desert areas of Rajasthan still have temperature reaching up to 40°C.

1. Pressure and winds

* The temperature in north-western plains are still very high as a result of which low pressure conditions prevail there.
* By early June the low pressure conditions are powerful enough to attract the trade winds of southern hemisphere.
* These south-east Trade winds coming from the Indian Ocean cross the Equator and enter the Bay of Bengal and The Arabian Sea.
* After crossing the Equator they follow a south- westerly direction known as South- West monsoon.

1. Rainfall.

* Three-forths of the total rainfall of India is received during this season.
* The progress of the monsoon winds beyond south Kerala is in the form of two branchces.

1. Arabian sea Branch

* It strikes the western coast of India in Kerala on the 1st June.
* It reaches Mumbai approximately the 10th of June.
* By the mid-June the Arabian Sea branch of the monsoon arrives over Saurashtra- Kachechh and the central part of the country.

1. Bay of Bengal Branch

* The Bay of Bengal branch advances rapidly and arrives in Assam in the first week of June.
* The lofty mountains causes the monsoon winds to deflect towards the west over the Ganga Plains.
* The Arabian Sea and the Bay of Bengal branches of the monsoon merge over the north-western part of the Ganga- Plains.
* Delhi generally receives the monsoon showers from the Bay of Bengal branch by the end of June.
* By the first week of July , western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan experiences the monsoon.
* By mid-July, the monsoon reaches Himachal Pradesh and the rest of the country.

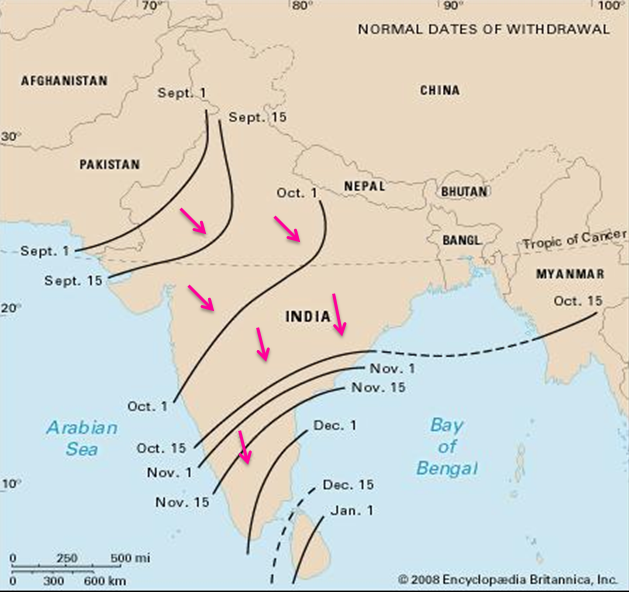
1. Breaks in rainfall

* Breaks in the rainfall is the most important phenomenon associated with the monsoon.
* Thus, it has wet and dry spells, in other words, the monsoon rains take place only for a few days at a time.
* They are interspersed with rainless intervals.

1. On the separate outline map of India locate and label the following-
2. Advancing Monsoon.



1. Retreating Monsoon.



1. Annual Rainfall.

